Ekonomická fakulta
Faculty of Economics

Jihočeská univerzita v Českých Budějovicích
University of South Bohemia in České Budějovice

Proceedings of the 15th International Scientific Conference INPROFORUM

New trends and challenges in the management of organisations

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Foreword

The conference INPROFORUM is a traditional event held by the Faculty of Economics, the University of South Bohemia in České Budějovice since 2007.

It is served as a platform to give academics, students, and practicing economists the opportunity to share their thoughts, debate issues, and exchange knowledge on relevant topics. It is focused on the research achievements in the fields of Innovations, Enterprises, Regions and Organizations. The conference offers the opportunity to discuss relevant topics among academic and practising economists.

The theme of the 15th Anniversary International Conference INPROFORUM 2021 has been "New trends and challenges in the management of organisations", which has concluded the following topics:

- Challenges and opportunities for the economy
- Circular economy and bioeconomy- challenges for the regional management
- Economic of Agriculture
- Economic Impacts of Changes and Policies in the Fields of Finance, Accounting and Taxation
- Management of Small and Medium-Sized Enterprises in Times of Turbulent Changes
- Market Research and Sustainable Marketing in Trade and Tourism
- Mathematical-Statistical Modelling and Optimization in Practice

The conference INPROFORUM 2021 has been organized under the auspices of Dagmar Škodová Parmová, Dean of the Faculty of Economics, the University of South Bohemia in České Budějovice.

Selvi Kannan (Victoria University Business School, Melbourne) and Lubomír Civín (ČZU Faculty of Economics and Management, Praha) opened the conference as keynote speakers, then about 90 participants could visit about 49 contributed talks.

We would like to thank all the conference participants, the members of the conference committee, keynote speakers, and organization staff. We also would like to express our thanks to the reviewers for valuable feedback for the authors.

On behalf of organizing committee

Martin Pech

Circular Economy and Bioeconomy – Challenges for the Regional Management

Insect-based protein represents untapped potential in the Central European region

Anna Marouškova[1]

Abstract: In the last decade, the popularity of industrial insect rearing has expanded worldwide. Various types of insects are being reared not only for fish and livestock farming but also for direct human consumption. Central Europe appears to be a region where the transformation of biowaste into protein could have many positive effects. A literature review on insect farming and an analysis of the targeted market were carried out. The findings were put into a Central European context and assessed in terms of current and prospective legislation, including the economic and social context. It cannot be predicted that insect protein would become a common part of the European diet in the near future. Nevertheless, the rapidly growing number of EU companies in the industry together with smooth changes in legislation indicates that insect rearing is likely to have significant potential as a feed, feedstock for biorefineries, cosmetics, and other products of high added value. In addition, insect rearing demonstrated the ability to serve as a complement to improve soil fertility and nutrient regeneration. Moreover, food waste treatment via insect farming with their subsequent utilization as a feed is in accordance with the EU Circular economy concept.

Keywords: sustainability, bioeconomy, insect-based protein, regional management.
JEL Classification: O13, Q57, R11

1 Introduction

Considering the global population growth, demands for food and feed, especially protein, are steeply rising (Wang et al., 2017). The European Union (EU) faces many challenges that threaten its competitiveness in the global market (Androniceanu et al., 2020; Ketels and Porter, 2020). In particular, the environmental issues present an uncomfortable dilemma, since the widely accepted proposals are currently costly to address and uncertain in their effectiveness (Langholtz et al., 2020; Joltreau and Sommerfeld, 2019). Sustainable production is one of the main objectives of the European Green Deal (Stevenson, 2020; Riggio et al., 2019). To fulfill this objective the European Commission outlined financial support of €100 billion over the period 2021 - 2027 for the green transition (Narciso and Fonte, 2021; Schebesta and Candel, 2020). As a part of the transition to sustainability, the European Commission has pledged to make alternative proteins a keystone of its research agenda (Moschitz et al., 2021; Duncan et al., 2020). According to the Farm to Fork strategy, which addresses the challenges of sustainable food production and consumption, €10 billion is allocated for bioeconomy and food (Schebesta et al., 2020). Developing alternative sources of protein which among others includes insect-based protein is the key task (Bessa et al., 2020; Ojha et al., 2020). Results published by FAO (2017) show the need to raise annual meat production by almost 50 % to feed a projected 10 billion people in 2050. Besides the doubling of meat production from poultry, swine, and beef, fish production is expected to almost triple by 2050 (Parisi et al., 2020). Growing consumption of livestock products is closely connected to increasing demand for animal feed (Kim et al., 2019). Therefore the need for novel and diverse sources of protein for both food and feed applications is essential and urgent (Lamsal et al., 2019). At the same time, the importance of sustainability should not be neglected. It is one of the main challenges regions face in sustainable development - the transformation of their production and consumption pattern into a more sustainable one (Coenen, 2004). A promising alternative source of protein appears to be the protein derived from insects. Thanks to easy rearing, low resource requirements, and the efficiency with which they can be transformed into food and feed, insects demonstrate their potential to fill the "protein gap" (Jensen et al. (2021). Insect-based protein can be used both for human and animal consumption (Arru et al., 2019; Onsongo et al., 2018). However, the EU`s outdated legislation slowed down the introduction of edible insects on the market (Belluco et al., 2017). Original EU regulations were strict, but they're slowly loosening (Montanari et al., 2021; EFSA, 2021; Gałęcki and Sokół, 2019; Belluco et al., 2017).

Besides the urgent need for new sustainable protein sources, there is another challenge that requires an immediate solution. This is inconsistent and ineffective management of biodegradable waste which is associated with the unnecessary release of CO_2; wastage of organic matter and nutrients (Araya, 2018). There is a consistent trend across public reports and peer-reviewed literature that the quantity of landfilled waste is continuously rising at an increasing level globally (Drangert et al., 2018). An unreasonably quantity of biowaste is being landfilled across the EU, in particular in

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the Member States that were among the last to join (Di Maria et al., 2018). Landfilling of biowaste results in a broad variety of negative environmental as well as economic effects (Fan et al., 2020). Mild implementation of innovative biowaste management technologies results in numerous adverse side effects (Teng et al., 2021). For example, the ongoing decay of organic matter causes widespread failures of landfill structures and an easily preventable release of greenhouse gases (Elmi et al., 2021; Huang and Fan, 2016). Outdated technologies and unsustainable practices represent risks to topsoil fertility and hazards to surface and groundwaters as well (Yahaya et al., 2021). According to the concept of circular economy, the EU considers biodegradable waste as an untapped source of raw materials and energy, which can be further processed (Elbeshbishy and Dhar, 2020; Di Maria et al., 2018).

At the same time, annually, one-third of food produced for human consumption is wasted worldwide (Rohini et al., 2020). This is nearly 1,4 billion tonnes of food, that could potentially be used for insect rearing as was pointed out by Jensen et al. (2021). Authors also estimate 129 million tonnes of food waste in the EU suitable for insect meal production could be available by 2030. There are numerous indications across the literature that processing biowaste via insects rearing represents a potentially competitive bioeconomy strategy of valorization of voluminous biowaste into high value-added products like protein feed, oil, fertilizers, etc. (Cadinu et al., 2020; Cappellozza et al., 2019). Also, the soaring fees for landfilling tend to boost the competitiveness of other biowaste refining practices (Jain et al., 2022), including treatment of municipal organic waste via insect rearing (Diener et al., 2011). However, there is a lack of knowledge on whether (or to what extent) this model can be transferred to Central European regions which are very specific in their culture, location, and industrial structure.

2 Methods

Established research (Google Scholar; Web of Science; SpringerLink, Taylor & Francis Online, Wiley Online Library; ScienceDirect and SCOPUS) and patent (European Patent Office; the United States Patent and the Trademark Office; The Japan Patent Office and Google Patent) databases were searched for publications via their indexing tools searching for documents containing following keywords (alone and in all possible combinations): insect rearing; insect farming; biowaste treatment; insect commercialization; circular economy; bioeconomy and policy.

3 Research results

The time series shows that the number of patents and publications on protein production from insects is on a steep upward trend, as can be seen on the example of black soldier fly (Figure 1 and 2). That indicates a big interest in insect farming from the academic and private sectors. It can be noticed that the slope of the trend is very similar, with the number of publications always being almost double the number of patents in each year. This trend suggests that the field is far from reaching its peak and that many more commercially applicable as well as theoretical findings can be expected in the coming years. Some authors point out the importance of relevant legislative changes for novel sources of protein (Belluco et al., 2017; Gasco et al., 2020). Since 2017 the protein originating from seven insect species is allowed as aquaculture feed. These are black soldier fly (BSF; *Hermetia Illucens*), common housefly (*Musca domestica*), yellow mealworm (*Tenebrio molitor*), lesser mealworm (*Alphitobious diaperinus*), house cricket (*Acheta domesticus*), banded cricket (*Gryllodes sigillatus*), and field cricket (*Gryllus assimilis*) (Gasco et al., 2020). Using live insects as feed for poultry was also permitted. Provided that (i) the latest report from Brusselaers and Van Der Linden (2020) assumes that 88 million tonnes of food (173 kg per EU citizen, W) is wasted annually in the EU; (ii) the average feed conversion ratio (FCR) regarding these insects and such feedstock is 2.2 (Cappellozza et al., 2019) the quantity of insects produced (I) can be quantified according to Equation 1.

$$W*FCR^{-1}= I \qquad (1)$$

Equation 1: Simplified quantification of the insect production within the EU.

Quantifying the Equation 1 brings us to the hypothetical quantity of 40 million tonnes of insects produced. However, there are factors that can both increase and decrease this estimate. Firstly, it should be remembered that a lot of waste is generated in the production of food, which would theoretically provide up to 5 times the amount of raw materials for feeding insects. On the other hand, it should be taken into account that many difficulties are posed by logistics, legislation, business risks and other uncertainties. Recently, in August 2021, insect protein in poultry and pig feed was fully approved in the EU. As the International Platform of Insects for Food and Feed (IPIFF) has announced on their webpage European Commission authorized the use of processed animal proteins derived from insects (insect PAPs) in poultry and pig feed. According to Commission Regulation (EU) 2021/1372 Poultry are insectivorous animals, while pigs are omnivorous and there should be no concern about including insect PAPs into their feed. Given that protein feed wholesale average price

(p) is around 1 €kg^{-1} and average protein content (P_c) in insects suitable for biowaste treatment is around 50 % (Thrastardottir et al., 2021), we are discussing a theoretical business potential ($B_p = I*p*P_c = 20*10^9$ €) of at least 20 billion €. This gives an opportunity for more sustainable and effective agriculture production. Especially from the perspective of regional management, this step gives a possibility to farmers to feed animals with high-quality protein produced from local sources. As the European Commission states every year about 5 million EU farmers need about 450 million tons of feed for the animals they raise (an official website of the European Union). For this purpose, more than 60% of the EU agricultural area is devoted to feeding animals (Guyomard et al., 2021). The Eurostat data on which the Farm to Fork strategy is based shows that this includes 39.1 million hectares of cereals and oilseeds and 70.7 million hectares of grassland on 161 million hectares of agricultural land (Schebesta and Candel, 2020). On the other hand, Guyomard et al. (2021) note that products of animal origin in the EU represent about 40% of the value of total agriculture production which is essential not only from an economic point of view.

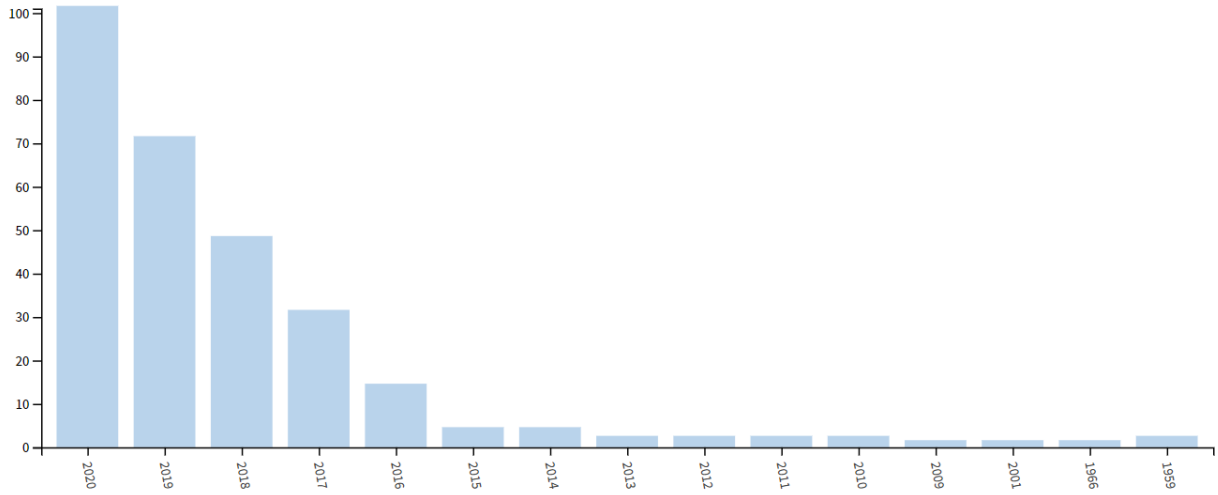

Figure 1 The number of publications indexed in the Web of Science that mention BSF and are affiliated to EU research institutions.

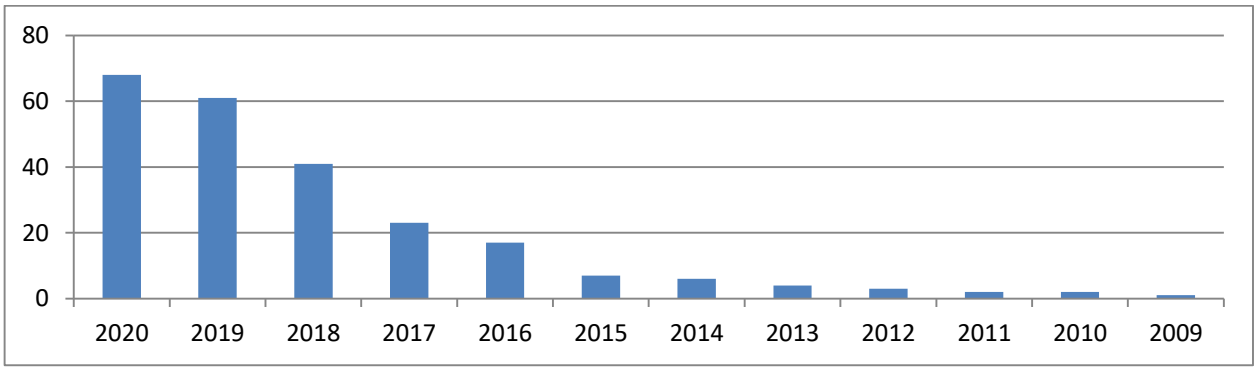

Figure 2 The number of patents that mention BSF and are affiliated to EU entities.

Another significant milestone for the European insect sector has occurred earlier in 2021 when the European Food Safety Authority (EFSA) authorized yellow mealworms for human consumption (Moruzzo et al., 2021). Edible insects are considered as a Novel Food in the EU, which means each product needs market authorization granted by European Commission after the safety evaluation by the EFSA and a favorable vote given by the EU Member States (IPIFF). This is a long and costly process that may discourage companies from producing and selling insects as food (Belluco et al., 2017). There is one more factor slowing down the promotion of edible insects on the market. The attitude of the European population towards insects is very often characterized by aversion and distaste (Skotnicka, et al., 2021). However, it can be expected, that gradually the number of people willing to include insects in their diet will increase. The growing number of start-ups in Europe bet on the production of edible insects shows promising expectations in this area (Mishyna et al., 2019).

There is one more benefit insect farming can bring to our society. As was mentioned above there is a concern regarding the growing demand for protein worldwide. Currently, soybean-based protein is widely used both in animal feeding and human consumption (Guyomard et al., 2021). This, however, has a large negative impact on the environment, since the amount of water and land necessary for growing this commodity is enormous. The large-scale transportation of soybean products contributes to overall impact negatively as well (DiGiacomo and Leury, 2019), considering that these products come from destinations that are quite distant, like the United States, Brazil, and Argentina (Taherzadeh and Caro, 2019). According to European Commission´s estimation (2019), the EU may be responsible for about 10% of the world's deforestation due to the import of several products, including soya and palm oil. Regeneration of nutrients from waste through insect farming would reduce the vast majority of these negative impacts.

4 Conclusions

Insect-based products are gaining popularity in the food and feed industry. The ability of insects to transform biowaste into high-value products gives a wide range of possibilities to build more effective, sustainable, and competitive economies, especially from the perspective of regional management. Using local food waste for insect rearing to feed local animals is a good example of the circular economy concept, which can be applied both in small and large scales. Moreover, the transition from the traditional linear production model (produce-use-dispose) to the circular economy concept is backed by the EU and other open-minded governments, institutions, and individuals all around the globe. Every single village to some extent could be self-sufficient in feed security and food waste management. Considering the fact that insect farming includes better waste management practice and, at the same time, ensures new sustainable sources of protein for the food and feed sector, it can be expected, that such a business model may be competitive and bring positive economic and environmental impacts not only to Central European region. The untapped potential of insect business can be estimated at around 45 € per EU citizen annually. This estimation is quite abstract, based on using insect protein as a feed and doesn't include calculations for other possible products with high-added value like pharmaceutical or cosmetic ingredients. However, more research is necessary to determine if local communities are willing to apply this concept and what kinds of issues they may face.

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References

An official website of the European Union [online]. Animal feed. https://ec.europa.eu/food/safety/animal-feed_en

Androniceanu, A. M., Kinnunen, J., Georgescu, I., & Androniceanu, A. (2020). A multidimensional approach to competitiveness, innovation and well-being in the EU using canonical correlation analysis. *Journal of Competitive-ness*, 12(4), 5.

Araya, M. N. (2018). A review of effective waste management from an EU, national, and local perspective and its influence: The management of biowaste and anaerobic digestion of municipal solid waste. *Journal of Environmental Protection*, 9(6), 652-670.

Arru, B., Furesi, R., Gasco, L., Madau, F. A., & Pulina, P. (2019). The introduction of insect meal into fish diet: The first economic analysis on European sea bass farming. *Sustainability*, 11(6), 1697.

Belluco, S., Halloran, A., & Ricci, A. (2017). New protein sources and food legislation: the case of edible insects and EU law. *Food security* 9, 803–814

Bessa, L. W., Pieterse, E., Sigge, G., & Hoffman, L. C. (2020). Insects as human food; from farm to fork. *Journal of the Science of Food and Agriculture*, 100(14), 5017-5022.

Brusselaers, J., & Van Der Linden, A. (2020). *Bio-waste in Europe—turning challenges into opportunities*. *European Environment Agency Report*. Luxembourg: Publications Office of the European Union. ISBN 978-92-9480-223-1

Cadinu, L. A., Barra, P., Torre, F., Delogu, F., & Madau, F. A. (2020). Insect rearing: Potential, challenges, and circularity. *Sustainability*, 12(11), 4567.

Cappellozza, S., Leonardi, M. G., Savoldelli, S., Carminati, D., Rizzolo, A., Cortellino, G., ... & Tettamanti, G. (2019). A first attempt to produce proteins from insects by means of a circular economy. *Animals*, 9(5), 278.

Coenen, F. (2004). *Regional sustainable production and consumption in a regional policy perspective*. A publication in the series CSTM Studies and Reports. ISSN 1381-6357.

DiGiacomo, K. & Leury, B. J. (2019). Review: Insect meal: a future source of protein feed for pigs? *Animals*. 13:12, 3022–3030. The Animal Consortium 2019.

Di Maria, F., Sisani, F., & Contini, S. (2018). Are EU waste-to-energy technologies effective for exploiting the energy in bio-waste? *Applied Energy*, 230, 1557-1572.

Diener, S., Solano, N.M.S., Gutiérrez, F.R., Zurbrügg, C., & Tockner, K. (2011). Biological Treatment of Municipal Organic Waste using Black Soldier Fly Larvae. *Waste and Biomass Valorization*. 2, 357–363.

Drangert, J. O., Tonderski, K., & McConville, J. (2018). Extending the European union waste hierarchy to guide nutrient-effective urban sanitation toward global food security—Opportunities for phosphorus recovery. *Frontiers in Sustainable Food Systems*, 2, 3.

Duncan, J., Rivera-Ferre, M., & Cleays, P. (2020). *The importance of Food Sovereignty for the Farm to Fork strategy and the New Green Deal.: Insights and limits of the SAM and SAPEA reports*. Wageningen University & Re-search.

European Commission, (EC) 2019. *Stepping up EU Action to protect and restore the world's forests.* COM (2019) 352 final, 23.7.2019. EC, Brussels, Belgium.

Elbeshbishy, E., & Dhar, B. R. (2020). Processes for Bioenergy and Resources Recovery from Biowaste. 8(8), 1005.

Elmi, A., Al-Harbi, M., Yassin, M. F., & Al-Awadhi, M. M. (2021). Modeling gaseous emissions and dispersion of two major greenhouse gases from landfill sites in arid hot environment. *Environmental Science and Pollution Research*, 28(12), 15424-15434.

EFSA (2021). Safety of dried yellow mealworm (Tenebrio molitor larva) as a novel food pursuant to Regulation (EU) 2015/2283. Nutrition, Novel Foods and Food Allergens (NDA), *EFSA Journal*, 19(1), e06343.

Fan, Y.V., Nevrlý, V., Šomplák, R., & Smejkalová, V. 2020. The Potential of Carbon Emission Footprint Reduction from Biowaste in Mixed Municipal Solid Waste: EU-27. *Chemical Engineering Transactions*, 81, 775–780.

FAO. 2017. The future of food and agriculture – Trends and challenges. Rome.

Guyomard, H., Bouamra-Mechemache, Z., Chatellier, V., Delaby, L., Détang-Dessendre, C., Peyraud, J.-L., & Réquillart, V. (2021). Review: Why and how to regulate animal production and consumption: The case of the European Union. *Animal.* 100283. doi: 10.1016/j.animal.2021.100283

Gałęcki, R., & Sokół, R. (2019). A parasitological evaluation of edible insects and their role in the transmission of parasitic diseases to humans and animals. *PLoS One*, 14(7), e0219303.

Gasco, L., Acuti, G., Bani, P., Zotte, A.D., Paolo, Danieli, P.P., De Angelis, A., Fortina, R., Marino, R., Parisi, G., Piccolo, G., Pinotti, L., Prandini, A., Schiavone, A., Terova, G., Tulli, F., & Roncarati, A. 2020. Insect and fish by-products as sustainable alternatives to conventional animal proteins in animal nutrition. *Italian Journal of Animal Science*. 19(1), 360 - 372.

Jain, A., Sarsaiya, S., Awasthi, M. K., Singh, R., Rajput, R., Mishra, U. C., ... & Shi, J. (2022). Bioenergy and bio-products from bio-waste and its associated modern circular economy: Current research trends, challenges, and future outlooks. *Fuel*, 307, 121859.

Jensen, H., Elleby, C., Domínguez, I.P., Chatzopoulos, T., & Charlebois, P. (2021). Insect-based protein feed: from fork to farm. *Journal of Insects as Food and Feed*. doi: 10.3920/JIFF2021.0007

Joltreau, E., & Sommerfeld, K. (2019). Why does emissions trading under the EU Emissions Trading System (ETS) not affect firms' competitiveness? Empirical findings from the literature. *Climate Policy*, 19(4), 453-471.

Huang, Y., & Fan, G. 2016. Engineering geological analysis of municipal solid waste landfill stability. *Natural Hazards*, 84(1), 93–107.

Ketels, C., & Porter, M. E. (2020). Rethinking the role of the EU in enhancing European competitive-ness. *Competitiveness Review: An International Business Journal*.

Kim, S. W., Less, J. F., Wang, L., Yan, T., Kiron, V., Kaushik, S. J., & Lei, X. G. (2019). Meeting global feed protein demand: challenge, opportunity, and strategy. *Annual Review of Animal Biosciences*, 7, 221-243.

Lamsal, B., Wang, H., Pinsirodom, P., & Dossey A.T. (2019). Applications of Insect-Derived Protein Ingredients in Food and Feed Industry. *Journal of the American Oil Chemists' Society* 96(2), 105–123.

Langholtz, M., Busch, I., Kasturi, A., Hilliard, M. R., McFarlane, J., Tsouris, C., ... & Parish, E. S. (2020). The economic accessibility of CO2 sequestration through bioenergy with carbon capture and storage (BECCS) in the US. Land, 9(9), 299.

Mishyna, M,. Chen, J., & Benjamin, O. (2019). Sensory attributes of edible insects and insect-based foods – Future outlooks for enhancing consumer appeal. *Trends in Food Science & Technology*. doi: 10.1016/j.tifs.2019.11.016

Montanari, F., de Moura, A. P., & Cunha, L. M. (2021). *The EU Regulatory Framework for Insects as Food and Feed and Its Current Constraints*. In Production and Commercialization of Insects as Food and Feed. Springer, Cham, 41-78.

Moruzzo, R., Riccioli, F., Diaz, S.E., Secci, C., Poli, G., & Mancini, S. (2021). Mealworm (Tenebrio molitor): Potential and Challenges to Promote Circular Economy. *Animals.* 11, 2568.

Moschitz, H., Muller, A., Kretzschmar, U., Haller, L., de Porras, M., Pfeifer, C., ... & Stolz, H. (2021). How can the EU Farm to Fork strategy deliver on its organic promises? Some critical reflections. *EuroChoices*, 20(1), 30-36.

Narciso, A., & Fonte, M. (2021). Making Farm-to-Fork Front-of-the-Pack: Labelling a Sustainable European Diet. The *International Journal of Sociology of Agriculture and Food*, 27(1), 54-70.

Ojha, S., Bußler, S., & Schlüter, O. K. (2020). Food waste valorisation and circular economy concepts in insect production and processing. *Waste Management*, 118, 600-609.

Onsongo, V. O., Osuga, I. M., Gachuiri, C. K., Wachira, A. M., Miano, D. M., Tanga, C. M., ... & Fiaboe, K. K. M. (2018). Insects for income generation through animal feed: effect of dietary replacement of soybean and fish meal with black soldier fly meal on broiler growth and economic performance. *Journal of economic entomology*, 111(4), 1966-1973.

Parisi, G., Tulli, F., Fortina, R., Marino, R., Bani, P., Zotte, A.D., De Angelis, A., Piccolo, G., Pinotti, L., Schiavone, A., Terova, G., Prandini, A., Gasco, L., Roncarati, A., & Danieli, P.P. (2020). Protein hunger of the feed sector: the alternatives offered by the plant world. *Italian Jounal of Animal Science*. 19(1), 1204 - 1225.

Riggio, G. M., Wang, Q., Kniel, K. E., & Gibson, K. E. (2019). Microgreens—A review of food safety considerations along the farm to fork continuum. *International journal of food microbiology*, 290, 76-85.

Rohini, C., Geetha, P.S., Vijayalakshmi, R., Mini, M.L., & Pasupathi, E. (2020). Global effects of food waste. *Journal of Pharmacognosy and Phytochemistry*. 9(2), 690-699.

Schebesta, H., & Candel, J. J. (2020). Game-changing potential of the EU's Farm to Fork Strategy. *Nature Food*, 1(10), 586-588.

Schebesta, H., Bernaz, N., & Macchi, C. (2020). The European Union Farm to Fork Strategy: Sustainability and Responsible Business in the Food Supply Chain. *European Food and Feed Law Review*., 15, 420.

Skotnicka, M., Karwowska, K., Kłobukowski, F., Borkowska, A., & Pieszko, M. (2021). Possibilities of the Development of Edible Insect-Based Foods in Europe. *Foods*. 10, 766.

Stevenson, P. (2020). Turning the Commission's Farm to Fork Strategy into a far-reaching reform of EU agriculture. In dA Derecho Animal: *Forum of Animal Law Studies* (11)4, 0177-187.

Taherzadeh, O., & Caro, D. (2019). Drivers of water and land use embodied in international soybean trade. *Journal of Cleaner Production*, 223, 83-93.

Teng, C., Zhou, K., Peng, C., & Chen, W. (2021). Characterization and treatment of landfill leachate: A review. *Water Research*, 117525.

Thrastardottir, R., Olafsdottir, H.T, & Thorarinsdottir, R.I. (2021). Yellow Mealworm and Black Soldier Fly Larvae for Feed and Food Production in Europe, with Emphasis on Iceland. *Foods*. 10, 2744.

Wang, H., ur Rehman, K., Liu, X., Yang, Q., Zheng, L., Li, W., Cai, M., Li, Q., Zhang, J., & Yu, Z. (2017). Insect biorefinery: a green approach for conversion of crop residues into biodiesel and protein. *Biotechnology for Biofuels*. 10, 304.

Yahaya, N. S., Pereira, J. J., & Taha, M. R. (2021). Using best available information to conduct impact assessment of future climatic hazards on a landfill. *Climatic Change*, 165(3), 1-19.

Literature Review on Circular Economics Adoption for the Vietnam Economy

Thanh Van LUU[1]

Abstract: The circular economy has been widely used in all industries and services in developed countries for sustainability. This is, however, a new concept in emerging economies. In Vietnam, although the government also has the overall strategic orientation for circular economy deployment, as well as a few large enterprises have implemented its principles in several operations and businesses, there are still many shortcomings compared to developed countries. Therefore, this paper aims to fill the gap to contribute to the thorough review of the literature that underpins circular economy practices in the fields of manufacturing, logistics, and supply chain. The main results of this research are (a) a literature review on circular economy examined in two aspects of government policies and high-tech applications in the light of sustainability; (b) a conceptual framework of the circular economy business model for the adoption and its hypothesis; (c) future research agendas to develop statistical analysis to evaluate and validate the proposed framework, as well as developing an optimization model for a case study in Vietnam.

Keywords: Circular Economy, Logistics, Manufacturing, Supply Chain, Sustainability.
JEL Classification: C12, M21, Q57

1 Introduction

1.1 Problem statement

The earth is increasingly destroyed by human activities. The global ecosystem is deteriorating more rapidly than ever, it is becoming increasingly impoverished due to land fallowing, salinization, and shrinking due to sea-level rise; moreover, to meet human consumption due to population explosion, the growth in the number of livestock and poultry increases waste, and at the same time reduces biodiversity at an alarming rate. The concept of circular economy (CE) is one of the best approaches for the future of mankind. (Hazen *et al.*, 2020).

In Vietnam, on the side of the government, speaking at the 13th National Congress, Sir Tran Hong Ha, Minister of Natural Resources and Environment, said that the development of a circular economy is an indispensable requirement of sustainable development in the new age[2]. The first thing to do, is complete the policy and legal corridor to facilitate enterprises for the adoption of the circular economy. On the enterprise side, it is necessary to focus on investing in modern and high technologies in business and production activities. There are already large enterprises that have developed sustainable development strategies and actively apply them in their operations. As a statement of Madam Mai Kieu Lien, General Director of Vinamilk, the largest dairy company in Vietnam, the circular economy orientation is the guideline in the sustainable development strategy. Practicing the circular economy not only helps businesses achieve their sustainable development goals but also increases their competitiveness[3].

The traditional economic model is often called linear economy, starting from resource extraction, production, consumption, and finally disposal, in contrast, the circular economy model is towards recovery and regeneration to the production of other products, thereby taking advantage of used materials instead of consuming new resources and waste treatment costs. Therefore, the development of a circular economy, with a focus on the reuse of scraps and waste, is considered a solution that can help countries develop sustainably and be environmentally friendly. It is necessary to have a clear understanding of the circular economy model for Vietnam's economy to meet the goal of sustainable development. The study outlined the following specific research questions (RQs).

RQ1. What is the circular economy?

RQ2. Why do CE models affect the Vietnam economy?

RQ3. How to design a conceptual CE framework for the Vietnam industry?

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1.2 Research gaps and objectives

A circular economy and its adoption worldwide are becoming more and more important. In developed countries, the principles of the circular economy have been strongly promoted through the efficient exploitation of resources and business processes. CE thinking and practices are applied in all areas of industry and business for sustainable development. However, the achievements and initiatives that developed economies have taken cannot be modeled and adopted in some emerging economies, because the reality and challenges faced by developed economies are quite different from emerging economies. Emerging economies focus more on economic factors because of their high population, which largely ignores the environmental and social factor that creates excessive resource consumption and a large amount of waste (Patwa *et al.*, 2021). The study aims to bridge this gap by investigating if a conceptual framework of CE can affect an emerging economy, shift towards sustainability in the Vietnam business economy, especially focusing on manufacturing and logistics & supply chain industries. The objective of the study is to provide comprehensive literacy on CE concerning sustainability, which focuses on developing a conceptual framework for CE models in Vietnam. The research objectives (RO) are formed in particular:

RO1. To produce a thorough review of the literature on CE models.

RO2. To outline a conceptual framework of CE adoption for Vietnam‘s economy.

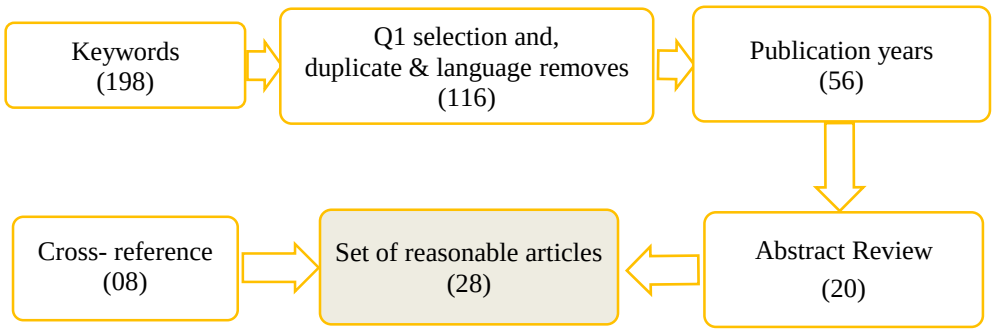
1.3 Related material and methods

Literature review process

To develop this section, some keywords are chosen such as “CE”, “sustainability”, “CE + logistics and supply chain”, “CE + manufacturing”, “optimization + CE”. The Scopus and Google Scholar are also used to search and download high-quality journals such as the Journal of Cleaner Production; Resources, Conservation & Recycling; Sustainability; Ecological Economics; etc.

The systematic review process is developed in Figure 1. In which a set of 198 articles has resulted from the keyword search. After Q1 selection and removal of duplicate & language, 116 articles are kept. The publication years are considered over a 5-year period from 2017 to 2021, where 56 selected papers are continuously reviewed on abstract with 20 articles are accepted. Moreover, the cross-reference contributed to 08 more articles. The literature review is developed based on a total of 28 articles.

Figure 1 the systematic literature review process



Source: own processing

CE background and framework

The circular economy idea has attracted a lot of people‘s attention in the 1960s, in which Preston (2012) affirmed that Industrial Ecology - the root of CE, was first developed in the 1970s. CE is defined as an economic circulation model with the intended use of minimum resources for closed-loop production and consumption systems.

Many researchers developed various CE frameworks. The study summarizes some of them, it does not follow a chronological order, but according to the number of used strategies, such as 3R (i.e. reduce, reuse, and recycle) (Patwa *et al.*, 2021), 4R, 5R, 6R, 10R or ReSOLVE framework (Lopes de Sousa Jabbour et al., 2018; Jabbour et al., 2019), etc. For instance, Piero Morseletto (2020) investigated what targets may facilitate the transition toward a circular economy, based on the 10R framework, specifically including recover, recycle, repurpose, remanufacture, refurbish, repair, reuse, reduce, rethink, and refuse strategies.

CE and sustainability

There are different approaches and research methodologies on the relationship between CE and sustainability with the aim of understanding and improving the degree of interdependence between the three economic, social, and environmental objectives. A circular economy has the potential to develop sustainability within an organization.

A study identified the organizational actors of a circular supply chain and their relationship with the environmental performance aspect of sustainable supply chain management (Hussain and Malik, 2020). Two years earlier, Jouni Korhonen, Antero Honkasalo, and Jyri Seppälä (2018) contributed to scientific research on CE and showed that CE plays an important role in engaging both the business community and the policy-making community to participate in sustainability, it also identified six challenges that need to be addressed for CE activities in light of environmental sustainability to be able to global sustainability. Moreover, Martin Geissdoerfer *et al.* (2017) aimed to produce a comprehensive literacy on CE. It is not only clearly defined relationships between CE and sustainability, but also identifying their similarities and differences. It defined twelve similarities and eight differences between the circular economy and sustainability. The eight differences, for example, come from their origins, goals, motivations, system prioritizations, institutionalizations, beneficiaries, timeframes, and perceptions of responsibilities.

CE and logistics & supply chain

Some researchers investigated supply chain management, green SCM, and circular economy (Kazancoglu, Kazancoglu, and Sagnak, 2018; Liu *et al.*, 2018; Kazancoglu *et al.*, 2021).

For example, Yigit Kazancoglu, Ipek Kazancoglu, and Muhittin Sagnak, (2018) proposed a holistic framework of GSCM processes that integrates tangible or intangible measures, including environmental, economic, logistics, operational, organizational, and marketing performance. That same year, Roberta De Angelis, Mickey Howard, and Joe Miemczyk (2018) presented the development of the term circular supply chains that are defined as the application of circular economy principles within supply chain management. While Chonmapat Torasa and Witthaya Mekhum (2020) examined the impacts of green logistics on the indicators of the circular economy of the ASEAN region, including Malaysia, Indonesia, Thailand, and Singapore. Recently, Syed Abdul Rehman Khan and Yu Zhang (2021) designed the green logistics evaluation system index corresponding to three levels of circular economy practices, including enterprise, industry, and society.

CE and manufacturing

In recent years, with technological advancement and increasing concerns for environmental sustainability, circular economy activities have appeared in production research and operations management.

Ana Beatriz Lopes de Sousa Jabbour *et al.* (2019) identified the changes required in operations management decision-making to fully assist functional managers such as operation managers, logistics managers, and designers in the journey towards the CE. Tsan-Ming Choi *et al.* (2020) examined production research and business operations in the circular economy. Surajit Bag and Jan Harm Christiaan Pretorius (2020) considered a detailed review of three concepts including industry 4.0 adoption on sustainable manufacturing and circular economy.

CE and high-tech applications

High-tech application is defined as Industry 4.0 technologies (e.g., big data, blockchain, Internet of Things, etc.), heuristic/metaheuristic algorithms, and integrated approaches such as optimization models, and multi-criteria decision making (MCDM). In which Ana Beatriz Lopes de Sousa Jabbour *et al.* (2018) developed a roadmap towards Industry 4.0 approaches and CE principles for sustainable operations management. Recently, Fortune Nwaiwu *et al.* (2020) analyzed which is the most important factor affected by sustainable process management in the implementation of Industry 4.0 within the Czech SME manufacturer. In addition, Manavalan and Jayakrishna (2019) explored the potential of Internet of Things (IoT) opportunities in a sustainable supply chain for the Industry 4.0 era.

Several researchers investigated the effects of big data on business performance in circular economy practices for various industrial sectors (Jabbour *et al.*, 2019; Dubey *et al.*, 2019; Del Giudice *et al.*, 2020) in which Manlio Del Giudice *et al.* (2020) studied its effects on big data-driven supply chain performance, while Rameshwar Dubey *et al.* (2019) focused on the effect of big data on manufacturing and operations management. Separately, Charbel Jose Chiappetta Jabbour *et al.* (2019) investigated the complexity in the relationship between circular economy and big data.

Blockchain technology is an emerging concept; it is also widely used in recent research. For instance, Mahtab Kouhizadeh, Qingyun Zhu, and Joseph Sarkis (2020) examined blockchain technology applications for circular economy practices, and it is explored that there are potential uses and relationships between the two concepts. In particular, Sara

Saberi *et al.* (2019) examined the relationship of blockchain technology with sustainable supply chain and identified the relative importance of blockchain technology for supply chain sustainability.

Optimal models and heuristic/metaheuristic algorithms are developed for solving many real-case problems in the light of CE implementations. Typically, Alperen Bal and Fazleena Badurdeen (2020) developed the three objectives model to optimize the facility locations to achieve a circular economy through closed-loop material flow in the case study of the Turkish appliance sector. Whilst, Amin Reza *et al.* (2020) also used the multi-objective model for the four-echelon network of the green and closed-loop supply chain to minimize the total expected value and variance of costs and minimize carbon dioxide emissions. Pravin Kumar Rajesh Kr Singh and Vikas Kumar, (2021) used the integrated approach including the Analytic Hierarchy Process (AHP) and Elimination and Choice Expressing Reality (ELECTRE) to analyze these barriers for the sustainable supply chain operating in the era of Industry 4.0 and CE. To end this section, Sadegh Feizollahi *et al.* (2021) also developed the multiobjective mathematical model for closed-loop supply chain networks, especially it is solved by using a Genetic Meta-heuristic Algorithm.

2 Methods

2.1 Research methodology

The study is designed as a mixed approach consisting of three phases. The first phase of the study explores a literacy understanding of the CE model in the Vietnam economy, including its scope in manufacturing, logistics, and supply chain fields. In the second phase, a theoretical framework for the application of CE in the Vietnamese economy is proposed. In the third phase, the research outlines a future agenda to develop a mathematical model and an optimization algorithm for a selected case study for problem-solving in logistics and supply chain operations such as transportation, location, or warehouse problem.

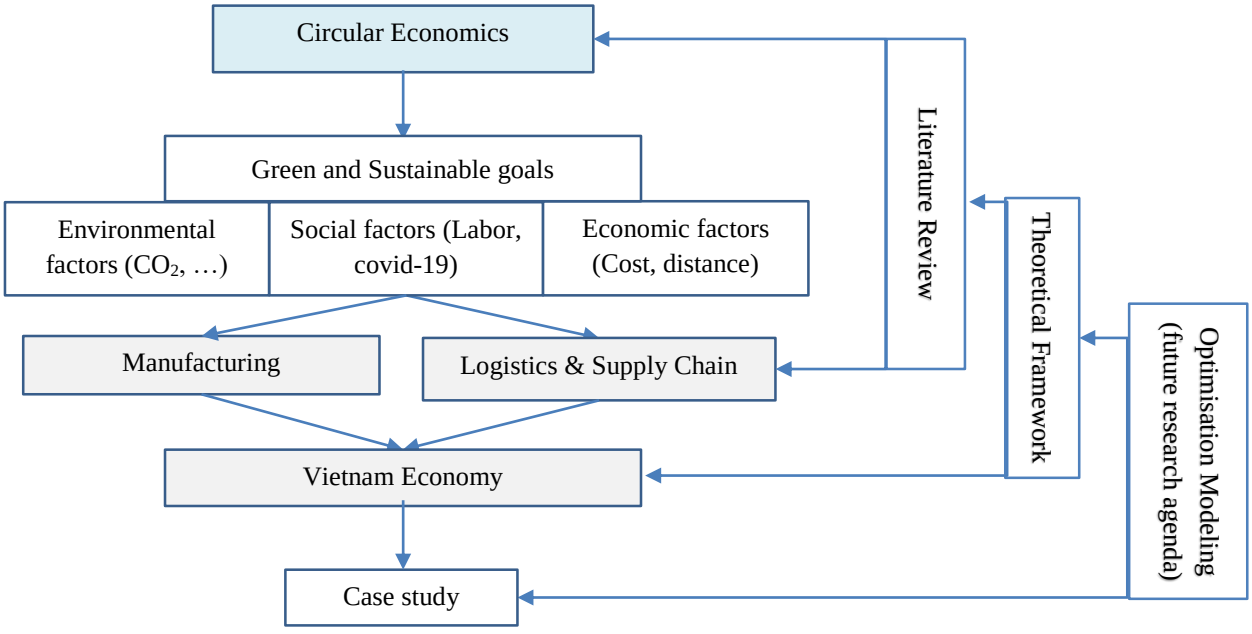
The study uses a qualitative method in the first phase to produce the literature review, which was useful for the second phase to propose a theoretical framework that can be applied in the Vietnam economy. Moreover, research hypotheses are also developed for the proposed framework in this phase. A quantitative method such as a statistical analysis tool be used in the future to evaluate and validate the research hypothesis of the proposed framework.

The third phase is outlined in the future agenda by using MCDM or AHP techniques to optimize and evaluate the proposed framework. A questionnaire, observation, and interview techniques are used for the primary collection of data for quantitative methods. Secondary data are also considered in a case study.

The conceptual design of the research is shown in Figure 2.

2.2 Research conceptual design

Figure 2 – Research conceptual design



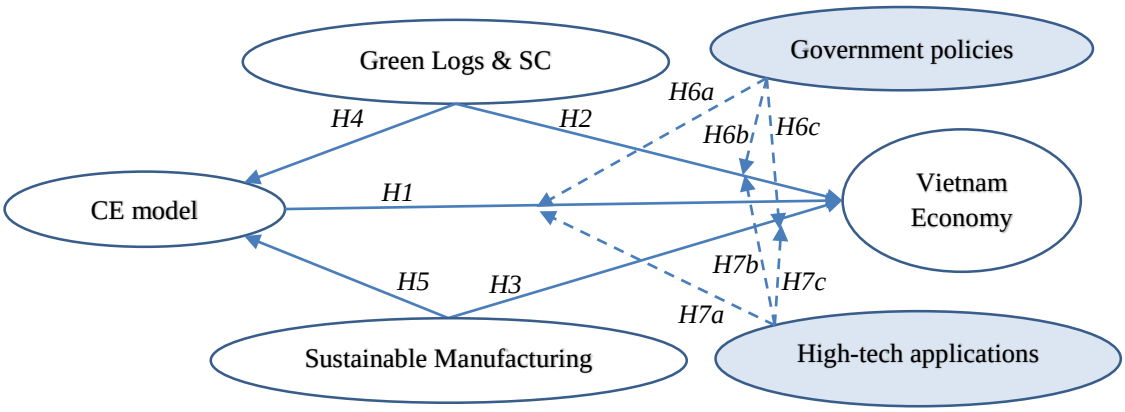
Source: own processing

3 Research results

3.1 Proposed research framework

As a result of the discussions in the above sections, a framework development of CE adoption in Vietnam economy is needed, especially in green logistics & closed-loop supply chain (Green Logs & SC) and sustainable manufacturing fields under impacting of policies and legal in the government aspect, and high-tech applications (AI, big data, machine learning, IoT, blockchain, etc.) on the enterprise side. The research framework is proposed in Figure 3.

Figure 3 – Research proposed framework



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3.2 Research hypothesis

To answer the research questions, hypotheses of the adoption of CE framework in Vietnam‘s economy are developed:

H1. ‚The CE adoptions have high effects on the Vietnam economy‘.

H2. ‚Green Logs & SC processes have high effects on the Vietnam economy‘.

H3. ‚Sustainable Manufacturing processes have great effects on the Vietnam economy‘.

H4. ‚Green Logs & SC processes are highly associated with CE adoption‘.

H5. ‚Sustainable Manufacturing processes are highly associated with CE adoption‘.

H6a/b/c. ‚Government policies positively affect the link between CE adoption/Green Logs & SC/Sustainable Manufacturing and the Vietnam economy‘.

H7a/b/c. ‚High-tech applications positively affect the link between CE adoption/Green Logs & SC/Sustainable Manufacturing and the Vietnam economy‘.

4 Conclusions

Circular economics, green logistics & closed-loop supply chain, and sustainable manufacturing are three main areas of knowledge and practices today. They are examined as the main scope of research to develop the conceptual design in this research (Figure 2).

In the current business economy, Vietnam enterprises are coping with the challenges in high-tech applications, new business model deployment, and government policy adaption; therefore, it is necessary to adopt an integrated conceptual framework of CE for Vietnam industries to improve manufacturing, logistics, and supply chain processes, especially in light of green and sustainable development. To answer the first and second research questions, as well as satisfy the first research objective, a thorough review of the literature on CE and its relation with sustainability, manufacturing, logistics, and supply chain is produced. It is a baseline for proposing a theoretical CE framework (Figure 3) and developing research hypotheses. The proposed CE framework is built to answer the third research question that also mentioned adoption for the Vietnamese economy, especially in the manufacturing, logistics, and supply chain industries. It is suitable for the second research objective mentioned in the introduction part.

The proposed framework benefits the Vietnam industry, especially in terms of CE adoption of Vietnam’s business economics, and aims to reduce the gap with developed countries. It also contributes to developing a strategic plan for trained human resources for the Vietnamese industries, especially in the fields of manufacturing, logistics, and supply chain in light of a green and sustainable mindset.

The study also outlines future research agendas in which the hypotheses of the proposed framework will be analyzed and validated using statistical tools. Furthermore, in the third phase, the study also considers developing a mathematical model and an optimal algorithm for selected CE case studies of the Vietnam industry in the light of sustainable perspectives.

Acknowledgement

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References

De Angelis, R., Howard, M. and Miemczyk, J. (2018). Supply chain management and the circular economy: towards the circular supply chain. *Production Planning and Control*, 29(6), 425–437. doi: 10.1080/09537287.2018.1449244.

Bag, S. and Pretorius, J. H. C. (2020). Relationships between industry 4.0, sustainable manufacturing and circular economy: proposal of a research framewor. *International Journal of Organizational Analysis*. doi: 10.1108/IJOA-04-2020-2120.

Bal, A. and Badurdeen, F. (2020). A multi-objective facility location model to implement circular economy. *Procedia Manufacturing*, 51(2019), 1592–1599. doi: 10.1016/j.promfg.2020.10.222.

Choi, T. M., Taleizadeh, A. A. and Yue, X. (2020). Game theory applications in production research in the sharing and circular economy era. *International Journal of Production Research*, 58(1), 118–127. doi: 10.1080/00207543.2019.1681137.

Dubey, R. *et al.* (2019). Big Data and Predictive Analytics and Manufacturing Performance: Integrating Institutional Theory, Resource-Based View and Big Data Culture. *British Journal of Management*, 30(2), 341–361. doi: 10.1111/1467-8551.12355.

Feizollahi, S., Soltanpanah, H. and Rahimzadeh, A. (2021). Development of Closed-Loop Supply Chain Mathematical Model (Cost-Benefit-Environmental Effects) Under Uncertainty Conditions by Approach of Genetic Algorithm. 6(2), 245–262. doi: 10.22034/amfa.2019.1864186.1198.

Geissdoerfer, M. *et al.* (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, 143, 757–768. doi: 10.1016/j.jclepro.2016.12.048.

Del Giudice, M. *et al.* (2020). Supply chain management in the era of circular economy: the moderating effect of big data. *International Journal of Logistics Management*. doi: 10.1108/IJLM-03-2020-0119.

Hazen, B. T. *et al.* (2020). Supply chain management for circular economy: conceptual framework and research agenda. *International Journal of Logistics Management*. doi: 10.1108/IJLM-12-2019-0332.

Hussain, M. and Malik, M. (2020). Organizational enablers for circular economy in the context of sustainable supply chain management. *Journal of Cleaner Production*, 256, 120375. doi: 10.1016/j.jclepro.2020.120375.

Jabbour, C. J. C. *et al.* (2019). Unlocking the circular economy through new business models based on large-scale data: An integrative framework and research agenda. *Technological Forecasting and Social Change*, 144(June), 546–552. doi: 10.1016/j.techfore.2017.09.010.

Kazancoglu, I. *et al.* (2021). Circular economy and the policy: A framework for improving the corporate environmental management in supply chains. *Business Strategy and the Environment*, 30(1), 590–608. doi: 10.1002/bse.2641.

Kazancoglu, Y., Kazancoglu, I. and Sagnak, M. (2018). A new holistic conceptual framework for green supply chain management performance assessment based on circular economy. *Journal of Cleaner Production*, 195, 1282–1299. doi: 10.1016/j.jclepro.2018.06.015.

Khan, S. A. R. and Zhang, Y. (2021). Development of Green Logistics and Circular Economy Theory. 516(Iserss 2020), 121–127. doi: 10.2991/assehr.k.210120.024.

Korhonen, J., Honkasalo, A. and Seppälä, J. (2018). Circular Economy: The Concept and its Limitations. *Ecological Economics*, 143, 37–46. doi: 10.1016/j.ecolecon.2017.06.041.

Kouhizadeh, M., Zhu, Q. and Sarkis, J. (2020). Blockchain and the circular economy: potential tensions and critical reflections from practice. *Production Planning and Control*, 31(11–12), 950–966. doi: 10.1080/09537287.2019.1695925.

Kumar, P., Singh, R. K. and Kumar, V. (2021). Managing supply chains for sustainable operations in the era of industry 4.0 and circular economy: Analysis of barriers. *Resources, Conservation and Recycling*, 164(October 2020), 105215. doi: 10.1016/j.resconrec.2020.105215.

Liu, J. *et al.* (2018). Green supply chain management and the circular economy: Reviewing theory for advancement of both fields. *International Journal of Physical Distribution and Logistics Management*, 48(8), 794–817. doi: 10.1108/IJPDLM-01-2017-0049.

Lopes de Sousa Jabbour, A. B. *et al.* (2018). Industry 4.0 and the circular economy: a proposed research agenda and original roadmap for sustainable operations. *Annals of Operations Research*, 270(1–2), 273–286. doi:

10.1007/s10479-018-2772-8.
Lopes de Sousa Jabbour, A. B. *et al.* (2019). Circular economy business models and operations management. *Journal of Cleaner Production*, 235, 1525–1539. doi: 10.1016/j.jclepro.2019.06.349.
Manavalan, E. and Jayakrishna, K. (2019). A review of Internet of Things (IoT) embedded sustainable supply chain for industry 4.0 requirements. *Computers and Industrial Engineering*, 127, 925–953. doi: 10.1016/j.cie.2018.11.030.
Morseletto, P. (2020). Targets for a circular economy. *Resources, Conservation and Recycling*, 153(October 2018), 104553. doi: 10.1016/j.resconrec.2019.104553.
Nwaiwu, F. *et al.* (2020). Industry 4.0 concepts within the Czech SME manufacturing sector: An empirical assessment of critical success factors. *Business: Theory and Practice*, 21(1), 58–70. doi: 10.3846/btp.2020.10712.
Patwa, N. *et al.* (2021). Towards a circular economy: An emerging economies context. *Journal of Business Research*, 122(May), 725–735. doi: 10.1016/j.jbusres.2020.05.015.
Preston, F. (2012). A Global Redesign? Shaping the Circular Economy. *Energy, Environment and Resource Governance*, (March), 1–20. Available at: http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy, Environment and Development/bp0312_preston.pdf.
Reza, A. *et al.* (2020). A Multi-Objective Model for Green Closed-Loop Supply Chain Design by Handling Uncertainties inEffective Parameters. doi: 10.22070/JQEPO.2020.5398.1153.
Saberi, S. *et al.* (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), 2117–2135. doi: 10.1080/00207543.2018.1533261.
Torasa, C. and Mekhum, W. (2020). Impact of green logistics activities on circular economy: Panel data evidence from ASEAN. *International Journal of Supply Chain Management*, 9(1), 239–245.

Organic food purchase behavior: In the light of the theory of planned behavior, does pro-social attitude matter?

Tam Minh Nguyen[1], Phuong Thi Lan Nguyen[2], Van Thi Anh Nguyen[3]

Abstract: This research presents a conceptual framework for exploring the role of pro-social attitude in encouraging organic food purchase behavior. An extensive review of the 62 relevant articles downloaded from the Scopus database and purified by a cluster of specific requirements contributes to the development of the conceptual model. Based on the traditional theory of planned behavior, this proposed framework can determine the drivers of organic food purchase behavior. This paper provides a proposed conceptual framework for researchers to empirically test and understand the antecedents of organic food purchase intention of Vietnamese customers in particular and in customers in other developing countries in general. The relationship of pro-social attitudes, attitudes towards pro-environmental behavior, subjective norm, perceived behavior control, pro-environmental intention, and organic food purchase behavior can be discussed. The study also gives a deep insight into the critical determinants for organic food in Vietnam, enhancing managers in assessing the condition and possible determinants that would lead to the successful adoption of customers. However, there are still some limitations. This paper makes progress in the stage of literature review and conceptual model development. Therefore, it is essential to have fundamental experimental research to evaluate the proposed conceptual framework and approve the consequences for the situation of developing countries.

Keywords: pro-social attitude, pro-environmental intention, grocery purchase, organic food, TPB.
JEL Classification: G32, G33, C35

1 Introduction

A series of environmental problems related to food waste, pollution, and global warming has emerged as the most pressing global issues today. All retailing industries and over-consumption of individuals are indicated to be primary culprits for this environmental degradation, and food consumption is no exception. As a result, it is considered that environmentally sustainable grocery shopping of households has been responsible for solving environmental well-being. Consequently, the shift to sustainable consumption behavior to meet the current needs and also bring benefits for the surrounding environment and future generation is the core mission of marketing researchers and policymakers. Sustainability, particularly environmental concerns, has attracted attention all over the world. Especially customers have been increasingly concerned about environmentally sustainable consumption and business (Chen, 2010). Sustainable consumption behavior has been concerned with long-term impact to guarantee social and environmental sustainability, and it is often called sustainable consumption, environmental behavior, environmentally sustainable behavior, or socially-friendly consumption behavior (Park & Ha, 2012). A range of literature reviews has been investigated the drivers or barriers to perform sustainable consumption behavior such as engagement (Kadic-Maglajlic et al., 2019), personal determinants (Aertsens et al., 2009).

Although most existing searches of these issues explored the antecedents of two kinds of sustainable consumption within a western context, little is still known about the actual inner relationship between pro-environment and pro-social

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behavior in grocery purchase in emerging markets, especially in Vietnam. Among emerging markets in Southeast Asia, Vietnam appears to have a strong economic outlook, along with enormous customer spending power, in both the short and long run based on its sustainability and inflation levels that it has drawn much attention from investors as well as businesses across industries. In particular, the food industry of Vietnam has witnessed remarkable growth which eventually contributes much to the total gross domestic product (GDP) of the nation. Over five years, ending in 2021, the total revenue of the food sector is projected to climb at around 11.3 percent in terms of the compound annual average. On the other hand, the food retail industry has also been scaled up at a dramatic rate. In the recent report from the association of Vietnam retailers, it is shown that there are approximately 800 supermarkets in addition to 150 shopping centers, 9000 traditional markets, and 2.2 million family-owned stores. Customers have been benefiting from the reduced price as a result of a cut-off in tariff. Vietnam's demographic, which is featured by 98 million people (Worldpopulationreview, 2021), mostly made up of the under-30 age group, demonstrates the strong potential for businesses to expand. Especially, residents in three high-income cities like Hanoi, Ho Chi Minh, and Da Nang tend to be aware and interested more in green and certified organic food. The growth of disposable incomes and the emerging westernization trends in culture are two key attributes to boost changes in consumption patterns in Vietnam (Australian trade and investment commission, 2016). According to organic food consumption among Vietnamese report (2018), only 39% of the total population buy organic food more than once a week. However, in Vietnam, buying organic food or sustainable issues for consuming in daily life are still very new. Therefore, besides narrow the theoretical gap, this research will practically help to explore what factors impact sustainable consumption for Vietnamese Enterprises.

The research question for this study is "What is the role of pro-social attitude in encouraging organic food purchase behavior?" To answer this question, research objectives need to be explored: Examining the relationship between pro-social attitude and pro-environmental behavior.

2 Literature review

This research section deeply analyses the relevant articles to address critical factors that govern sustainable customer behaviour. To produce this literature review, some keywords, such as "consumer behaviour" OR "sustainable" OR "sustainability" AND pro-environmental* OR pro-social* are applied for the search in Scopus abstract and citation database. It is believed that the Scopus database was widely used for research and study purposes across different fields (Ahi and Searcy,2013). At first, the Scopus database initiated 41,210 articles by using such keywords regardless of fields. This number was then reduced to 104 after imposing constraints under the "title", "abstract" and "keywords". In the last step, 42 articles were then handpicked and removed from 104 results, based on their relevance to the current article, leading to 62 articles. From these papers, certain critical elements of pro-environmental and pro-social were identified and concluded.

2.1 Theoretical background

To explore and predict organic food behaviors, the theory of planned behavior (TPB) has gained profound attention. The theory of planned behavior originally stems from the theory of reasoned action (TRA). TRA indicates that human behavioral intention would be identified by rational human choices, including attitudes and subjective norms. Primarily, attitude can be known as the degree that a person has a favorable or unfavorable evaluation or appraisal of the behavior in question (Ajzen, 1991). At the same time, subjective norm refers to the perceived social effect to act or not to act the actual behavior. Based on the basics of TRA, Ajzen in 1991 extended TRA to establish TPB with perceived behavior control which refers to “the perceived ease or difficulty of performing the behavior and it is assumed to reflect experience as well as anticipated impediments and obstacles.” It was added as antecedents of behavioral intention in juxtaposing attitude and subjective norm. By inclusion of perceived behavioral control, Ajzen enhanced the explanatory power of TRA to explain the human behavioral intention and also actual human behavior. However, the extant literature also showed that in many circumstances, TPB is even insufficient to explain the human behavioral intention and actual behavior, and thus, more drivers should be added to TPB. Within sustainable consumption, especially green behavior, hundreds of literature reviews have primarily emphasized psychological and cognitive influences (Theory of Reasoned Action) or purchase situations (Grimmer et al., 2016) or subjective norms, perceived behavioral control (Theory of Planned Behavior) (Ho et al., 2015). However, in 2019, Paco and colleagues suggested that social aspects, attitudes, and the surrounding environment should be incorporated into the models when analyzing green behavior. Yet, this paper follows his direction to fill the gap by integrating pro-social attitudes, which describes the moral compass of individuals towards the well-being of others to predict the purchase behavior during shopping time.

2.2 The constructs

Pro-social Attitudes

Pro-social attitudes can be discussed as activities that focus on the well-being of others (Weinstein and Ryan, 2010). Although the revolution of marketing literature has witnessed the effectiveness of attitudes as key drivers of consumer behavior, there is a dearth of investigation of the role of pro-social attitudes (Briggs et al., 2010), especially in the green purchase stage. Thus, the following hypotheses have been developed:

H1: Consumer's pro-social attitudes have a positive influence on pro-environmental intention.

Attitudes towards pro-environmental behavior

Several researchers applied the theory of planned behavior to predict pro-environmental performance. Ho and colleagues (2015) found that attitudes towards pro-environmental behavior were positively associated with green-buying. Thus, the following hypotheses have been developed:

H2: Attitudes towards pro-environmental behavior have a positive influence on pro-environmental intention.

Subjective norm

Subjective norm refers to the social pressure from family, friends, or close neighborhood to do or not to do the behavior (Ajzen, 1991). Based on the ground of theory of planned behavior, the subjective norm has confirmed the driver role to affect pro-environmental purchase behavior via intention, Park, and Ha (2012) indicated the significant positive effect of the social norm on recycling intention. Thus, the following hypotheses have been developed:

H3: Subjective norms have a positive influence on pro-environmental intention.

Perceived behavior control

Perceived behavior control reflects consumers' perception of their ability to perform a given behavior (Ajzen, 1991). Cleveland and colleagues (2020) recently emphasized the notable effect on intention. Thus, the following hypotheses have been developed:

H4: Perceived behavior control have a positive influence on pro-environmental intention

Pro-environmental intention

In the planned behavior model, intention has been indicated as a significant mediator between attitudes, norms, and perceived behavior control. Thus, the following hypotheses have been developed:

H5: Pro-environmental intention has a positive influence on organic food purchase behavior.

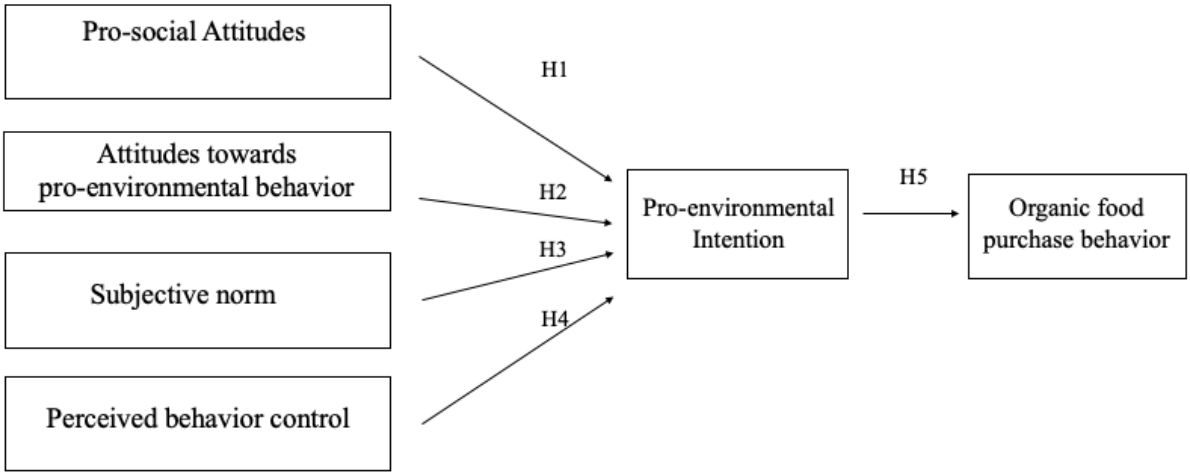

Figure 1: Proposed framework

3 Methodology

Pro-social attitudes will be adapted six items from former studies performed by (Paço et al., 2019). Attitude towards pro-environmental behavior and perceived behavior control will be adapted from Ho et al. (2015) and Ajzen (1991), respectively. Subjective norms will be established using the Fielding et al. (2008) scale. The pro-environmental intention will be measured using the Nguyen et al. scale (2016). In addition, Organic food purchase behavior will be operationalized using one item from Nguyen et al (2019) by frequency question "How often in the last ten times you purchased organic food?" with 1 for 'Never' and 7 for 'Always'.

This study will apply CFA and SEM approach to analyze data. The respondents will be Vietnamese citizens aged 18 and over and had already purchased organic food. The paper-based survey will be applied to collect data at the grocery store in three big cities in Vietnam, namely the capital of Hanoi, Ho Chi Minh, and Da Nang city located in the north, the south, and the center, respectively.

4 Conclusion

This research proposes a conceptual model for researchers to test and better understand the critical drivers for organic buying purchase behavior in Vietnamese customers in particular and other developing countries in general. This study contributes to a better understanding of pro-environmental grocery purchases in developing countries, particularly in Vietnam. It can facilitate the development of the organic industry in Vietnam by providing a knowledge base analyzed from the literature review.

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References

Ahi, P. & Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management, *Journal of Cleaner Production*, 52, 329-341.doi: 10.1016/j.jclepro.2013.02.018

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*. 179-211.

Australian Trade and Investment Commission. (2016, 11). *Australian Trade and Investment Commission*. Retrieved from Australian Trade and Investment Commission

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology*, *27*(1), 14–25. https://doi.org/10.1016/j.jenvp.2006.12.002.

Briggs, E., Peterson, M., & Gregory, G. (2010). Toward a better understanding of volunteering for nonprofit organizations: Explaining volunteers' pro-social attitudes. *Journal of Macro-marketing*, *30*(1), 61–76. https://doi.org/10.1177/0276146709352220

Carrington, M. J., Neville, B.A., &Whitwell, G. J. (2010). Why ethical consumers don't walk their talk: Towards a framework for understanding the gap between the ethical purchase intentions and actual buying behavior of ethically-minded consumers. *Journal of Business Ethics*, 97(1), 139–158

Chen, Y.S. (2010). The Drivers of Green Brand Equity: Green Brand Image, Green Satisfaction, and Green Trust. *Journal of Business Ethics*, 93, 307-319. http://dx.doi.org/10.1007/s10551-009-0223-9

Cleveland, M., Robertson, J. L., & Volk, V. (2020). Helping or hindering: Environmental locus of control, subjective enablers and constraints, and pro-environmental behaviors. *Journal of Cleaner Production*, *249*. https://doi.org/10.1016/j.jclepro.2019.119394

Fielding, K.S., McDonald, R. and Louis, W.R. (2008). Theory of planned behavior, identity and intentions to engage in environmental activism. *Journal of Environmental Psychology*, (4) 318-326.

Ho, S. S., Liao, Y., & Rosenthal, S. (2015). Applying the theory of planned behavior and media dependency theory: Predictors of public pro-environmental behavioral intentions in Singapore. *Environmental Communication*, *9*(1), 77–99. https://doi.org/10.1080/17524032.2014.932819

Kadic-Maglajlic, S., Arslanagic-Kalajdzic, M., Micevski, M., Dlacic, J., & Zabkar, V. (2019). Being engaged is a good thing: Understanding sustainable consumption behavior among young adults. *Journal of Business Research*, *104* (December 2017), 644–654. https://doi.org/10.1016/j.jbusres.2019.02.040

Moisander, J. (2007). Motivational complexity of green consumerism. *International Journal of Consumer Studies*, 31(4), 404–409.

Nguyen, H. V., Nguyen, N., Nguyen, B. K., Lobo, A., & Vu, P. A. (2019). Organic food purchases in an emerging market: The influence of consumers' personal factors and green marketing practices of food stores. *International Journal of Environmental Research and Public Health*, 16(6). https://doi.org/10.3390/ijerph16061037

Nguyen, T. N., Lobo, A., & Greenland, S. (2016). Pro-environmental purchase behavior: The role of consumers' biospheric values. *Journal of Retailing and Consumer Services*, *33*, 98–108. https://doi.org/10.1016/j.jretconser.2016.08.010

Paço, A. do, Shiel, C., & Alves, H. (2019). A new model for testing green consumer behavior. *Journal of Cleaner Production*, *207*, 998–1006. https://doi.org/10.1016/j.jclepro.2018.10.105

Park, J., & Ha, S. (2012). Understanding pro-environmental behavior: A comparison of sustainable consumers and apathetic consumers. *International Journal of Retail and Distribution Management*, 40(5), 388–403. https://doi.org/10.1108/09590551211222367

Penner, L. A., Dovidio, J. F., Piliavin, J. A., & Schroeder, D. A. (2005). Pro-social behavior: multilevel perspectives. *Annual Review of Psychology*, 56, 365-392.

Penner, L. A., Dovidio, J. F., Piliavin, J. A., & Schroeder, D. A. (2005). Pro-social behavior: multilevel perspectives. *Annual Review of Psychology*, 56, 365-392.

Scheffer, V. B. (1991). *The shaping of environmentalism in America*. University of Washington Press

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407–424

Small, D. A., & Cryder, C. (2016). Pro-social consumer behavior. *Current Opinion in Psychology*, *10*, 107–111. https://doi.org/10.1016/j.copsyc.2016.01.001

Weinstein, N., & Ryan, R.M. (2013). When helping helps: Autonomous motivation for pro-social behavior and its influence on well-being for the helper and recipient. *Journal of Personality and Social Psychology*. 98(2), 222–244

Logistics performance of European Union countries

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Abstract: The subject of the author's research is the evaluation of the logistical performance primarily of the member states of the European Union. The high level of logistics performance of the country and its growth is a positive signal for all entrepreneurs, investors and traders who intend to operate in a particular national market.

The article first deals with the methodology of determining the logistics performance index (LPI) by the World Bank, then the calculation of the index of change in the overall logistics performance of individual member countries and the index of changes in the evaluation of logistics performance of countries according to six criteria. The key outputs of the article include determining the specific value of the logistics performance of the 27 countries of the European Union, using the LPI index, determining their position in the world and among the member states of the European Union. Last but not least, the result of the research is also the determination of the change in the logistical performance of European countries on the basis of the calculation of the basic index. Using these calculations, Member States are divided into three groups, those that show an improvement in 2018 compared to 2010 and those that show a deterioration. The last group is represented by countries in which there was no change in the value of the overall logistics performance. The next part of the article examines the main causes of positive and negative changes in the index of logistics performance of individual member states of the European Union, using the basic index of evaluation of countries according to individual criteria, which monitors the World Bank in determining LPI.

Keywords: logistic performance, logistic performance index, change index, European Union, improvement
JEL Classification: F21, F23

1 Introduction

The article deals with the evaluation and development of the logistics performance of the 27-member states of the European Union.

The European Union is one of the most open economies in the world. Its internal market is the largest single market in the world. Free trade between Member States is one of the fundamental pillars on which the Union stands. The European Union is also seeking to engage in world trade. The Union is actively working with individual countries and regional groupings to negotiate trade agreements with them. Thanks to these agreements, both parties, the EU and the country concerned, have mutually beneficial access to the market. Businesses in the Member States can thus develop their activities and make it much easier to import the raw materials they use to produce their products. Therefore, in order for the EU trade to function without problems, it needs efficient logistics. The high level of logistics performance of the country is a positive signal for all entrepreneurs, investors and traders who intend to operate in a particular national market. (World Bank Group, 2020)

Logistics services represent the level of logistics services with regard to their costs. (Macurová & Klabusayová & Tvrdoň, 2018) Typical indicators of logistics performance are delivery times, reliability of deliveries, completeness of deliveries and logistics productivity. *This leads to consider the logistics performance as one of the key factors of international trade.* (Medina & Selva & Menendez, 2014, p. 77)

We divide the methods of measuring logistics performance into internal and external. Internal monitoring of logistics performance takes place directly in the companies that are evaluated. External measurement of logistical performance can be performed by research and consulting agencies or other independent entities, such as the World Bank.

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2 Methods

The LPI (Logistics Performance Index) is the first international competitive benchmarking method to fundamentally evaluate trade and transport terms and conditions. (Arvis & Musta & Ojala, 2010, pp. 11-13). Herewith, it should be noted that theLPI index has a number of limitations, which relate mainly to the evaluation of customer service quality. These limitations are common in expert methods, which are generally highly subjective. Nevertheless, the importance of this key method of evaluating the performance of individual countries is not really diminished.

In his article from 2020, for example, S. N. Chakrabarty also dealt with the mathematical-statistical limitations of the Logistics Performance Index (LPI) and their corrective measures.

The Logistics Performance Index (LPI), created by the World Bank, is a benchmark tool used to determine the threats and opportunities faced by countries in their logistics performances and to improve their performance. Countries aim to increase their LPI scores and rank higher on the LPI list while developing their strategies. (Senir, 2021, p. 193)

Logistics performance research has been carried out by the World Bank since 2007, and regularly every 2 years since 2010 (Lukoszová, 2020). It measures the performance of the supply chains that are the backbone of international trade. (Puertas & Marti & Garcia, 2014) Since the first implementation of LPI logistics performance research, it is clear that good government policy contributes to the development of efficient supply chains, but also that many developing countries are still lagging behind. LPIs and their components help countries understand the challenges they face with their trading partners so that their national logistics can be strong. Through LPIs, the government, entrepreneurs and society as a whole can better identify the competitive advantage created by good logistics and understand the relative importance of different interventions. (The World Bank, 2014) As supply chains become more and more global, the quality of logistics services can show the extent to which individual countries are able to participate in world trade.

The LPI Index assesses the logistical performance of countries on the basis of the following six criteria:

1. **Customs** – efficiency of customs clearance processes, border crossing control.
2. **Infrastructure** – transport-related transport infrastructure and its quality.
3. **International Shipments** – it is about the ease of achieving competitive prices and the availability of transport services.
4. **Logistics competence** – expertise and quality of logistics services.
5. **Tracking and tracing** – ability to track shipments.
6. **Timeliness** – meeting delivery deadlines; the frequency at which consignments arrive at the consignee within a specified or expected time. (Kladiva, 2014), (Lukoszová, 2020)

The Logistics Performance Index (LPI) is determined on the basis of a worldwide survey of multinational organizers of orders related to the transport, storage and distribution of goods, so-called forwarders and major express carriers. The principles of creating the LPI index were created using the methodology of Finnish professor Lauri Ojalema from the School of Economics in Turku. The LPI itself was determined on the basis of surveys conducted by the World Bank and was attended by approximately 6,000 logistics managers. (Kladiva, 2014), (Lukoszová, 2020)

The LPI is calculated using the weighted arithmetic average of the six criteria mentioned above, which are scored on a scale of 1 to 5 based on respondents' ratings, with 5 being the maximum rating. (Lukoszová, 2020)

The methodological approach today to LPI is constructed based on a survey with respondents that are experts in the field of international shipping and logistics. For all the countries experts that are not based in that country are asked to give a rating on the six main components of LPI. With regards to proposals for improving the LPI, a modified index has been proposed that qualitatively and quantitatively represents an objective view of countries' logistics systems and subsystems, based on international statistical data. The possible constraint of this approach with direct impact on results might be the fact that respondents (the sample) might not give an objective and complete overview of countries due to not having the precise opinion about the local logistics performance. It is therefore vital to examine the impact of the sample on the outcome of the LPI and to summarize logistics performance across countries based on modified methodology. (Janno & Mochalina & Ivankova & Labanova & Lationina & Safulina & Uukkivi, 2021)

Emphasizing the logistics role for the economy, many logistics reports, especially global ones, are published. One of them is the World Bank's Logistics Performance Index (LPI) Report. The LPI index is a tool that allows you to identify challenges and opportunities in logistics of the region/country studied and indicates what needs to be done to improve logistics efficiency. An index is a benchmarking tool used by managers in the logistics industry and decision-makers -

economists, politicians, representatives of financial institutions, representatives of institutions supporting development, and investors. (Sergi & D'Aleo & Konecka, 2021)

In 2018, the survey compared 160 countries (World Bank, 2018). In 2010, 155 of them were evaluated. All member states of the European Union were evaluated in both monitored periods.

Logistics performance can be assessed from two perspectives: international and national. The international perspective provides a qualitative assessment by foreign logistics professionals within the above six criteria. The National Logistics Performance Index provides both qualitative and quantitative assessments of the country by domestic logistics professionals who, unlike foreign evaluators, have more information on the logistics environment, key logistics processes and other performance and time data. (Kladiva, 2014)

In the future, the World Bank and logistics experts expect further objectification of the LPI calculation. *As one of the solutions, it is proposed to calculate LPI of an individual monitored country on a semi-annual basis with a variable set of respondents. Further, the methodology for calculating the index should meet the requirements of completeness, reliability, relevance, and sufficiency of information on the development of digital technologies individual monitored countries. This will allow in the form of a generalized indicator to compare the logistics indicators occurring in each study region.* (Janno & Mochalina & Ivankova & Labanova & Lationina & Safulina & Uukkivi, 2021, p. 153)

In order to determine the changes in the logistics performance indices from 2018 compared to 2010, as well as the changes in the evaluation according to their partial criteria, basic indices were used. The basis for calculating the basic index was the value from 2010. The change index (Iz) is then calculated according to the formula:

$$Iz = LPI2018/LPI2010 \quad (1)$$

An analogous formula is then used to calculate changes in the assessment of a country according to the sub-criteria:

$$Izi = Hi2018/Hi2010 \quad (2)$$

follows:

LPI2018	the value of the logistics performance index in 2018
LPI2010	the value of the logistics performance index in 2010,
Hi2018	evaluation of the i-th criterion in 2018
Hi2010	evaluation of the i-th criterion in 2010
i = 1, 2, 3, 4, 5, 6	
Iz, Izi > 1	improving the country rating or the i-th country criterion
Iz, Izi < 1	deterioration of the country's assessment or the i-th country criterion
Iz, Izi = 1	the assessment of the country or the i-th country criterion remains unchanged

The index of change (Iz, Izi) may take a value higher than 1, which means that in 2018 compared to 2010 there was an increase in the logistics performance of the country or an increase in logistics performance with respect to the monitored criterion i, a value less than 1, on the other hand, means a reduction in its logistical performance, or a reduction in logistical performance according to criterion i.

If the change index is equal to 1, there was no change in the monitored country index in 2018 compared to 2010 or the logistical performance according to criterion i.

3 Research results

The result of the study of the logistical performance of the countries of the European Union is primarily an evaluation of their logistical performance in 2018 and finding out whether or not the logistical performance has improved (see Table 1).

Table 1 Evaluation of the logistical performance of the member states of the European Union in 2018 and its changes compared to 2010

Country	**LPI 2018**	**World ranking** (2018)	**EU ranking** (2018)	LPI 2010	**Change Index** (Iz)
Germany	**4,20**	**1.**	**1.**	4,11	**1,02**
Sweden	**4,05**	**2.**	**2.**	4,08	**0,99**
Belgium	**4,04**	**3.**	**3.**	3,94	**1,03**
Austria	**4,03**	**4.**	**4.**	3,76	**1,07**
Netherlands	**4,02**	**6.**	**5.**	4,07	**0,99**
Denmark	**3,99**	**8.**	**6.**	3,85	**1,04**
Finland	**3,97**	**10.**	**7.**	3,89	**1,02**
France	**3,84**	**16.**	**8.**	3,84	**1,00**
Spain	**3,83**	**17.**	**9.**	3,63	**1,06**
Italy	**3,74**	**19.**	**10.**	3,64	**1,03**
Czech Republic	**3,68**	**22.**	**11.**	3,51	**1,05**
Portugal	**3,64**	**23.**	**12.**	3,34	**1,09**
Luxembourg	**3,63**	**24.**	**13.**	3,98	**0,91**
Poland	**3,54**	**28.**	**14.**	3,44	**1,03**
Ireland	**3,51**	**29.**	**15.**	3,89	**0,90**
Hungary	**3,42**	**31.**	**16.**	2,99	**1,14**
Slovenia	**3,31**	**35.**	**17.**	2,87	**1,15**
Estonia	**3,31**	**36.**	**18.**	3,16	**1,05**
Greece	**3,20**	**42.**	**19.**	2,96	**1,08**
Cyprus	**3,15**	**45.**	**20.**	3,13	**1,01**
Romania	**3,12**	**48.**	**21.**	2,84	**1,10**
Croatia	**3,10**	**49.**	**22.**	2,77	**1,12**
Bulgaria	**3,03**	**52.**	**23.**	2,83	**1,07**
Slovak Republic	**3,03**	**53.**	**24.**	3,24	**0,94**
Lithuania	**3,02**	**54.**	**25.**	3,13	**0,96**
Malta	**2,81**	**69.**	**26.**	2,82	**1,00**
Latvia	**2,81**	**70.**	**27.**	3,25	**0,86**

Source: Own processing

It is clear from Table 1 that the majority of member states (18 in total, i.e. 66.67 %) recorded an improvement in the logistics performance index in 2018 compared to 2010. In 7 (25.93 %) countries, on the other hand, its value deteriorated. Table 1 also shows, among other things, that in the case of France and Malta, there was no change in the assessment using the overall LPI index (these 2 countries represent 7.40% of the sample).

Other results (presented in Table 2) follow the structural changes in the index of logistics performance of all member states of the European Union according to individual criteria.

Table 2 Increasing the logistical performance of countries according to individual criteria

Ranking by increase size	Country	Iz1 Customs	Iz2 Infrastructure	Iz3 International Shipments	Iz4 Quality Logistics Services	Iz5 Tracking and Tracing	Iz6 Timeliness
1.	**Slovenia**	**1,32**	**1,23**	1,12	1,05	1,03	**1,20**
2.	**Hungary**	1,18	1,06	1,16	1,12	**1,28**	1,08
3.	**Croatia**	1,14	**1,28**	0,99	**1,23**	1,07	1,11
4	**Romania**	1,09	**1,29**	0,98	1,15	1,12	1,07
5.	**Portugal**	0,96	1,03	**1,27**	1,12	1,10	1,08
6.	**Greece**	1,15	1,08	1,16	1,14	0,96	1,05
7.	**Austria**	1,06	1,14	1,03	1,10	1,07	1,04
8.	**Bulgaria**	1,18	**1,20**	1,05	1,01	1,02	1,04
9.	**Spain**	1,04	1,07	**1,23**	1,05	0,97	0,99
10.	**Czech Rep.**	0,99	1,06	1,10	1,14	1,03	0,99
11.	**Estonia**	1,06	1,13	1,03	0,99	1,09	1,03
12.	**Denmark**	1,09	1,11	1,02	1,05	1,06	1,01
13.	**Belgium**	0,96	0,99	**1,21**	1,00	0,96	1,03
14.	**Italy**	1,03	1,03	1,09	1,02	1,00	1,01
15.	**Poland**	1,04	1,08	1,14	1,10	1,02	0,87
16.	**Germany**	1,02	1,01	1,05	1,04	1,01	0,98
17.	**Finland**	0,99	1,02	1,04	0,99	1,06	1,05
18.	**Cyprus**	1,04	0,98	1,01	1,06	0,89	1,05

Source: Own processing

The most significant improvement in logistics performance is evident in the countries of Central and Eastern Europe, namely Slovenia, Hungary, Croatia and Romania (as can be seen from the information provided in Table 1 and Table 2). The most significant improvement in this group of countries has been in infrastructure, which is probably largely due to the European Union's policy and its support programs. Undoubtedly, Austria represents a great opportunity for European business, ranking fourth in the overall LPI index worldwide and within the European Union, and ranking 7th in terms of improvement through the Index of Change.

On the other hand, the smallest improvement in logistics performance was recorded in Cyprus, which in the case of an island country can be considered understandable, and even this small improvement can be assessed positively.

The information contained in Table 3 relates to countries showing a reduction in logistical performance as a whole, which is also monitored here according to individual criteria.

Table 3 Reduction of logistical performance of member countries according to individual criteria

Ranking by size of reduction	Country	Iz1 Customs	Iz2 Infrastructure	Iz3 International Shipments	Iz4 Quality Logistics Services	Iz5 Tracking and Tracing	Iz6 Timeliness
1.	**Latvia**	0,95	1,03	**0,81**	0,91	**0,79**	**0,77**
2.	**Ireland**	0,93	0,91	0,92	0,94	0,90	**0,84**
3.	**Luxembourg**	**0,87**	**0,89**	0,92	1,02	0,92	**0,85**
4.	**Slovak Rep.**	1,00	1,00	1,02	1,00	0,97	**0,80**
5.	**Lithuania**	1,02	1,00	**0,87**	1,04	0,95	0,93
6.	**Sweden**	1,04	1,05	1,02	0,94	0,92	0,99
7.	**Netherlands**	0,98	0,99	1,02	0,99	0,98	0,96

Source: Own processing

Table 3 shows that the most significant reason for the deterioration in the logistics performance index is delivery time, which was very pronounced in the case of Latvia, Ireland, Luxembourg and the Slovak Republic in particular. Also in the remaining three countries, which saw a slight decrease in overall logistics performance, the assessment of the time parameter deteriorated, albeit to a minimal extent.
From the point of view of business and trade, the riskiest of the European Union countries therefore seems to be Latvia, which is not solely the last in the LPI ranking, but is also the country that has deteriorated the most compared to 2010.

The last Table 4 is devoted to countries with a maintained level of the overall performance index, and these countries may also show and often show improvements or deterioration in logistics performance indices according to individual criteria.

Table 4 Structural changes in the logistical performance of France and Malta

Country	Iz1 Customs	Iz2 Infrastructure	Iz3 International Shipments	Iz4 Quality Logistics Services	Iz5 Tracking and Tracing	Iz6 Timeliness
France	0,99	1,00	1,08	0,99	1,00	0,95
Malta	1,02	1,00	0,93	0,97	1,10	1,00

Source: Own processing

Table 4, which shows the values of the change indices for France and Malta, shows that in both countries there is no change did not change the assessment of the logistics infrastructure. In France, there was a slight improvement in International Shipments and in Malta, there was Tracking and Tracing. Malta's improvement in the Customs criterion can be considered negligible.

The biggest deterioration in Malta was in the International Shipments criterion. As in many European Union countries, France also saw a deterioration in supply timelines, while in the case of Malta the assessment remained same compared to 2010.

4 Conclusions

Evaluating the logistics performance of the various territories of the world, and of course the countries of the European Union, is very important not only for international logistics, but also for international trade and business. The main role in this sense is played primarily by the location of foreign direct investment or the conditions of international technical and technological exchange. This concerns in particular the type, content and conditions for concluding international business agreements between corporations. (Gołembska, 2014)

The article deals in some details with the changes in the logistic performance indices of 2018 compared to the values of 2010 in the countries of the European Union.

It is clear from the results of the research that the unequivocal leader in the logistics performance of the member states of the European Union is Germany, which ranked first not only within the European Union but also in the world with the value of the LPI logistics performance index. In addition, compared to 2010, Germany, according to logistics experts, shows a slight improvement overall, which is due to positive changes, especially in the area of infrastructure, International Shipments and Quality Logistics Services. A similar situation exists in Belgium, which ranked 3rd in the European Union and worldwide and also shows a slight improvement in its logistics performance (as measured by the overall LPI index in 2018 to 2010), mainly due to a significant improvement International Shipments. The improvement was also recorded in Austria, which ranks 4th in the European Union and in the world and is caused by positive changes even in all 6 monitored areas. At the same time, Austria shows the most significant improvement in the infrastructure criterion. Austria can thus be considered a very promising country in terms of trade and logistics.

Slovenia, Hungary, Croatia and Romania show the most significant improvement in logistics performance among the countries of the European Union, although in terms of the overall LPI logistics performance index in 2018, these countries are around 20th place in all member states. A significant improvement in logistics performance is also evident in the case of Portugal, Greece and Bulgaria.

No change in the overall logistics performance index was recorded for France and Malta.

A decrease in logistics performance was recorded in 7 countries of the European Union. These are Latvia, Ireland, Luxembourg, Slovak Republic, Lithuania, Sweden and the Netherlands. Significant factors in the deterioration of the logistics performance of these countries appear to be the problems in the area of delivery time parameters. The problem with the time criterion was also noted in the case of France, which otherwise retained the same value in the overall evaluation in 2018 as in 2010. It is the improvement of the time criterion that logistics companies in the European Union should focus on in the future. Sweden, which recorded only a slight deterioration compared to 2010, is the country that ranks second in the ranking of the overall LPI index in the world and in the European Union. A similar situation prevails in the Netherlands, which ranks 5th in the European Union and 6th in the world in the LPI ranking.

A positive finding of the study seems to be the fact that the most significant improvements in logistics performance were recorded by post-communist countries and may, in addition to the countries at the top of the LPI overall logistics performance scoreboard, represent a suitable business opportunity in the future.

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References

Arvis, J. F., Musta, M. A., Ojala, L., Sheperd, B., Salavsky, D. (2010). *Connecting to Compete 2010, trade Logistics in the Global Economy, The Logistics Performance Index and Its Indicators.* Washington: The World Bank.

Chakrabarty, S. N. Logistics Performance Index: Methodical Issues. *Foreign Trade Review* 55(4), 466-467.

Janno, J., Mochalina E. P., Ivankova G. V., Labanova, O., Latonina, M., Safulina, E., Uukkivi, A. (2021). The Impact of Initial Data on the Logistics Performance Index Estimation: Estonian and Russian Study. *Logforum* 17(1), 147-156. http://doi.org/10.17270/J.LOG.2021.554

Kladiva, J. Indexy logistické výkonnosti 2014. (2014). Logistika.info.cz [online]. 2014 [cited 2021-04-03]. Retrieved from:https://www.elogistika.info/indexy-logisticke-vykonnosti-2014/?fbclid=IwAR1hMREtRt-88wN9CikHdHFFO1N1Z-kj-gMbJjKmX_DD1-qvwe-dyTNAtk0

Lukoszová, X. (2020). *Logistika pro obchod a marketing*. Praha: Ekopress.

Macurová, P., Klabusayová, N., Tvrdoň, L. (2018). *Logistika.* Ostrava: VŠB-TU Ostrava.

Medina, R. P., Selva, M. L. M., Menendez, L. G. (2014). Logistics Performance Index: European Exports. *Revista de Economia Mundial* 38, 77-99.

Puertas, R., Marti, L., Garcia, L. (2014). Logistics performance and export competitiveness: European experience. Dordrecht: Springer 41(3), 467-480. doi: 10.1007/s10663-013-9241-z

Senir. G. (2021). Comparasion of Domestic Logistics Performances of Turkey and European Union Countries in 2018 with an Integrated Model. Poznan: *Logforum* 17, 193-204. doi: 10.17270/J.LOG.2021.576

Sergi, B. S., D'Aleo, V., Konecka, S. (2021). Competiveness and the Logistics Performance Index: The ANOVA method application for Africa, Asia, and the EU regions. *Sustainable Cities and Society* 69.

The World Bank. (2014). Connecting to Compete: Trade Logistics in the Global Economy. In: The International Bank for Reconstruction and Development/The World Bank [online]. 2014 [cited 2021-05-03]. Retrieved from: https://www.worldbank.org/content/dam/Worldbank/document/Trade/LPI2014.pdf

The World Bank. (2018). Connecting to Compete: Trade Logistics in the Global Economy. In: The International Bank for Reconstruction and Development/The World Bank [online]. 2018 [cited 2021-05-03]. Retrieved from: https://www.worldbank.org/content/dam/Worldbank/document/Trade/LPI2018.pdf

World Bank Group. (2020) Logistics Costs and Competitiveness: Measurement and Trade Policy Applications. Openknowledge.worldbank.org [online]. 2020 [cited 2021-05-03]. Retrieved from: https://openknowledge.worldbank.org/handle/10986/26724

Economic Impacts of Changes and Policies in the Fields of Finance, Accounting, and Taxation

The impact of corporate investment strategy on firm profitability moderated by economic policy uncertainty: Evidence from Pakistan.

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Abstract: This study investigates the impact of corporate investment strategy on firm profitability moderated by economic policy uncertainty. The study's sample includes of 23 non-financial firms, and data were obtained from the website of Pakistan Stock Exchange from 2014 to 2019. The Pooled, Fixed-effect, Random-effect, and Generalized Least Square methods are applied to estimate the quantitative models' estimation results to investigate the impact of economic policy uncertainty on the relationship between investment per total assets, financial leverage on firm performance. The findings of the study indicate that corporate investment strategy and leverage have a significant and positive influence on the firm's profitability. Moreover, the overall moderated regression findings suggest that economic policy uncertainty moderates the relationship between investment strategy and leverage on firm profitability negatively and significantly. These results contribute significant indications for managers and related authorities to manage their investment strategy under economic policy fluctuations.

Keywords: investment decisions, economic policy uncertainty, profitability, financial leverage
JEL Classification : D25, E6, L27, L25

1 Introduction

The study investigates the link between economic policy uncertainty (EPU) and corporate investment at the firm level. The impact of uncertainty on investment has been studied before, but the results are inconclusive. We're more concerned about the impact of economic policy uncertainty than idiosyncratic uncertainty. Economic or political shocks may be a major cause of uncertainty for firms, as they can have a substantial influence on earnings. Corporate investment is usually costly and irreversible. Changes in policy would have an impact on the environment in which businesses operate and, as a result, their investment decisions. As a result of the significant degree of uncertainty and fluctuations in future policies of the government, firms' financial decisions are influenced. To determine whether policy uncertainty has an impact on investment, financial leverage (FL) and firm performance, it is vital to explore it in depth. According to more recent studies, the reduction in business investment expenditures during the topical global financial meltdown is due to increased policy uncertainty (Baker et al., 2013; Gulen and Ion, 2013). Sahinoz and Cosar (2018) reveal that EPU has a negative impact on economic development and investment. The study of Baker, Bloom, and Davis (2016) has indicated a negative correlation between EPU and business investments. Further, He and Niu (2018) finds that EPU has an adverse influence on the valuation of banks. Conversely, policy uncertainty may exacerbate information asymmetry among creditors and borrowers, affecting the risk of default and resulting in increased debt financing costs (Zhang et al., 2015). Debt would be less appealing under the Trade-off theory approach, and companies would reduce their leverage levels. The study of Pan et al. (2019) support to this inverse linkage. On the other hand, Heightened policy uncertainty might result in a higher equity risk premium (Pastor and Veronesi, 2013), raising the equity finance cost and limiting the number of seasoned equities offers (Çolak et al., 2017). As a result, financial leverage could be positively correlated with EPU (Qiu and Li,

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2017). The BBD index was used as an economic policy uncertainty proxy, similar to prior research linked to economic policy uncertainty. Policy uncertainty is positively associated to financial leverage. The study employed to a sample of 5456 firm-quarter 163 observations of Brazilian non-financial enterprises from 2010 to 2019 (Bonaime et al., 2018; Zhang et al., 2015). To measure economic policy uncertainty, it defines three types of underlying components. The coverage of policy-related economic uncertainty in the newspaper is one component that has been quantified. the sections of federal tax code number is indicated in the second segment. The third aspect uses economic forecaster disagreement as a proxy for uncertainty. However, economic uncertainty has a moderating effect on the connection among investment and financial leverage on firm performance has not been examined in the context of Pakistan. Most of the prior studies were directed on different economic parameters of enterprises.

The following are the study's major contributions. To the best of the authors' knowledge, the first novel study that looks at the impact of EPU on the relationship between investment per total assets, financial leverage on firm performance. The study shows that investment per total assets, financial leverage relates positively to the profitability of firm. On the other hand, the moderation results of the study show that EPU negatively and significantly moderates the relationship between investment per total assets, financial leverage on firm profitability. It means that when economic policy high, firms should not take more debt and also conservative to making investment decisions, which cause ultimately decreasing the firm's profitability.

2 Methods

2.1 Description of variables

The study has employed Return on Assets (ROA) as a dependent variable and Investment per total Assets (IPA) and Financial Leverage (FL) as an independent variable, while economic policy uncertainty (EPU) as a moderating variable (IPA*EPU and FL*EPU) and Firm's Size (FS) is a control variable. The measurement of variables shown below:

2.1.1 Return on Assets (ROA)

Return on Assets is measured through net income / total assets, as many researchers uses same measure such as (Abdullah & Tursoy, 2021; Fosu, 2013).

2.1.2 Investment per total Assets (IPA)

Investment per total assets measures as capital expenditure to total assets as similarly to (Wang et al., 2014).

2.1.3 Financial Leverage (FL)

The study measures financial leverage as total debt to total assets. Similarly, the studies of (Pan et al., 2019) uses same measure.

2.1.4 Economic policy uncertainty (EPU)

The study employs data from the index of Economic Policy Uncertainty (www.policyuncertainty.com), which has been extensively used in recent empirical studies in corporate finance to assess economic policy uncertainty (Iqbal, Gan, and Nadeem, 2019; Mirza and Ahsan, 2020)

2.1.5 Firm's Size (FS)

The study measures the firm's size as to Log of total assets.

2.2 Quantitative models

To investigate the effect of EPU on the association among investment per total assets, financial leverage on firm's profitability, the following models formulated.

$$ROA_{it} = \beta_{0_{it}} + \beta_1(\mathrm{IPA}_{it}) + \beta_2(\mathrm{FL}_{it}) + \varepsilon_{it} \quad (1)$$

$$ROA_{it} = \beta_{0_{it}} + \beta_1(\mathrm{IPA}_{it}) + \beta_2(\mathrm{FL}_{it}) + \beta_3(\mathrm{EPU}_{it}) + \varepsilon_{it} \quad (2)$$

$$ROA_{it} = \beta_{0_{it}} + \beta_1(\mathrm{IPA}_{it}) + \beta_2(\mathrm{FL}_{it}) + \beta_3(\mathrm{EPU}_{it}) + \beta_4(\mathrm{FS}_{it}) + \varepsilon_{it} \quad (3)$$

$$ROA_{it} = \beta_{0_{it}} + \beta_1(\mathrm{IPA}_{it}) + \beta_2(\mathrm{FL}_{it}) + \beta_3(\mathrm{EPU}_{it}) + \beta_4(\mathrm{FS}_{it}) + \beta_3(\mathrm{IPA} * \mathrm{EPU}_{it}) + \varepsilon_{it} \quad (4)$$

$$ROA_{it} = \beta_{0_{it}} + \beta_1(\mathrm{IPA}_{it}) + \beta_2(\mathrm{FL}_{it}) + \beta_3(\mathrm{EPU}_{it}) + \beta_4(\mathrm{FS}_{it}) + \beta_3(\mathrm{FL} * \mathrm{EPU}_{it}) + \varepsilon_{it} \quad (5)$$

Where:

(The interaction term employed between IPA*EPU and FL*EPU)

i = Numbers of companies ranging from 1- 23
t = Period ranging from 2014-2019
β_0 = the intercept of the equation.
β_i = Coefficients of independent variables
ε = the error terms

According to Wooldridge (2001), Hansen (1982), and Arellano and Bond (1991), the study utilizes the Pooled, Fixed-effect technique (FE) and the Random-effect approach (RE) to measure regression models. All observations are treated as cross-section data in the Pooled method, whereas FE and RE analyze both time-series and cross-section components simultaneously. For choosing the suitable estimation outcomes of FE and RE, Hausman test has used. FE and RE may have the autocorrelation or heteroskedasticity problems as per the suggestions of (Gujarati and Porter, 2009), so, the Wald test is applied to examine heteroskedasticity, while the Wooldridge test, as well as the Breusch and Lagrangian tests, are employed to investigate autocorrelation. The study will also use the Generalized Least Square (GLS) to overcome the issues if FE or RE prevails, as it is best choice presents by Kamarudin et al. (2019) and Gujarati and Porter (2009).

3 Research results

This section shows the descriptive, correlation and regression results for all quantitative model.

Table 1 Descriptive statistic

Variable	Obs.	Mean	Std. Dev.	Min	Max
ROA	138	0.0743568	0.2670163	-2.647398	0.4165002
IPA	137	0.1896801	0.2179937	1.42e-06	0.8385806
FL	138	1.002199	1.941377	-2.648348	13.28095
EPU	6	93.2511	22.89301	62.45566	129.6692
SIZE	138	15.65767	2.126366	10.00762	19.03796

Source: Own processing

The descriptive statistics of the variables used in the analysis are shown in table 1. In 23 Pakistani non-financial firms, the income based on shareholder investment is the mean value of ROA is 0.074. The average financial leverage value is 1.00 companies desiring to keep a balance for current assets, the average IPA value is .18, and the EPU is 93.25. It means the value of EPU is higher which impact firm's financial leverage and ultimately on its performance. In this situation, the next consideration is extra suitable, examine the mean value of size is 15.65, which means a very high relation between total assets and ROA.

Table 2 Correlation between variables and VIF

Variable	VIF	ROA	IPA	LEV	EPU	SIZE
ROA	0	1.0000				
IPA	1.04	0.1212	1.0000			
LEV	1.09	0.1844	0.1929	1.0000		
EPU	1.00	-0.0365	0.0028	-0.0237	1.0000	
SIZE	1.05	0.3387	-0.0257	0.1953	0.0585	1.0000

Source: Own processing

The table 2 shows the results of Pearson correlation for the study variables. Investment per total assets, financial leverage and firm size is positively correlated with firm profitability (ROA). These results suggest that the correlation statistics among variables are consistent with the profitability measure. On the other hand, economic policy uncertainty natively and significantly associated with the profitability of a firm, which suggests a higher EPU lead lower firm profit and vice versa. The study also estimates the variance inflation factor (VIF) to additional test the presence of multicollinearity. The maximum value of VIF is 1.09, demonstrating that multicollinearity is not exist in our analysis.

The estimate of all qualified models performed by the Pooled, FE, and RE methods is shown in Table 3. All of the estimation outcome models are statistically significant at 10%, 5%, and 1%, respectively. The value of the Hausman test shows that if it is significant at a level less than 10%, the FE estimation is superior to the RE. In this study, there are five FE estimation findings that are more appropriate than RE estimates (see column 2-5-8-11-14). The independent variables in the models explain 32.3 percent to 44.9 percent of profitability, according to the fixed effects estimate findings. The RE and Pooled explanation proportion, on the other hand, is low, hovering around 29%. At 1%, all IPA, LEV, EPU, and

Variable	Pooled	FE	RE	Pooled	FE	RE	Pooled	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CONS.	0.028	-0.289***	-0.033	0.063	-0.256***	0.005	-0.548***	-5.264***	-0.612***
	[0.92]	[-5.13]	[-0.71]	[0.66]	[-2.84]	[0.06]	[-3.04]	[-4.79]	[-2.72]
IPA	0.108	1.630***	0.355**	0.109	1.632***	0.327**	0.135	1.565***	0.249*
	[1.03]	[5.82]	[2.32]	[1.03]	[5.80]	[2.19]	[1.35]	[6.04]	[1.94]
LEV	0.022*	0.052***	0.038***	0.022*	0.051***	0.037***	0.013	0.045***	0.026**
	[1.94]	[3.97]	[3.06]	[1.92]	[3.93]	[2.96]	[1.17]	[3.75]	[2.15]
EPU				-0.000	-0.000	-0.000	-0.000	-0.002***	-0.000
				[-0.39]	[-0.47]	[-0.41]	[-0.66]	[-2.66]	[-0.69]
SIZE							0.040***	0.331***	0.042***
							[3.95]	[4.57]	[3.10]
Obs.	137	137	137	137	137	137	137	137	137
R-Square	0.089	0.323	0.241	0.042	0.325	0.236	0.143	0.432	0.303
Val.	4.37***	26.81***	17.07***	1.98	17.82***	16.04***	5.54***	20.99***	22.32***
Haus.		47.93***			49.05***			74.30***	
Wal. /Bre.		1.617			1.660			1.598	
Woo.		51532.8***			53606.6***			27781.0***	

SIZE coefficients are significant and positive. The EPU coefficients are significantly negative level at 1%, while LEV*EPU coefficients are likewise significantly negative, as shown in columns 11-13 and 14.

Table 3 The estimation results of the Pooled, FE and RE

Variable	Pooled	FE	RE	Pooled	FE	RE
	(10)	(11)	(12)	(13)	(14)	(15)
CONS.	-0.582***	-5.366***	-0.624***	-0.614***	-5.530***	-0.697**
	[-2.95]	[-4.84]	[-2.66]	[-3.17]	[-5.04]	[-3.05]
IPA	0.311	1.822***	0.335	0.128	1.468***	0.217*
	[0.74]	[4.22]	[0.83]	[1.27]	[5.61]	[1.73]
LEV	0.012	0.044***	0.025**	0.049	0.103***	0.077**
	[1.12]	[3.57]	[2.05]	[1.22]	[3.07]	[2.00]
EPU	-0.000	-0.001*	-0.000	-0.000	-0.001*	-1.99e-06
	[-0.22]	[-1.69]	[-0.36]	[-0.20]	[-1.79]	[-0.00]
SIZE	0.040***	0.334***	0.042***	0.042***	0.345***	0.044***
	[3.94]	[4.60]	[3.13]	[4.05]	[4.79]	[3.35]
IPA*EPU	-0.001	-0.002	-0.000			
	[-0.43]	[-0.75]	[-0.25]			
LEV*EPU				-0.000	-0.000*	-0.000
				[-0.93]	[-1.84]	[-1.42]
Obs.	137	137	137	137	137	137
R-Square	0.144	0.435	0.299	0.149	0.449	0.296
Val.	4.44***	16.83***	22.03***	4.60***	17.83***	24.19***
Haus.		258.34***			108.56***	
Wal. /Bre.		1.773			1.450	
Woo.		36187.93***			77706.68***	

*Note: *, **, and *** are the significant level at 10%, 5% and 1%, respectively.*
Haus., Wal. /Bre., and Woo. Are Hausman test, Wald test/ Breusch, and Pagan Lagrangian test, and Wooldridge test, respectively.

The Wooldridge test and the Wald test/Breusch test estimate heteroskedasticity and autocorrelation (particularly columns 2, 5, 8, 11, and 14) based on the Hausman test value (see Haus. row in Table 3). There is no autocorrelation in the Wooldridge test (see Woo. row). At 1% significance, the Wald test/Breusch and Lagrangian tests (see Wal. /Bre. row) indicated a heteroskedasticity problem. We use the GLS technique to estimate the impact of independent variables on dependent variables to solve the heteroskedasticity problem; the GLS estimation results are presented in Table 4. The findings reveal that almost all models are significant at 1%, and the significant sign of independent variable coefficients is similar to the estimate results in Table 3, except for IPA*EPU at 10% and LEV*EPU at 5%. The GLS approach's estimation findings, are used in the study. Five equations of the firm performance assumption are derived referring to Table 4. As a result, the aggregate moderated GLS regression outcomes show that economic policy uncertainty adversely and significantly moderates the connection among investment strategy and leverage on firm profitability.

Table 4 The estimation of the Generalized Least Square model.

Variable	(16)	(17)	(18)	(19)	(20)
CONS.	0.033***	0.057***	-0.378***	-0.413***	-0.450***
	[3.86]	[3.49]	[-7.90]	[-8.65]	[-9.04]
IPA	0.119***	0.115***	0.135***	0.317***	0.139***
	[5.41]	[5.55]	[5.22]	[3.35]	[4.92]
LEV	0.014**	0.014**	0.011***	0.012***	0.051***
	[2.47]	[2.45]	[2.71]	[2.95]	[3.26]
EPU		-0.000*	-0.000*	-0.0000	0.000
		[-1.74]	[-1.77]	[-0.41]	[0.76]
SIZE		0.115***	0.028***	0.029***	0.029***
			[9.44]	[9.60]	[9.70]
IPA*EPU				-0.001*	
				[-1.94]	
LEV*EPU					-0.000**
					[-2.50]
Obs.	137	137	137	137	137
Val.	29.95***	35.55***	144.76***	180.08***	216.32***

*Note: *, **, and *** are the significant level at 10%, 5% and 1%, respectively*

4 Conclusions

This study examines the impact of investment strategy through the moderation impact of economic policy uncertainty on the relationship of investment per total assets, financial leverage and firm profitability by employing a 23 sample of Pakistani non-financial firms, we find that investment per total assets and financial leverage have positive and significant impact on firm performance, meaning higher levels of investment provide higher profitability to the firm. Secondly, we examine the interactions impact of EPU on the relationship between investment strategy and financial leverage on firm performance. We found that the negative and significant influence of EPU on the relationship between investment strategy, financial leverage and firm performance. Therefore, the negative impact of EPU on leverage decisions is channeled through the size and profitability of the firm. Hence, sizable and high profitable firms are extremely conservative in the existence of higher EPU and decrease their leverages to alleviate these shocks' impact. This happens because these types of firms have more to lose from uncertainty than their smaller and less profitable equivalents.

Although we contribute to the growing body of knowledge in this field, several issues remain unsolved. The non-financial sector of the Pakistani economy has undergone fundamental changes. These types of policy shifts may have an influence on financial decisions. Given that this research only spans six years and focuses on one industry, additional industries, such as finance or manufacturing, might be added to the future scope.

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References

Abdullah, H., & Tursoy, T. (2021). Capital structure and firm performance: a panel causality test.

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, 58(2), 277–297.

Baker, S. R., N. Bloom, and S. J. Davis. 2016. Measuring Economic Policy Uncertainty. *The Quarterly Journal of Economics* 131 (4): 1593–1636.

Baker, S.R., Bloom, N., Davis, S.J., 2013. *Measuring economic policy uncertainty*. Chicago Booth Paper No. 13-02.

Bonaime, A., Gulen, H., Ion, M., 2018. Does policy uncertainty affect mergers and acquisitions? *Journal of Financial Economics*. 129 (3), 531 – 558.

Çolak, G., Durnev, A., Qian, Y., 2017. Political uncertainty and IPO activity: evidence from US gubernatorial elections. *Journal of Financial and Quantitative Analysis*. 52 (6), 2523 – 2564.

Fosu, S. (2013). Capital structure, product market competition and firm performance: Evidence from South Africa. The *Quarterly Review of Economics and Finance*, 53(2), 140-151.

Gujarati, D. N., & Porter, D. C. (2009). Basic econometrics. Douglas Reiner, McGraw-Hill/Irwin.

Gulen, H. and Ion, M. 2013. *Policy Uncertainty and Corporate Investment*. Purdue University mimeo.

Hansen, L. P. (1982). Large Sample Properties of Generalized Method of Moments Estimators. *Econometrica*, 50(4), 1029–1054.

He, Z., and J. Niu. 2018. The Effect of Economic Policy Uncertainty on Bank Valuations. *Applied Economics Letters* 25 (5): 345–347.

Iqbal, U., Gan, C., & Nadeem, M. (2020). Economic policy uncertainty and firm performance. *Applied Economics Letters*, 27(10), 765–770.

Kamarudin, F., Sufian, F., Nassir, A. M., Anwar, N. A. M., & Hussain, H. I. (2019). Bank Efficiency in Malaysia a DEA Approach. *Journal of Central Banking Theory and Practice*, 8(1), 133–162.

Mirza, S. S., & Ahsan, T. (2020). Corporates' strategic responses to economic policy uncertainty in China. *Business Strategy and the Environment*, 29(2), 375-389.

Pan, W.F., Wang, X., Yang, S., 2019. Debt maturity, leverage, and political uncertainty. *The North-American Journal of Economics and* Finance 50, 100981.

Pastor, L., Veronesi, P., 2013. Political uncertainty and risk premia. *The North-American Journal of Economics and Finance*. 110 (3), 520 – 545.

Qiu, M., Li, X., 2017. Capital structure and economic policy uncertainty: US versus german firms. Working paper.

Sahinoz, S., and E. E. Cosar. 2018. Economic Policy Uncertainty and Economic Activity in Turkey. *Applied Economics Letters* 25 (21): 1517-1520.

Wang, Y., Chen, C. R. and Huang, Y. S. (2014), Economic policy uncertainty and corporate investment: Evidence from China. *Pacific-Basin Finance Journal*, 26, 227-243.

Wooldridge, J. M. (2001). Applications of generalized method of moments estimation. *Journal of Economic Perspectives*, 15(4), 87–100. https://doi.org/10.1257/jep.15.4.87

Zhang, G., Han, J., Pan, Z., Huang, H., 2015. Economic policy uncertainty and capital structure choice: evidence from China. *Economic Systems* 39 (3), 439 – 457.

Economics of Agriculture

Investment activity of Czech farms according to their acreage

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Abstract: The aim of the paper is to find out whether it is possible to identify indicators that can affect the growth of investment activity of farms and to analyze differences in investment activity depending on the size of the farm. For this purpose, data from the Albertina database were used. The categorization used to determine the degressivity of ANC payments was used to classify enterprises by size. The dependence of investment activity on profitability, indebtedness and the share of received subsidies in revenues has not been proven. However, our findings suggest that there is an inverse relation between investment activity of farms and the farm size.

Keywords: Investment activity, farms, subsidies, profitability, indebtedness.
JEL Classification: Q14

1 Introduction

Investment is viewed as an essential aspect to enhance agricultural productivity and the key to promoting long-term growth (Rosenzweig & Binswanger, 1992; Roy & Pal, 2006; Bathla, 2017; Nilsson, 2017; Quiroga et al., 2017). Because investment is irreversible, farmers only invest during years when profits are high and/or borrowing costs are low. Rosenzweig & Binswanger (1993) find that the agricultural investment behaviour of farmers reflects their risk aversion, with poorer farmers accepting lower returns in exchange for lower risk.

Large farms can better capture the benefits of technological progress and increasing returns to size (Kokic et al., 2006; Sheng et al., 2016; Sheng & Chancellor 2019). By contrast, small farms often lack the willingness and financial ability to invest in similarly advanced and expensive capital equipment—limiting potential benefits from increasing returns to size.

The larger farms have higher rates of farm investment on a per hectare basis. There may also be a direct effect (Latruffe et al., 2010) whereby decoupled subsidies add to the internal pool of finance available to the farmer and reduce the requirement to seek external finance. O'Toole & Hennessy (2015) identified that decoupled subsidies by reducing the risk related to earned income can reduce financing constraints faced by farms, especially small- and medium-sized operations.

Giannakis & Bruggeman (2015) in their paper are to investigate the factors that are behind the differential performance of agriculture across the EU-27 countries. The low level of investments in agriculture in the Mediterranean and Eastern European countries explains the adoption of measures directly aimed to improve farm competitiveness. At the same time, in Northern-Central Europe, the policy focus has moved towards more integrated policies aiming to improve the environment and quality of life in rural areas.

Support to investment and modernization of farms is a capital subsidy that aims to encourage agricultural firms to undertake more gross investment in plant, machinery, and new production equipment on the assumption that this results in increased productivity and output (Harris & Trainor, 2005). Hence, the subsidy can give rise to investment-induced productivity gains because of improved access to capital and the possibility of adopting new production equipment (Serra et al., 2008). The investment subsidy may thus stimulate technological development and market adjustment to lower the investment cost and assist firms in using better economies of scale (Blancard et al., 2006).

Bojnec & Latruffe (2007) investigated determinants of investment decisions of Slovenian farms using a standard accelerator model and an augmented accelerator model. The results of the standard accelerator model confirm a positive

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and statistically significant association between the decision of gross investment and the growth in real sales. These results indicate that investments in Slovenian farms were driven by growth in real sales and by growth in real farm income.

This paper aimed to identify differences in the investment activity of farms broken down by size (ha Utilised Agricultural Area - UAA) and determine whether there is a linear relationship between the investment activity of farms and selected financial indicators.

2 Methods

The work used data from the Albertina database for the last available years 2017 - 2019. The database contains financial statements of legal entities. Entrepreneurs in agriculture were selected according to the classification of economic activities NACE, for which the main economic activity according to NACE is 0110 to 0160. After removing incomplete data, the number of observations was 1869 (in 2017), 1669 (2018) and 756 (2019). The data were paired with publicly available data on subsidy recipients for the years 2017 to 2019 (SZIF 2020), and according to the granted area payment, the acreage of utilized agricultural land (i.e. the acreage for which the SAPS payment was granted) was estimated. The categorization used to determine the degressivity of ANC payments was used to classify farms by size (e.g. Rudinskaya et al. 2019):

- area of up to 300 ha,
- area of over 300 ha up to (and including) 500 ha,
- area of over 500 ha up to (and including) 900 ha,
- area of over 900 ha up to (and including) 1 800 ha,
- area of over 1800 ha up to (and including) 2 500 ha,
- area of over 2 500 ha.

The indicator used in the evaluation of the financial health of the company according to the RDP methodology 2014 – 2020 (SZIF 2021) was used as an indicator of investment activity:

$$IA = 100 * (FA_1 - FA_0 + D) / FA_0 \quad (1)$$

where:

FA_1 Fixed assets of the current accounting period (nett)

FA_0 Fixed assets of the previous accounting period (nett)

D Depreciation

The dependence of investment activity was tested using a correlation coefficient on other indicators such as profitability, indebtedness, the share of operating subsidies on revenues and the share of investment subsidies on assets in order to try to identify indicators that may be related to investment activity of agricultural holdings.

3 Research results

In 2017, the average farm farmed on 1,029 ha of agricultural land, received 9,009 CZK/ha of subsidies and 405 thous. CZK investment subsidies per company. The indicator of investment activity of the average farm in 2017 reaches the value of 24.26 (Table 1), which is a high value reaching the maximum number of points in terms of the evaluation of the financial health of the farm. Out of the whole set of 1869 companies, 137 (7.3%) companies have 0 points for investment activity, 184 (9.8%) companies achieved 1 point, 131 (7%) companies achieved 2 points, and 3 points (maximum value) reached 1417 (75.8%) of farms.

In 2017, the value of the investment activity indicator was the highest in the category of the smallest farms, with an area of up to 300 ha of agricultural land. In this category, the average company managed an area of 89 ha and received 13,536 CZK/ha of subsidies and 120 thous. CZK of investment subsidy. In this category, the lowest return on assets and above-average return on equity were achieved. Total indebtedness in this category is the highest, and long-term indebtedness is above average.

The lowest value of investment activity in 2017 was reported by the average farm operating in an area of over 2,500 hectares. The average area of farms in this category is 3,687 ha, subsidies per 1 ha 8,464 CZK and the highest volume of investment subsidies per farm (1,305 thousand CZK). In this category, the highest ROA value and the lowest indebtedness were achieved (Table 1).

Table 1 Investment activity by size of farm in 2017

UAA (ha)	Number of Farms	Investment Activity	Subsidies to Revenues	Investment Subsidies to Assets	ROA	ROE	Total Indebtedness	Long-term Indebtedness
≤ 300	514	35.36	26.6	0.36	1.74	9.41	65.52	24.73
300 – 500	189	26.66	32.8	0.17	4.24	4.80	46.39	25.02
500 – 900	350	19.30	26.8	0.32	3.68	4.81	43.63	24.67
900 – 1,800	478	18.97	27.6	0.38	3.74	4.58	37.03	22.71
1,800 – 2,500	190	19.30	18.2	0.35	4.02	4.91	38.26	22.49
> 2,500	148	17.85	17.4	0.35	4.95	5.36	30.21	16.37
Total	1,869	24.26	25.9	0.34	3.35	5.48	46.63	23.34

Source: Own processing

In 2018, the average farm farmed 1,028 ha of agricultural land, received 9,385 CZK/ha of subsidies and 784 thous. CZK investment subsidies. The indicator of investment activity of the average farm in 2018 reaches a value lower than in the previous year, 20.94 (Table 2). Out of the total set of 1,669 farms, 126 (7.5%) farms have 0 points for investment activity, 187 (11.2%) farms achieved 1 point, 113 (6.8%) farms achieved 2 points and 3 points (maximum value) reached 1243 (74.5%) farms. This division of farms according to the indicator of investment activity coincides with the previous year.

Table 2 Investment activity by size of farm in 2018

UAA (ha)	Number of Farms	Investment Activity	Subsidies to Revenues	Investment Subsidies to Assets	ROA	ROE	Total Indebtedness	Long-term Indebtedness
≤ 300	433	21.18	21.5	0.91	2.57	8.37	64.97	21.26
300 – 500	197	22.84	32.1	0.50	4.09	4.70	44.50	24.57
500 – 900	296	26.92	25.1	0.56	4.65	5.16	43.49	24.59
900 – 1,800	455	19.55	26.1	0.49	4.11	4.73	36.43	21.91
1,800 – 2,500	158	15.21	16.7	0.53	3.96	4.27	36.27	21.03
> 2,500	130	15.55	15.3	0.45	4.99	5.50	29.89	16.29
Total	1669	20.94	23.7	0.61	3.86	5.40	45.51	22.01

Source: Own processing

Disaggregated by the size of the farm in 2018, the average investment holding 500 to 900 hectares of agricultural land showed the highest investment activity. This average company managed 694 ha and received 10,063 CZK/ha of subsidies and 647 thous. CZK of investment subsidies, the total indebtedness is slightly below average, and the long-term indebtedness is the highest.

On the contrary, the lowest investment activity was in the category of farms with 1,800 to 2,500 hectares. The average company in this category manages 2,067 ha, with subsidies per 1 ha 9,094 CZK and the volume of investment subsidies per company 1,538 thousand. CZK. In this category, a slightly above-average ROA value and the below-average ROE were achieved. Indebtedness is slightly below average (Table 2).

Table 3 Investment activity by size of farm in 2019

UAA (ha)	Number of Farms	Investment Activity	Subsidies to Revenues	Investment Subsidies to Assets	ROA	ROE	Total Indebtedness	Long-term Indebtedness
≤ 300	155	26.52	22.1	0.34	2.42	10.02	72.06	22.84
300 – 500	93	26.40	31.2	0.20	4.84	3.43	42.77	24.44
500 – 900	132	15.12	27.2	0.39	4.48	5.55	40.36	20.70
900 – 1,800	214	14.13	21.6	0.41	3.31	3.69	35.32	20.49
1,800 – 2,500	84	13.26	16.9	0.39	3.95	4.19	32.54	18.26
> 2,500	78	14.16	18.0	0.64	3.98	4.82	30.34	15.36
Total	756	18.26	23.0	0.39	3.66	4.90	43.83	20.72

Source: Own processing

In 2019, the average farm farmed 1,179 ha of agricultural land, received 9,668 CZK/ha of subsidies and 707 thous. CZK investment subsidies (per company). The indicator of investment activity of the average farm in 2019 reaches a lower value than in the previous year, 18.26 (Table 3). The structure of companies according to the point evaluation of investment activity does not differ from previous years. Out of the entire set of 756 farms, 56 (7.4%) farms have zero investment activity, 79 (10.5%) farms achieved 1 point, 52 (6.9%) farms achieved 2 points, and the highest investment activity reached 569 (75, 3%) of farms.

In 2019, the smallest average farm (up to 300 ha) showed the most extensive investment activity. This average farm managed an area of 93.7 ha, received 13,894 CZK/ha of subsidies and 90 thousand. CZK of investment subsidies. The

lowest return on assets and significantly above-average ROE are in this category. Total indebtedness is the highest, and long-term indebtedness is slightly above average.

The lowest value of the investment activity indicator in 2019 is in the category of farms with an area from 1,800 to 2,500 ha. The average company in this category manages 2,073 ha, received 9,562 CZK/ha of subsidies and 1366 thousand. CZK of investment subsidies. Return on assets is slightly above average, and indebtedness is below average (Table 3).

Correlation coefficients comparing the linear relationship between the investment activity indicator and selected indicators are shown in Tables 4 to 6.

Table 4 Correlation coefficient of investment activity and monitored variables in 2017

UAA (ha)	n	ROA	ROE	Total Indebt-edness	Long-term Indebtedness	Subsidies to Revenues	Investment Subsidies to Assets
≤ 300	514	0.087	0.037	-0.017	0.084	0.142	0.027
300 – 500	189	0.153	-0.013	-0.089	-0.115	0.080	-0.005
500 – 900	350	0.024	0.036	-0.114	-0.080	0.030	-0.105
900 – 1,800	478	-0.024	-0.041	0.070	0.040	-0.037	-0.067
1,800 – 2,500	190	0.050	0.089	0.171	0.159	-0.169	-0.081
> 2,500	148	-0.003	0.041	0.112	0.077	-0.026	-0.106
Total	1869	0.069	0.011	0.015	0.050	0.074	-0.004

Source: Own processing

Table 5 Correlation coefficient of investment activity and monitored variables in 2018

UAA (ha)	n	ROA	ROE	Total Indebt-edness	Long-term Indebtedness	Subsidies to Revenues	Investment Subsidies to Assets
≤ 300	433	0.141	-0.019	0.009	0.056	0.032	-0.044
300 – 500	197	-0.010	-0.046	0.129	-0.095	0.025	-0.099
500 – 900	296	0.068	0.011	-0.043	-0.021	-0.038	-0.034
900 – 1,800	455	0.020	0.012	0.092	0.123	0.002	-0.033
1,800 – 2,500	158	-0.056	-0.226	0.268	0.320	-0.034	-0.124
> 2,500	130	-0.103	-0.005	0.040	0.010	0.394	-0.100
Total	1669	0.051	-0.004	0.018	0.027	0.002	-0.031

Source: Own processing

As can be seen from Tables 4 to 6, the correlation with the monitored indicators does not explain the investment activity of farms. The significant correlation coefficients are marked in red. A weak positive correlation between investment activity and profitability is observed in the category of farms with an area of 900 – 1,800 ha in 2019. There is a weak positive correlation with indebtedness in the category of farms with an area of 1,800 – 2,500 ha in 2018 and a medium positive correlation with indebtedness in the largest farms in 2019. As far as subsidies are concerned, the correlation coefficient is rather negative, but its value is very low. Only in the category of the largest companies in 2018 can we observe a weak positive correlation with the share of operating subsidies to revenues.

Table 6 Correlation coefficient of investment activity and monitored variables in 2019

UAA (ha)	n	ROA	ROE	Total Indebt-edness	Long-term Indebtedness	Subsidies to Revenues	Investment Subsidies to Assets
≤ 300	155	0.038	-0.031	0.122	-0.001	-0.074	-0.022
300 – 500	93	0.008	0.019	0.152	-0.097	-0.034	-0.041
500 – 900	132	0.151	0.070	0.177	0.177	0.025	-0.082
900 – 1,800	214	0.230	0.214	-0.076	-0.083	0.089	-0.197
1,800 – 2,500	84	0.002	-0.151	0.101	0.131	0.203	-0.231
> 2,500	78	-0.112	-0.098	0.351	0.504	0.154	-0.061
Total	756	0.0378	0.000	0.143	0.005	-0.018	-0.044

Source: Own processing

According to Bojnec & Latruffe (2011), a larger production scale means that larger farms depend on operating subsidies to cover the costs of their day-to-day operations. Conversely, smaller farms may be more autonomous, have less variable input costs, and use operating subsidies for investments. Smaller farms may have older assets that need to be exchanged, while the property of larger farms may be more modern. In addition, large farms need a more extensive source of money than small farms to invest in new assets.

According to our results, investment activity seems to have a declining trend towards increasing farm size, except for medium-sized farms (500-900 ha) in 2018. A certain limitation of the work is that the database does not include farms of natural persons, and the results can therefore be generalized only for legal entities doing business in agriculture. In the last monitored year, the results may be affected by a significantly lower number of observations; however, there are no extreme differences in the monitored indicators compared to previous years.

4 Conclusions

The article evaluated the investment activity of farms broken down by the area of cultivated agricultural land in the years 2017 to 2019. In terms of the financial health assessment under the RDP methodology, 75% of farms score the highest number of points for investment activity, while the breakdown of partition frequencies is virtually unchanged in the reference years.

The dependence of investment activity with selected variables was not confirmed; however, some trends related to the size of the farm were found. The investment activity indicator has a declining trend with an increasing acreage of cultivated land in all monitored years. The share of subsidies in total revenues also shows a declining trend with an increasing farm area, except for the category of the smallest farms (up to 300 ha), where this indicator is close to the average. In addition, the category of farms with the smallest acreage of agricultural land shows the lowest return on assets and the highest total indebtedness. On the contrary, the average largest company with an area of over 2,500 ha UAA achieves above-average ROA and the lowest indebtedness in all years.

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References

Bathla, S. (2017). Public Investment in Agriculture and Growth: An Analysis of Relationship in the Indian Context. In: *Bathla S., Dubey A. (eds) Changing Contours of Indian Agriculture.* Springer, Singapore. doi.org/10.1007/978-981-10-6014-4_2

Blancard, S., Boussemart, J. P., Briec, W., & Kerstens, K. (2006). Short-and long-run credit constraints in French agriculture: A directional distance function framework using expenditure-constrained profit functions. *American journal of agricultural economics*, 88(2), 351-364. doi.org/10.1111/j.1467-8276.2006.00863.x

Bojnec, S., & Latruffe, L. (2007). Investment of Slovenian farms in the transition context. In *Joint seminar IAAE-EAAE, 104. Seminar of the European Association of Agricultural Economics: Agricultural Economics and Transition: What was expected, what we observed, the lessons learned*, (pp. 10-p).

Bojnec, S., & Latruffe, L. (2011). Financing availability and investment decisions of Slovenian farms during the transition to a market economy. *Journal of Applied Economics*, 14(2), 297-317. doi.org/10.1016/S1514-0326(11)60016-0

Giannakis, E., & Bruggeman, A. (2015). The highly variable economic performance of European agriculture. *Land Use Policy*, 45, 26-35. doi.org/10.1016/j.landusepol.2014.12.009

Harris, R., & Trainor, M. (2005). Capital subsidies and their impact on Total Factor Productivity: Firm-level evidence from Northern Ireland. *Journal of Regional Science*, 45(1), 49-74. doi.org/10.1111/j.0022-4146.2005.00364.x

Kokic, P., Davidson, A., & Boero Rodriguez, V. (2006). Australia's grains industry: factors influencing productivity growth. *Australian Commodities: Forecasts and Issues*, 13(4), 705-712. https://search.informit.org/doi/10.3316/ielapa.090065504085170

Latruffe, L., Davidova, S., Douarin, E., & Gorton, M. (2010). Farm expansion in Lithuania after accession to the EU: The role of CAP payments in alleviating potential credit constraints. *Europe-Asia Studies*, 62(2), 351-365. doi.org/10.1080/09668130903506862

Nilsson, P. (2017). Productivity effects of CAP investment support: Evidence from Sweden using matched panel data. *Land use Policy*, 66, 172-182. doi.org/10.1016/j.landusepol.2017.04.043

O'Toole, C., & Hennessy, T. (2015). Do decoupled payments affect investment financing constraints? Evidence from Irish agriculture. *Food Policy*, 56, 67-75. doi: 10.1016/j.foodpol.2015.07.004

Quiroga, S., Suárez, C., Fernández-Haddad, Z., & Philippidis, G. (2017). Levelling the playing field for European Union agriculture: Does the Common Agricultural Policy impact homogeneously on farm productivity and efficiency? *Land Use Policy*, 68, 179-188. doi.org/10.1016/j.landusepol.2017.07.057

Rosenzweig, M. R., & Binswanger, H. P. (1992). *Wealth, weather risk, and the composition and profitability of agricultural investments* (Vol. 1055). World Bank Publications.

Rosenzweig, M. R. & Binswanger, H. P. (1993). Wealth, weather risk and the composition and profitability of agricultural investment. *The Economic Journal*, 103(1), 56-78.

Roy, B. C., & Pal, S. (2006). Investment, agricultural productivity and rural poverty in India. *Indian Agriculture in the New Millennium: Changing Perceptions and Development Policy*, 2, 367.

Rudinskaya, T., Hlavsa, T., & Hruška, M. (2019). Estimation of technical efficiency of Czech farms operating in less favoured areas. *Agricultural Economics*, 65(10), 445-453. doi.org/10.17221/52/2019-AGRICECON

Serra, T., Zilberman, D., & Gil, J. M. (2008). Differential uncertainties and risk attitudes between conventional and organic producers: the case of Spanish arable crop farmers. *Agricultural Economics*, 39(2), 219-229. doi.org/10.1111/j.1574-0862.2008.00329.x

Sheng, Y., & Chancellor, W. (2019). Exploring the relationship between farm size and productivity: evidence from the Australian grains industry. *Food Policy*, 84, 196-204. doi.org/10.1016/j.foodpol.2018.03.012

Sheng, Y., Davidson, A., Fuglie, K., & Zhang, D. (2016). Input substitution, productivity performance and farm size. *Australian Journal of agricultural and Resource Economics*, 60(3), 327-347. doi.org/10.1111/1467-8489.12136

SZIF (2020). Seznam příjemců dotací [Online]. Retrieved from: https://www.szif.cz/cs/seznam-prijemcu-dotaci [Accessed: 06-26-2020].

SZIF (2021). Metodika výpočtu finančního zdraví [Online]. Retrieved from: https://www.szif.cz/cs/CmDocument?rid=%2Fapa_anon%2Fcs%2Fdokumenty_ke_stazeni%2Fprv2014%2Fzakladni_informace%2Ffin_zdravi%2F1536930782781.pdf [Accessed: 06-21-2021].

The agri-food trade between the Czech Republic and Vietnam in the context of the FTA

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Abstract: The EU-Vietnam Free Trade Agreement (EVFTA) came into force in August 2020 and its main purpose is the substantial reduction of trade barriers and tariffs between the partners. The agreement should also open the door to Czech exports to Vietnam. This article evaluates the agri-food trade between the Czech Republic and Vietnam in the context of this EVFTA. The authors use a battery of methods and procedures to identify potential benefits and risks for the agri-food sector in the Czech Republic and to identify possible dynamics in Czech agri-food exports to Vietnam. The results suggest that the EVFTA between European Union and Vietnam poses no risk to the agri-food sector in the Czech Republic. The agri-food export structures of both countries are complementary rather than competitive. The agreement creates improved export opportunities for some of the agri-food sectors in the Czech Republic, but not to the extent of all tariff reductions included in the agreement.

Keywords: European Union, Free Trade Agreement, Trade complementarity,
JEL Classification: Q17, F14, F15

1 Introduction

Globalization and liberalization of world agricultural markets is unquestionably one of the key processes that significantly shaped the environment of today's agribusiness. These processes have been reflected in changes in the size and structure of a number of national agricultural sectors, at least in the last two decades (Bečvářová & Zdráhal, 2013). At the same time, however, it must be borne in mind that, despite the undeniable shift in the degree of liberalization of agricultural markets, especially after the Uruguay Round of GATT negotiations, there is currently no consensus at multilateral WTO for further liberalization and no further shift in liberalization. One of the consequences of this development is the rapid growth of regionalism. The number of preferential trade agreements between individual states, between regional integration groupings or between regional integration groupings and individual states is increasing (Cihelková, 2012). The European Union's activities in this area are also a response to this development. Preferential trade agreements have become a mechanism of further implemented liberalization of economic relations with other regions in general (EC, 2021a). Foreign trade in agricultural and food products is part of this mechanism. Examples of such agreements that recently came into force include the agreements with Canada (which came into force in 2017), Japan (2019), Singapore (2019) or Vietnam (2020). In addition, negotiations have been launched or are in varying degrees of completion with other countries (e.g. New Zealand, Australia, Mexico) or regional integration groupings (e.g. MERCOSUR).

The EU-Vietnam Free Trade Agreement (EVFTA) was signed on 30 June 2019 and came into force on 1 August 2020. The EVFTA (EC, 2020) is described as the largest and most ambitious trade agreement the EU has ever concluded with a developing country. This agreement aims to eliminate tariffs on 99 percent of traded goods and simplify customs procedures, remove non-tariff barriers to trade, make it easier for European companies to access Vietnamese government contracts and provide stronger protection of intellectual property rights. EU companies will have easier access to the Vietnamese market e.g. for machinery, equipment, cars, alcoholic beverages and agricultural products. The EU market will provide increased access for products such as e.g. textiles, footwear, agricultural products, seafood and wood products coming from Vietnam. Along with the FTA, the Vietnamese parliament also approved the EU-Vietnam Investment Protection Agreement, which is still subject to approval by the national parliaments of the respective EU member states. This EU-Vietnam Investment Protection Agreement is expected to enter into force soon (MZV, 2019).

The fact that economic and trade relations between the Czech Republic and Vietnam are based on existing long-term relations and cooperation in various areas. This provides a potentially good point of departure. The beginning of mutual

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trade relations arose from the political and ideological proximities of both countries developed during the second half of the 20th century. Vietnam was expected to be an economically strategic trading partner with considerable future potential in the Asian market. That is why then the Czechoslovak Socialist Republic actively participated in providing international aid for the reconstruction of post-war Vietnam. In 1955, an Agreement on Economic and Technical Assistance, Exchange of Goods and Delivery of Goods on Credit was signed between the Czechoslovak Socialist Republic and The Socialist Republic of Vietnam (Studík & Teplík, 2006). However, a change in its foreign trade orientation occurred as part of the processes of transformation of the Czechoslovak economy during the 1990s. The newly transformed Czechoslovak Republic began to focus on the markets of the developed western countries of the Europe. This led to a partial slowdown in economic cooperation and a reduction in the foreign trade with other regions, including Vietnam.

After the separation between Slovakia and the Czech Republic in 1993, the later began to be perceived Vietnam again as a promising trading partner in Southeast Asia. There was a resumption of mutual relations and a gradual increase in foreign trade, which intensified after the Czech Republic's integration into the European Union (Hlavatá et. al., 2008). The historical importance of these mutual relations is undoubtedly reflected in the fact that there is a large Vietnamese community in the Czech Republic. The impact study prepared by Kocourek & Šimanová (2017) suggests that in comparison with other EU member states, the adoption of the EVFTA will have significantly more favourable effects on the open Czech economy. A partial increase in exports can be expected especially in the automotive, engineering, electrical, food and chemical industries. In the case of Czech imports from Vietnam, the most significant increases can be expected in textile and food products.

As already mentioned, the EVFTA entered into force during mid-2020. During the same time, the global covid pandemic negatively affected the Czech Republic as well as Vietnam and caused shock situations in international trade activities. The aim of this article is to evaluate the development of agri-food trade between the Czech Republic and Vietnam in the context of the approved liberalization trade agreement specifically 1) to evaluate the potential benefits and risks of this agreement for agricultural and food sector; 2) identify those agricultural and food products for which an increase in Czech exports to Vietnam can be expected. The negative covid pandemic conditions limited opportunities for assessment, as the interpretation of results.

2 Methods

Meeting the set objectives, changes to the trade policy framework were identified in the EVFTA (section 3.1) and authors identified the changes in tariff and other related trade measures that are relevant to the Czech Republic exports potentials. Subsequently, the development of mutual agrarian trade between the Czech Republic and Vietnam was evaluated for the last two decades. The selected time period allow to interrogate changes in agri-food trade between the Czech Republic and Vietnam both in the period before the Czech Republic's accession to the European Union and in the following phase of development until 2020, when EVFTA entered into force. In terms of analytical procedures, both the time series changes and the territorial and commodity structures of trade flows were analysed. Specifically, authors evaluated the overall development of agri-food trade between the two countries in terms of exports and imports and the balance of trade. Furthermore, the development in the range of the traded varieties of agri-food products was analysed. Subsequently, trade flows were evaluated in terms of the degree of finalization of traded products (broken down according to the BEC classification) as well as the changes of unit prices of mutual agri-food exports. The evaluation of mutual complementarity of export structures in agri-food trade was done using Export Similarity Index. The methodology for using this index is as follows. Export similarity index (ESI) was proposed by Finger and Kreinin (Finger and Kreinin, 1979) and it measures the similarity of export structures in relation to the world market. The formula is as follows:

$$\mathrm{ESI}(\mathrm{ab},\mathrm{w}) = 100 \times \left\{ \sum_{\mathrm{j}}^{\mathrm{n}} \min \left(\frac{\mathrm{x}_{\mathrm{a}}^{\mathrm{j}}}{\mathrm{x}_{\mathrm{a}}}, \frac{\mathrm{x}_{\mathrm{b}}^{\mathrm{j}}}{\mathrm{x}_{\mathrm{b}}} \right) \right\} \quad (1)$$

where ESI(ab,w) represents the product similarity index of exports of country a and country b to the market w. The x_a^j / $x_a$represents the ratio of the commodity *j* exported by the country *a* to the world (*w*) to the total agri-food export of country a to market *w*. The x_b^j / $x_b$represents the ratio of the commodity *j* exported by the country *b* to the world (w) to the total agrarian export of country b to market w. The value of index ranges from 0 to 100. In the case the two countries export exactly the same products, the index is 100 (countries are competing in the world market); if they export completely different products, then the index is 0 (it indicates division of labour and natural possibilities to trade).

Subsequently, the dynamics of trade for individual products was evaluated in detail (at the level of the 4-digit code of the Harmonized Classification System). The data comes from EUROSTAT (EUROSTAT, 2021) and UNCTAD (UNCTAD, 2021). In the case of the Harmonized System, agrarian trade is defined as HS01 to HS24; in case of SITC classification it is 0+1+22+4.

3 Research results

3.1 Changes in the trade framework for agricultural and food products

Directly after the introduction of the EVFTA, Vietnam had to remove 65% of the tariffs imposed on agricultural imports from the EU. The remaining 35% of imports will be exempted from the tariff duty within the next ten years, with the exception of specifically identified items. After the implementation of the EVFTA, the European Union will exempt 71% of imported agricultural commodities and food products from Vietnam from tariff duties. After seven years, 99% of agricultural products imported from Vietnam should be exempt from tariff duties (MZV, 2019).

A specific condition is that Vietnam will reduce trade barriers for frozen pork and semi-finished pork products (to be tariff free in seven years), dairy products (tariff free in five years) and chicken (tariff free in ten years). In the case of fish, salmon, plaice, trout and crawfish will be tariff free. After three years more species will become tariff free. Wine and spirits will be exempt from tariffs in seven years´ time with beer becoming tariff free in ten years´ time. Vietnam will continue to apply WTO tariffs and quotas on refined sugar, salt and eggs. Table 1 provides a detailed overview of the change in tariffs for selected products in more detail (EC, 2020).

Table 1 Changes in tariffs for selected products exported from the EU to Vietnam

HS code	Products	Pre-Agreement tariffs	Gradually removed in
0201	Meat of bovine animals; fresh or chilled	14 - 30%	2023
0202	Meat of bovine animals; frozen	14 - 20%	2023
0203	Meat of swine; chilled or frozen	15 - 25%	2027 - 2029
0204	Meat of sheep or goats	7%	2023
0207	Meat of edible offal of poultry	15 - 40%	2030
04	Dairy produce; bird's eggs; natural honey	3 - 20%	2025
0406	Cheese and curd	10%	2023 - 2025
07	Vegetables	10 - 30%	2025
0808	Apples, pears and quinces; fresh	10%	2023
1001	Wheat and meslin	5%	2023
1107	Malt	5%	2025
1108	Starches; inulin	15 - 20%	2025 - 2030
1210	Hop cones	5%	2023
15	Animal or vegetable fats and oils	5 - 30%	2023 - 2030
1806	Chocolate and other preparations	12 - 30%	2025 - 2027
1905	Bread, pastry, cakes, biscuits	10 - 40%	2025
21	Miscellaneous edible preparations	5 - 40%	2025 - 2030
2203	Beer made from malt	35%	2030
2204	Wine of fresh grapes	50%	2027
2208	Alcoholic beverages	48%	2027
2309	Preparations of a kind in animal feeding	3 - 7%	2023

Source: EC (2020)

The EU shall reduce barriers and set a zero tariff on white rice to the maximum quantity of 30 thousand tonnes; husked rice to a maximum quantity of 20 thousand tonnes; and aromatic rice to a maximum quantity of 30 thousand tonnes (the tariff on broken rice will be reduced by 50% and the rest then reduced linear over a 5 year period). A zero tariff will be set for sweetcorn (to a maximum quantity of 5 thousand tonnes), corn pellets, garlic (to a maximum quantity of 400 tonnes), mushrooms (to a maximum quantity of 350 tonnes), sugar and products with a high sugar content (combined to a maximum quantity of 20 thousand tonnes), manioc starch (to a maximum quantity of 30 thousand tonnes), surimi (to a maximum quantity of 500 tonnes) and pickled tuna (to a maximum quantity of 11.5 thousand tonnes – with strict origin regulations). Also, a zero tariff rate will be set for unprocessed shrimp while pangas (Siamese catfish) will obtain a zero tariff rate after 3 years. The EVFTA also provides protection of geographical indications of origin, which guarantees a distinction between original products and imitations, for example, the designations "České pivo", " Budějovické pivo" or "Žatecký chmel" will be protected (EC, 2020).

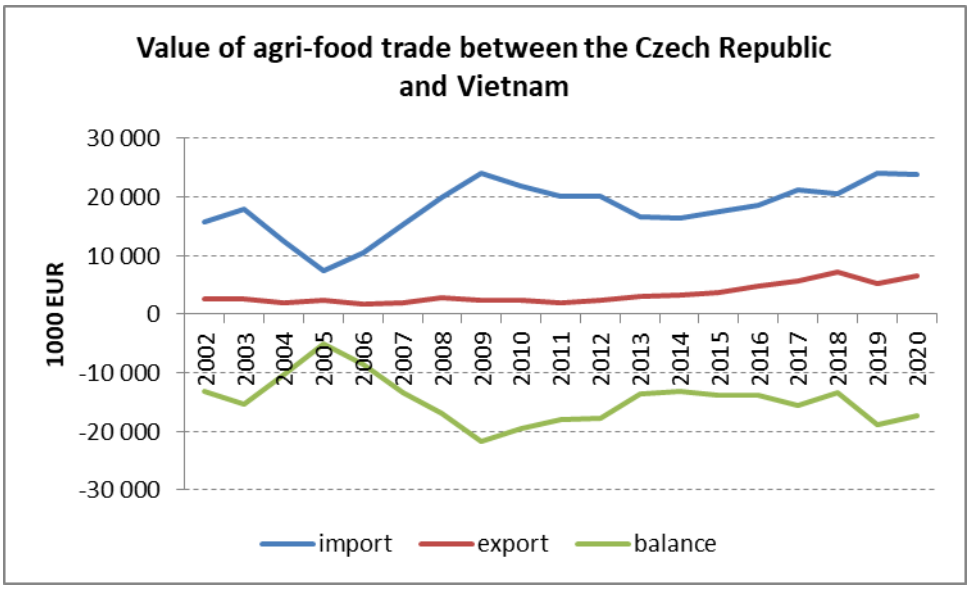
Another benefit of the EVFTA for potential EU agricultural exports to Vietnam will be the simplification and greater transparency in sanitary and phytosanitary regulations. The very complicated Vietnamese import regulations for food imports will also be significantly simplified and made more transparent under the new EVFTA and will ensure a level playing field for all EU Member States. At the same time, the need to approve food imports for each Member State separately is eliminated.

3.2 Changes in the agri-food trade between the Czech Republic and Vietnam

As part of the research methodology, the relative importance of the Czech Republic and Vietnam in their respective agri-food trade structures was investigated. The analysis indicates that in terms of all imports of agri-food products to the Czech Republic in 2020, Vietnam was in the 24th position. When excluding EU member states, Vietnam ranked in the 9th position. When analysing all imports of agri-food products from Asian countries only, Vietnam ranks 4th after China, Thailand and India. The Czech Republic ranks 66th in the structure of all Vietnam's agri-food exports and ranks 15th amongst the importing EU27 countries (with similar trade values as Greece, Croatia and Finland). In the structure of all agri-food exports of the Czech Republic, Vietnam is in the 58th position. From the above, it can be concluded that, in terms of agri-food trade, neither the Czech Republic nor Vietnam, is an important trading partner to the other.

Also, despite the increase in the value of mutual agri-food trade turnover between the two countries, the share of the value of agri-food trade, as part of the value of total trade, has decreased in the previous two decades. In 2002, agri-food trade represented 29.1% of the value of total export from Vietnam to the Czech Republic. In the same period the Czech Republics´ agri-food trade to Vietnam represented 16.0% of the total value of export. At present, this share is around 10% for both countries. Therefore there is rather a profiling of non agri-food sectors in mutual trade between the two countries. Figure 1 illustrates the changes in the values of agri-food trade between the two countries from 2002 to 2020.

Figure 1 Changes in the value of agri-food trade between the Czech Republic and Vietnam (2002-2020; from the Czech Republic point of view).



Source: based on EUROSTAT (2021) data

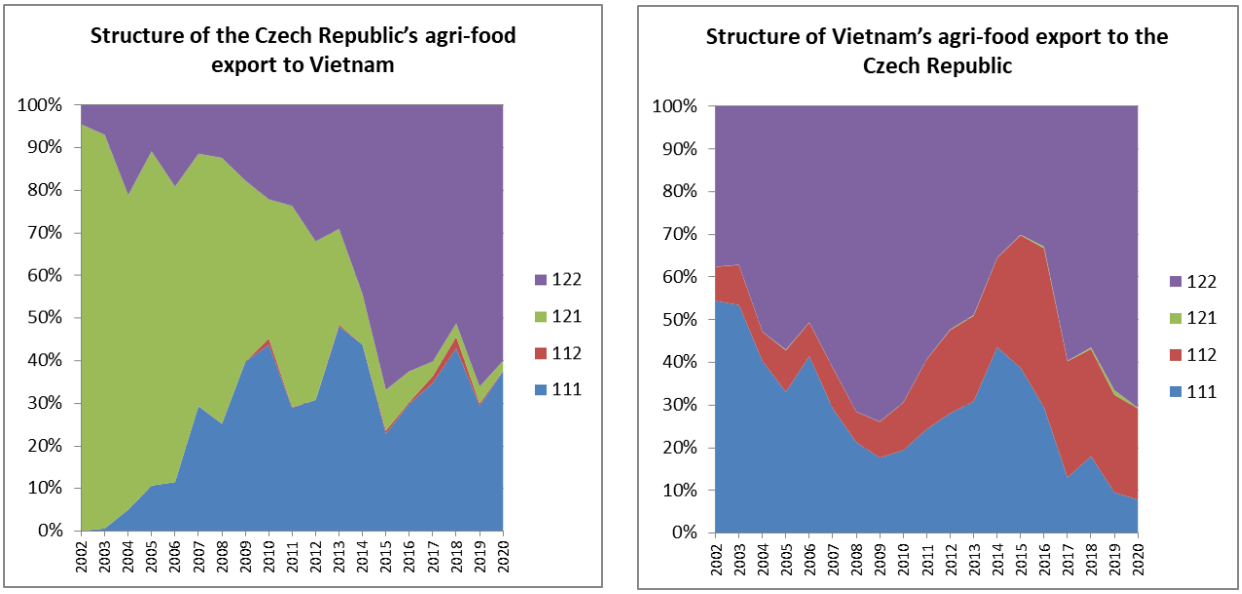
Generally, the Czech Republic represents a net importer of agri-food products to Vietnam with a significantly negative mutual agri-food trade exchange value of around 20 million EUR. The deepening of this negative balance of agri-food trade occurred mainly after 2006. The observable fluctuation in the trend of imports and the balance between 2006 and 2013 was the result of a noticeable increase and then again a decrease in the imports of *Fish fillets and other fish meat* (HS0304) to the Czech Republic from Vietnam during this period. Significantly higher values of imports of Vietnamese agri-food products (compared to Czech agri-food exports to Vietnam) can be associated with a different commodity structure and easier access for Vietnamese goods into the European market (including the Czech Republic). A study by Kocourek and Šimanová (Kocourek & Šimanová, 2017) indicated that tariff duties on exports of agri-food products from the Czech Republic to Vietnam averaged 11.38% before the implementation of the EVFTA. On the contrary, customs duties on imports from Vietnam to the Czech Republic were, on average, only 2.88%. In the period before implementation of the EVFTA, Vietnam applied relatively strong protectionist policy on imports of foreign agrifood products. This included not only high tariffs, but also import quotas, business permits, technical regulation and relatively lengthy customs procedures. In 2020, when EVFTA entered into force, a slight increase in the value of Czech agri-food exports to Vietnam can be observed. However, it was an atypical year during the global pandemic and many agri-food products tariff lines

will gradually decrease. Therefore, it is not possible to draw a more general conclusion from this change in the context created by the EVFTA.

Another perspective on the form and changes in mutual agri-food trade is provided by analysing the trade dynamics in the product range. In the period under scrutiny, Vietnam's export structure to the Czech Republic represented on average 71.7 products out of 201 (35.7%) possible products (at the HS 4-digit code level). Between 2019 and 2020, a significant year-on-year increase is evident in the number of traded products – from 67 (33.3%) to 84 (41.8%) products. In the case of the Czech Republic, the number of traded products gradually increased from 13 (6.5%) in 2002 to 43 (21.4%) in 2017. However, after 2017 till 2020 this number fell to 34 products. In terms of the range of exported products, the Czech Republic currently exports only about half the number of products compared to Vietnam's exports to the Czech market. In the case of the Czech Republic, the possible effect of EVFTA has not yet manifested, and there is no evidence of an increasing number of agri-food products exported to Vietnam.

Subsequently, the structure of agri-food trade between the Czech Republic and Vietnam was analysed using the BEC (Broad Economic Categories) classification (EUROSTAT, 2021). This classification allows for a stricter assessment in terms of the levels of processing and the added value of traded products. The structure of traded products is shown in the following graphs (Graphs 2a and 2b) and unit prices of exports are shown in Table 2.

Figure 2a, 2b The structure of mutual agr-food trade between the Czech Republic and Vietnam



Source: based on EUROSTAT (2021) data

Note: 111 - Food and beverages, prim., mainly for industry; 112 - Food and beverages, prim., mainly for consumption; 121 - Food and beverages processed, mainly for industry; 122 - Food and beverages processed, mainly for consumption

Table 2 Changes in the unit price of exports in agri-food trade between the Czech Republic and Vietnam

	2002	2005	2010	2015	2016	2017	2018	2019	2020
	EUR/100 kg								
Czech Rep. UV_{EX}	39.0	103.2	79.2	99.4	126.4	133.3	159.1	192.6	219.0
Vietnam UV_{EX}	66.1	84.8	113.0	164.6	151.5	212.3	186.4	181.5	151.0

Source: own calculation based on EUROSTAT (2021) data

Figures 2a and 2b clearly indicates that the comparative level of processing of agri-food products traded between the Czech Republic and Vietnam differs. During the period of investigation the composition of the export structures of traded products between the Czech Republic and Vietnam also changed.

In the case of the Czech Republic´s agri-food exports to Vietnam, *processed food and beverages, mainly for industry* dominated in the structure of export during the first half of the observed period. In the second half of the same period, the share of *food and beverages, prim., mainly for industry* increased (approximately 40%) as well as *food and beverages processed, mainly for consumption* (approximately 60%).

In the case of Vietnam´s agri-food exports to the Czech Republic, *Food and beverages, prim., mainly for industry* and *Food and beverages processed, mainly for consumption* dominated in the export structure during the first half of the observed period. Despite fluctuations, a significant reduction in the share of *Food and beverages, prim., mainly for industry* and an increase in the share of *Food and beverages processed, mainly for consumption* are evident in the second

half of the same period. A partial increase in the share of *Food and beverages processed, mainly for industry* is also observed.

These changes are subsequently reflected in the development of the unit prices of agri-food exports to both countries. In most years between 2002 and 2020, Vietnam's agri-food exports to the Czech Republic revealed higher export prices compared to the Czech Republic's product prices to Vietnam. However, in the case of the Czech Republic, the changes in the unit price of exports can be considered as positive, because of the continuous increase in this price and therefore, an improvement in the terms of agri-food trade since 2013. At the end of the observed period, the unit prices of agri-food export products from the Czech Republic exceeded the price of agri-food export products from Vietnam.

The export similarity index (ESI) was used to assess the mutual complementarity of agri-food trade between the Czech Republic and Vietnam, which measures the extent to which the structure of agri-food exports is complementary or competitive relative to the world market. The following table shows the index values for selected years.

Table 3 The Export Similarity Index (ESI) scores for the agri-food trade structure between the Czech Republic and Vietnam for selected years

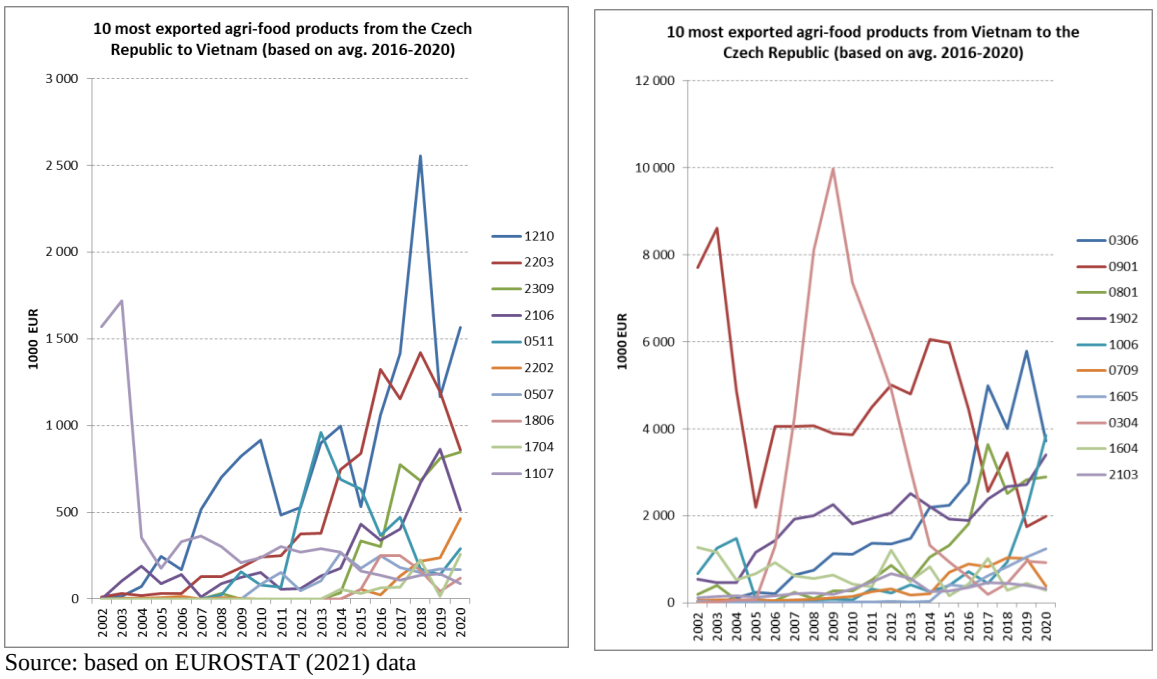
	2002	2005	2010	2015	2020	Average for 2002 to 2020
ESI	21.2	21.4	20.1	27.4	23.3	22.0

Source: own calculation based on UNCTAD (2021) data

The values of the ESI averaged 22.0 for the period under review. This can be interpreted as a strong complementarity between the agri-food trade structures of the Czech Republic and Vietnam relative to the world market. In other words, the structures of agri-food exports of the Czech Republic and Vietnam are different and therefore do not compete on the world market. The value of the ESI reached a minimum in 2008 (17.3). Since then, there has been a slight increase to an ESI value of 25.0 in the last five years, which value marks the boundary between strong and weak complementarity. Despite the significantly higher values of agri-food imports and the long-term negative balance of the Czech Republic's agri-food trade with Vietnam, the composition of traded commodities can undoubtedly be considered a positive character of this trade.

An analysis of the product composition of trade was performed to assess the representation of several product groups in the structure of mutual agri-food trade and its changes. The results of this analyses are presented Figures 3a and 3b.

Figures 3a, 3b The 10 most exported products in bilateral agri-food trade between the Czech Republic and Vietnam.



Source: based on EUROSTAT (2021) data

According to Hoang et. al. (2017), Vietnam has strong competitive advantages in crop sectors such as spices, rice, coffee, tea, fruit & nut and vegetables; and fishery sectors such as fish and crustaceans whilst it is clearly uncompetitive in livestock sectors such as live animal, meat, eggs and birds; and processed food sectors such as chocolate, cheese, butter, and other processed meat & foods.

The majority of Vietnam agri-food exports to EU consist of unroasted coffee, tea in bulk and mate (44% of the total value of agri-food export from Vietnam to the EU) and 37% of tropical fruits, nuts and spices (EC, 2021b). The 10 most exported agri-food products from Vietnam to the Czech Republic (for 2016 to 2020) are HS0306 (*Crustaceans, live, fresh, chilled, frozen*; share 19.6%), HS0901 (*Coffee*; 13.1%), HS0801 (*Coconuts and cashew nuts*; 12.6%), HS1902 (*Pasta, noodles, etc*.; 12.1%), HS1006 (*Rice*; 7.5%), HS0709 (*Other vegetables, fresh or chilled*; 3.8%), HS1605 (*Crustaceans, prepared or preserved*; 3.8%) , HS0304 (*Fish fillets and other fish meat*; 2.9%), HS1604 (*Prepared or preserved fish*; 2.3%) and HS2103 (*Sauce and preparations*; 1.8%).

When adding HS0301 (live fish) and HS0303 (frozen fish) to the above groups HS0306, HS0605, HS0304 and HS1604 it becomes clear that 30% of the value of Vietnam's agri-exports to the Czech Republic is fish and other fish products. This export structure corresponds to the composition of Vietnam's comparative advantage in agri-food trade. However, some difference exists from the structure of Vietnam's agri-food exports to the Czech Republic compared to exports to the rest of the EU, which excludes coffee and tropical fruits. It is clear from the above overview that a significant share of imported agri-food products to the Czech Republic from Vietnam are the so-called non-competitive products, i.e. those that cannot be produced in the Czech Republic. Therefore, these products do not present a competition to Czech producers.

Relative to the rest of the World (without the EU 28 internal trade), the Czech agri-food trade is especially competitive in the trade of live animals, dairy products, sugar, beverages and alcohol, oil seeds, preparation of cereals, milling products, cocoa preparations, vegetable saps and tobacco products (Smutka et. al., 2018).

The agri-food trade Statistical Factsheet (EC, 2021b) shows, that the majority of EU agri-food exports to Vietnam consist of feed and feed ingredients (10%), milk powders and whey (7%), offal, animal fats and other meats (7%), pet food (7%) and food preparations (7%). The 10 most exported agri-food products from the Czech Republic to Vietnam (for 2016 to 2020) are HS1210 (*Hop*; share 26.4%), HS2203 (*Beer made from malt*; 20.2%), HS2309 (*animal feeding*; 11.6%), HS2106 (*Food preparations*; 9.5%), HS0511 (*Animal products unfit for human consumption*; 4.9%), HS2202 (*Waters*; 3.7%), HS0507 (*horns, antlers, hooves, nails, etc*.; 3.1%), HS1806 (*Chocolate and other food preparations containing cocoa*; 2.8%), HS1704 (*Sugar confectionery not containing cocoa*; 2.2%) and HS1107 (*Malt*; 2.1%). These products represent 86.4% of the value of Czech agri-food exports to Vietnam during 2016–2020. In terms of individual products, half of the value of Czech agri-food exports to Vietnam is products related to brewing. At the same time, the values of hop and beer exports have increased significantly in the last decade, as can be seen from Figure 3a. In contrast to the typical export structure of the EU as a whole (EC, 2021b), Czech exports to Vietnam lack milk powder, which is otherwise commonly exported by the Czech Republic.

As already mentioned in section 3.1, the EVFTA will lead to the liberalization of the market between the EU and Vietnam. This will include Czech products that are typical in the production and export structure of the Czech agriculture and food industry. This liberalization, leading to a reduction in tariffs and the removal of other barriers, will create the potential for an increase in Czech agri-food exports to Vietnam for those products that are already exported to Vietnam and those products that currently do not significantly profile Czech export structure to Vietnam. Keeping these positive effects in mind, the following outcomes may reasonably be expected.

- Tariffs will be reduced and other barriers removed for beef, pork and lamb. The Czech Republic is a net importer of these products and reveals a comparative advantage and international competitiveness only for live animals. Therefore, it cannot be expected that the Czech Republic will successfully establish itself on the Vietnamese market with these exports, especially when competing with other European Union countries.
- The Czech Republic primarily exports dairy milk and low value added dairy products within the Common Market of the European Union. It also maintains a negative trade balance for processed dairy products with higher added value (e.g. cheeses). Promoting the export of dairy products to the Vietnamese market is therefore a questionable option, especially considering competition of other EU member states. A possible exception could be the export of powdered milk; it’s a product that the Czech Republic successfully exports to markets outside the EU.
- Vegetable and fruit production in the Czech Republic reveal low levels of competitiveness and therefore it is unlikely that these sectors will succeed in international competitive markets.
- The Czech Republic agri-food export to Vietnam already significantly represents the segment related to brewing production. Hops and malt are among the most successful export items, however, the tariff burden on their exports to Vietnam was 5% before the EVFTA, so this will not be a significant reduction in the cost of trade. To the contrary, the tariff on beer exports was 35% and after its reduction, it became possible to improve the position

of Czech beer on the Vietnamese market. The protection of geographical indications of origin should also play a positive role and support this improvement.

- Similarly, products such as confectionery and food or animal feed preparations are already successfully exported to Vietnam, and a reduction in tariffs could lead to a further increase in exports of these products.
- There will be a gradual and significant reduction in the tariff burden on wine exports to the Vietnamese market. Although viticulture and winemaking in the Czech Republic has undergone a positive transformation in the last three decades and domestic producers have improved their position on the domestic market, although it is still a net importer of wine. Very small volumes are exported outside the EU market. Premium wines are however exported outside the EU market. Therefore, despite the significant reduction in the tariffs, no significant increase in wine exports to Vietnam can be expected.
- On the contrary, although spirits are not currently profiled in the export structure of the Czech Republic's agrifood trade to Vietnam, a significant reduction in tariffs on spirits could increase export opportunities to Vietnam. The variety and uniqueness of Czech spirit products is very positive.

In the long term, it can be assumed that a number of Czech firms will exploit market opportunities in the Vietnamese market.

4 Conclusions

The EVFTA came into force in mid-2020. It is generally perceived as another way of strengthening the European Union's involvement in global economic structures, especially in the context of stagnant WTO negotiations. It is also a mechanism for the EU to further engage in the markets and economies of currently fast-growing regions of Southeast Asia. A potentially good point of departure for the Czech Republic is the fact that economic and trade relations between the Czech Republic and Vietnam have been developing since the middle of the 20th century, establishing long-term relations and cooperation in several areas.

Despite the fact that the value of foreign trade in agricultural commodities and food products has increased between the Czech Republic and Vietnam in the last two decades (especially in the period when the Czech Republic became a member of the European Union). Despite these developments, neither country is an important trading partner in agri-food trade for the other. The agri-food trade is also no longer a significant segment of trade between the two countries.

Substantial opportunity for further development of the agri-food trade between the two countries is not only dependent on the EVFTA, but existing structures of agri-food trade between the two countries are complementary. From the perspective of the Czech Republic, the structure of agri-food export are positive, because the share of ready-to-consume products in this structure increased significantly, and thus the unit value of exports increased.

The EVFTA itself commissions the reduction and elimination of tariffs, the simplification of customs procedures, the removal of non-tariff barriers, the protection of geographical indications of origin, facilitates access to Vietnamese government contracts and provides stronger protection of intellectual property rights. The resulting effect is expected to be beneficial not only for the producers themselves, but also for consumers in both countries. The removal of these barriers will be gradual and increas in agri-food trade flows should become more significant in the next decade.

If comparing the values of exports and imports between the Czech Republic and Vietnam in 2019 and 2020, it is not yet possible to identify significant increases or changes in broad trends or at the level of individual products. Certain changes can be observed in the ranges of traded products. There was a year-on-year increase in the number of exported agri-food products imported from Vietnam. To the contrary, this range of products reduced in the case of the Czech Republic agri-food exports to Vietnam. The current time period is however, atypical due to the disruption of international trade by the global coronavirus pandemic. That could also be the reason for the tendencies observed in the data. More robust analyses and assessment of actual changes in these tendencies need to be conducted.

It is however, possible to identify and interpret which agricultural and food products can reasonably be expected to improve Czech exports to Vietnam. Some of the traditionally and successfully exported agri-food products from the Czech Republic are already exported to Vietnam such as hops, malt and beer. Trade in these products can be expected to further improve on the Vietnamese market. Similarly, the promotion of other products such as spirits, animal nutrition preparations, milk powder, food preparations and confectionery are potentially successful options.

Czech companies that are considering entering the Vietnamese market or strengthening their position in it, will consider the attractiveness of this market compared to other export opportunities. Despite the reduction of trade barriers, the Vietnamese market is geographically and culturally distant, which undoubtedly reduces its attractiveness and export opportunities. In addition, many successful Czech exporters are owned by multinational companies and therefore the

decision to enter or expand activities in the Vietnamese market is conditioned by the alignment to the overall corporate strategy and objectives. This could mean both promotion of trade (especially if the parent company is already operating in the Vietnamese market) and, counter wise, preventing export activities not aligned with corporate strategy. Another determinant of the export success of agri-food exports to Vietnam will be the ability to successfully compete with other European Union countries offering similar types of agri-food products to Vietnam.

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References

Bečvářová, V. & Zdráhal, I. (2013). *Agriculture and Rural Development in the European Model of Agricultural Policy - Shaping Strategy in the Context of Environmental Changes*. 1. ed. Brno: Mendel University in Brno, 2013. ISBN 978-80-7375-858-5.

Cihelková, E. (2021). *Aktuální otázky světové ekonomiky: proměny a governance*. Praha: Professional Publishing, 2012. ISBN 978-80-7431-104-8.

EC (2020). European Commission: EU-Vietnam trade and investment agreements. [Online]. Retrieved from: https://1url.cz/fKVI0

EC (2021a). European Commission: negoations and agreements. [Online]. Retrieved from: https://1url.cz/HKVIS

EC (2021b). European Commission: agri-food trade statistical factsheet. [Online]. Retrieved from: https://1url.cz/nKVIP

EUROSTAT (2021). International trade in goods. [Online]. Retrieved from: https://1url.cz/4KVII [Accessed: 20 Jun. 2021]

Finger, J. M. & Kreinin, M.E (1979). A Measure of `Export Similarity' and Its Possible Uses. *The Economic Journal*, 89(356), 905-912. https://doi.org/10.2307/2231506

Hlavatá, L., Karlová, P. & Strašáková, M. (2008). *Dějiny Vietnamu*. Praha: Nakladatelství Lidové noviny. ISBN 978-80-7106-965-2.

Hoang, V. V., Tran, K. T. & Tu, B. V. (2017). Assessing the Agricultural Competitive Advantage by the RTA index: A Case Study in Vietnam. *AGRIS on-line Papers in Economics and Informatics*, 9(3), 15-26. https://doi.org/10.7160/aol.2017.090302

Kocourek, A. & Šimanová, J. (2017). *Studie dopadů uzavření dohody o volném obchodu mezi EU a Vietnamem a EU a Singapurem na ekonomiku ČR*. [Online], Retrieved from: https://1url.cz/eKVIJ

MZV (2019). Ministerstvo zahraničních věcí České republiky: Dohoda o volném obchodu. [Online], Retrieved from: https://1url.cz/eKVI5

Smutka L., Maitah M., Svatoš M. (2018). Changes in the Czech agrarian foreign trade competitiveness – different groups of partners' specifics. *Agricultural Economics (Czech Republic)*, 64, 399–411. https://doi.org/10.17221/399/2016-AGRICECON

Studík, P. & Teplík, T. (2006). *Vietnam – země rozmachu, země příležitostí*. Praha: Longa. ISBN 80-86391-20-5.

UNCTAD (2020). World statistical database [Online]. Retrieved from: https://bit.ly/21GbfKX [Accessed: 20 Jun. 2021].

Level of agricultural development in the V4 countries

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Abstract: In this paper the economic growth of the agricultural sector in the V4 countries is compared by using the Hellwing´s model. The data from Eurostat and FADN EU were used for the modulation. The results indicate higher differences between the countries by the indicator of production potential – especially by the utilized agricultural area per farm. The differences in the production potential productivity are not so crucial. According to the level of agricultural development, it is possible to declare that Czech Republic and Poland are the countries with better agricultural potential within the V4 countries.

Keywords: agricultural, economic development, competitiveness, potential of farms, production factors, V4
JEL Classification: O13, Q11, Q12, Q13

1 Introduction

V4 countries (Czech Republic, Hungary, Poland nad Slovakia) are strongly connected not only based on their history. Till today there is a strong cooperation within Eastern-Central-Europe among these countries, not only on regional, but on the European and global level as well (Fenyves et al., 2020). Taking the agricultural land into account (Utilized Agriculture Area = UAA), are these countries among the smaller countries in the EU, except of Poland, whose agriculture land counted around 14.5 mil. hectares in 2018[3]. The agriculture area of Hungary was 5.3 mil. in 2018, Czech Republic 3.5 mil. ha and Slovakia 1.9 mil. ha. Based of FAO data there is no substantial difference in the ration of agricultural land and the total land area in these countries. The highest ratio is in Hungary (58%), followed by the Czech Republic (46%), Poland (47%) a Slovakia (39%). Focusing on the size of agriculture enterprises, in the Czech Republic and Slovakia the large and strongly concentrated companies prevail (European Commission, 2018; Fenyves et al., 2020; Glowinkel et al. 2021).

The total area of Poland ranks it also among the countries with higher area of UAA and even higher number of farms (1.4 mil.). The averages size of a farm it therefore not so high (10.21ha per farm). The similar situation is in Hungary (10.9 ha per farm), whose UAA is around 30 % of the Polish UAA and the number of farms is 430 K. The number of farms in the Czech Republic and the Slovakia reaches the similar value of 26 K. However, the different area of agriculture land contributes to the substantial differences in UAA hectares per one farm. The average Slovak farm has 73.6 ha, the Czech one 130.2 ha. The EU average is 16.6 ha what means that Czech and Slovak Republic counts above the average.

The analysis of the development of agrarian farms in V4 countries by using different factors has been the research topic of a lot of authors. Szabo et al. (2018) use the production factors and calculate their productivity in the period 2004-2013 by using the EU Farm Accountancy Data Network (FADN). Their results show, that in the period under observation the V4 countries significantly lag behind the EU average in the development of agricultural production. Fenyves et al. (2020) analyzed the factors that affect the capital structure of the agricultural and food companies. Theirs reached the conclusion that more profitable firms are less likely to use debt in all the V4 countries expect of Slovakia. On the other hand, if the farms use the debt to finance their growth these farms are usually the ones with higher growth potential. The same authors also draw attention to the huge influence of the country-specific factors on the capital structure. Bartóková (2019) evaluates position and the development of the agriculture and food sectors in V4 countries in the period of 2000-2014. She used the share of one country agriculture output / employment to the total output / employment of the agricultural and food sector for eachV4 country. The shares of production and employment on the total production and employment decline. Also Ďurčová & Oravcová (2019) have focused on the analysis of structural changes in Agricultural sector of V4 countries in the same period as Bartóková (2019). Based on their findings, the position of agricultural sector in V4 countries (mainly in Poland) is still significant although the job creation in the agricultural sector is declining.

Nowak et al. (2020) evaluate the development of the agricultural companies' competitiveness in the new EU member states in the period 2007 – 2017. They use namely the production factors values and their productivities. By

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applying the cluster analysis and the principal component analysis the differences between the "old" and "new" EU member states are confirmed.

The decrease of the share of the agricultural sector on total employment and GDP in the country does not have to equal to the decrease of its role in the economic development. The agricultural sector remains the crucial producer of inputs for food sector. As mentioned by Kijek et al. (2019) agriculture contributes also to the filling of social, civil, cultural and environmental goals. Each state (country) operates under different conditions but the aim of them is to achieve the economic growth or to be competitive in some sectors of its economy.

In this paper we compare the economic growth of the agricultural sector in the V4 countries by using the Hellwing´s development measure. The aim is to increase the knowledge of the agricultural performance in the V4 countries.

2 Methods

To evaluate the level of agricultural different variables could be applied. Szabo et al. (2018) use the productivity indicators, e.g. labor productivity or total productivity. The output of the company is expressed by agricultural production, gross farm income and net value added. The value of inputs is measured by the total equity, current assets, labor and livestock. The influence of subsidies on the total economic situation of the farms is expressed by total subsidies per one hectare. For the agricultural potential evaluation recommends Pawlak (2021) to use the indicators describing the "global inputs structure". The attention is paid to the share of land, labor, current and fixed assets on the total inputs value. This should be added by the mutual shares of production factors using the indicators of utilized agricultural area per 1 person employed in agriculture, the value of capital inputs per one employee or per one hectare of UAA and the mutual share of current and fixed assets. Kijek et al. (2019) analyzed the differences in productivities of old and new EU member states by using the total factor productivity defined as output-input ratio. Except of the level of production factors productivities focused the authors also on the factors involving these productivities. They have taken the education (Yao, 2019), knowledge (Li et al., 2020), health (Meegahapola & Prabodanie, 2018), social capital (Markowska-Przybyla, 2020), innovation (Čechura et al., 2015), competitiveness (Blažková & Dvouletý, 2018; Nowak et al., 2020) or geographical location (Lososová et al., 2017; Hlavsa et al, 2020) into consideration.

In our paper we have used the Helwling´s indicator, based on the method by Nowak et al. (2016). The similar method is used by Ogryzek et al. (2021) who analyzed the development in agriculture in the Polish regions. This method could be used for the evaluation of the regional development, as done by Rzasa et al. (2019), Podstawka or Suchodoslki (2018). This method allows combining different factors and composing one synthetic indicator evaluating the level of country (region) within the chosen sector based on the given set of partial characteristics (Poczta-Wajda and Poczta; 2016). Our research is focused on the comparison of the level of agricultural companies in V4 countries. It is necessary to keep in mind the differentiation of agricultural production conditions in particular counties as well as the specifics of agriculture sector, what results in complexity of evaluation of agricultural production in different countries (Nowak et al., 2016). According to these authors, is the conception of "the development level of agriculture" based on the more general concept of "economic development". As authors continues, this development does not equal to the economic growth, as it covers not only the quantitative changes measured by the indicators of economic growth, but the social and economic structure changes as well. Unlike the materialistic conception of prosperity, which is based on continuous economic growth, the sustainable development conception covers sustainable economic, environmental and social development. The development of agriculture is therefore understood as quantitative and qualitative changes in the sector, while the development level is a situation reached as a result of the above mentioned changes. The quantitative growth sources are: the volume of natural resources (namely land), labor and capital inputs. The growth reached as a result of these inputs is labeled as extensive. The qualitative growth is called intensive and is based on the scientific and technological progress, the labor division and economic activities cooperation, the soil fertility, climatic and wind conditions or the natural properties of animal and plants. The level of production factors usage could be measured by the land productivity, labor and capital productivities eventually by the total productivity (Slavickiene and Savickiene 2014; Ryan et al. 2016). The productivity is defined as the ability of the factors of production to generate output (Latruffe et al. 2016).

As mentioned already above, the analysis of such a complex problem requires the method taking a lot of factors into account (Nowak et al., 2016), what is the reason why the Hellwig´s indicator has been chosen.

Based on the literature review, the appropriate indicators have been chosen (see below), that could be divided to two categories: production potential and productivity. (Nowak et al. 2016; Nowak & Rózańska-Boczula, 2019; Ogryzek et al. 2021). The variables, that we used, are like below:

- The indicators evaluating the production potential:
    - x_1 = the average UAA by one farm (in hectares)
    - x_2 = the share of UAA to the total UAA EU-28 (%)
    - x_3 = the average number of employees per one (AWU/holding)
    - x_4 = the ratio of UAA to one AWU (ha/AWU),
    - x_5 = the share of agricultural production on total agricultural production of EU-28 (%)
    - x_6 = gross investment per one farm (€),
- The indicators evaluating the production factors efficiency:
    - x_7 = the total livestock output per large unit (€/LU),
    - x_8 = the wheat yield (t/ha),
    - x_9 = milk yield (kg/ha),
    - x_{10} = land productivity – total production / UAA (€/ha),
    - x_{11} = labor productivity – net value added / AWU (€/AWU),
    - x_{12} = potential capital productivity – total production /total assets (€/1 €),
    - x_{13} = current capital productivity – total production /total inputs (€/1 €).

For the analysis of the level of agriculture the multidimensional comparison method has been used, the taxonomical Hellwing´s method called "the formula method of development". The process of calculation has been overtaken by Nowak et al. (2016) and Ogryzek et al. (2021) as follows:

1. The standardization of the particular variables using the formula:

$$z_{ij} = \frac{(x_{ij} - \bar{x}_j)}{s_j}, (j = 1, \dots, m),$$

Where: $\bar{x}_j$ = arithmetical average, s_j = standard deviation

2. The calculation of distances between the analyzed object and the average value of analyzed objects:

$$d_i = \sum |z_{ij} - z_{0j}|$$

where: $z_{0j} = \max\{z_{ij}\}$

3. Hellwig´s indicator "m_i" calculation:

$$m_i = 1 - \frac{d_i}{d_0}$$

Where: $d_0 = \bar{d} + 3s_d$, $\bar{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$, $s_d = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(d_i - \bar{d})^2}$,

The value of indicator "m" is between <0;1>. The rank of V4 countries is set by the value of indicator, while the higher value the higher level of economic development of agriculture.

Our calculation uses the average values of the indicators from period 2016 – 2019. The data are from Eurostat and FADN EU.

3 Research results

The bases for the summary development index calculation have been the statistical characteristics stated in Table below. The Table 1 shows the disproportions among the analyzed V4 states – the minimal and maximal values and the variation coefficient. The higher value of characteristic, the better is its influence on the value of index.

Table 1 Statistical characteristic of variables in V4 countries in the period 2016-2019

Variable	Mean	Min.	Max	Coefficient of variation (%)
x_1	56,23	10,21 (PL)	130,20 (CZ)	88,69
x_2	3,52	1,09 (SK)	8,31 (PL)	80,13
x_3	1,85	0,80 (HU)	3,70 (CZ)	60,98
x_4	24,61	9,00 (PL)	41,44 (SK)	56,25
x_5	2,65	0,53 (SK)	6,87 (PL)	93,66
x_6	11.204,30	3.809,90 (HU)	16.891,20 (CZ)	43,76
x_7	1.071,75	898,10 (CZ)	1.232,50 (SK)	12,15
x_8	5,50	5,12 (SK)	5,99 (CZ)	5,63
x_9	676,45	411,90 (HU)	921,60 (PL)	33,96
x_{10}	1.427,03	1.187,60 (SK)	1.672,00 (HU)	12,61
x_{11}	10.975,50	6.053,00 (PL)	16.038,00 (CZ)	34,89
x_{12}	0,57	0,17 (PL)	0,86 (SK)	44,29
x_{13}	0,99	0,85 (CZ)	1,10 (PL)	10,90

Source: Own processing by using data Eurostat, FADN EU

The value of variation among the characteristics is described by the variation coefficient. The lowest variability is in case of x_8 (wheat yield) = 5.63%. The highest is for x_1 (the average UAA by one farm) = 88.7%. Using the Eurostat data (2021) the average number of farms in EU is around 10.5 million. In Poland is the average number of farms 1.4 million, in the Czech as well as Slovak Republic there is a similar number of 26 K farms, in Hungary 430 K. Taking the area and historical development into account, the Czech Republic counts for the countries with the biggest average size of farms (130.2 ha UAA). Contrary, in Poland and Hungary there is around 10.5 hectares of UAA per one farm. The average UAA / farm in the EU-28 is 16.56 ha.

The values of agricultural development level index "m" (Table 2) declare the highest values in case of Czech Republic, followed by Poland. There is no substantial difference between Poland and Slovak Republic.

Table 2 The values of agricultural development level index in V4 countries

Country	**Agricultural Development Level Index**
CZ	0,39
HU	0,16
PL	0,28
SK	0,20

Source: Own processing by using data Eurostat, FADN EU

The value of summary index for particular states is involved by following factors: **the Czech Republic** reached the highest value of V4 countries in the average UAA per one farm (x_1 indicator), average AWU per farm (x_3 indicator), gross investment (x_6 indicator), and wheat yield (x_8 indicator) and labor productivity (x_{11} indicator). Taking the production potential evaluation indicators the maximal value for **Poland** is reached in x_2 indicator (the share of UAA on the total UAA of EU-28). Because of higher value of current capital productivity (x_{13} indicator) there is a higher share of agricultural production (SO) on total EU-28 agricultural production compared to other V4 countries. There is also higher milk yield (x_9 indicator). The level of **Slovak** agriculture is substantially involved by the UAA per AWU (x_4 indicator), the animal production per LU (x_7 indicator) and potential productivity of capital (x_{12} indicator). The lowest index has

been reached by **Hungary**. From the total number of 13 indicators, Hungary has got the lowest values in three of them: average number of employees per holding (x_3), gross investment (x_6) and milk yield (x_9).

Comparing the productivity level, there is the great similarity in the land productivity (x_{10}), what is also evident from variation of 12.61%. The most differentiated indicator is the share of agriculture production on the total EU-28 agriculture production (x_5), where the variability is 94%. The attention should be payed also to the differentiation in the labor productivity (x_{11}), what is one of the key indicators of sector´s competitiveness (Novotná and Volek, 2016). The values of this indicator tend to decrease, what has the substantial impact on the summary Hellwig´s indicator in case of analyzed V4 countries. The lowest work equipment in the agriculture is reached in Slovakia. Based on Eurostat data (2021) this indicator is around 45 K / AWU or 2.86 AWU/100 ha Based on EUROSTAT data, the average number of workers in agriculture in Slovakia is 45 K AWU. When taking the UUA into account, there is a 2.86 AWU/100 ha. Observing the development of the last years it could be said, that the labor inputs in agriculture decrease, however in Poland remain the highest (11 AWU/100 ha). In Hungary was in 2018 almost 8 AWU / 100 ha.

The net value added per AWU is in Poland 2.5 times lower compared to the Czech Republic. There are no substantial differences between the labor productivities of the Czech and Slovak Republic. Dorward (2013) regards the labor productivity growth as a key factor of total economic growth and structural changes in the agricultural sector.

The level of potential capital productivity, measured by the ratio of the value of production and total assets value (x_{12}), is 0.57 in the V4 average. Raking the countries, the Czech Republic is the second one, while the Slovakia is the first. The lowest value of this indicator has got Poland (as mentioned already above). The countries ranking for potential capital productivity is the same like for the total agriculture development level index.

Focusing on the indicators evaluating the production factors efficiency, there is a small differentiation in x_{13} - current capital productivity. This indicator is at the average value of 0.99. The value above 1 is reached by Poland (1.1), followed by Hungary (1.08). The Czech Republic has got the lowest total productivity of 0.85.

4 Conclusions

In this paper the question of agriculture development level of V4 countries has been solved. For the evaluation of the situation in particular states the indicators of production potential and efficiency of production factors have been used. The complex evaluation of economic growth in the particular countries has been done by applying the Hellwing´s indicator. The results show that among V4 countries the Czech Republic and Poland are the states with higher agricultural level. Generally it is possible to declare that higher variability is in case of the indicators evaluating the production potential. There are no big differences in the production factors usage among the countries what mean the effort of effective usage of these factors in analyzed countries.

The level of agriculture development is involved by the production potential factors, as well as their usage. Beside these factors, incorporated to the index of agricultural development level, it is necessary to mention other factors as well as e.g. different economic and natural conditions and the historic development of agricultural in the given area. Related to this fact, the authors would like to take in their next research focused on the agricultural level evaluation into account also these other factors.

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References

Bartóková, Ľ. (2019). The Position of Agriculture and Food Sector in V4 Countries. *AGRIS on-line Papers in Economics and Informatics,*11(3), 13-22. ISSN 1804-1930. doi: 10.7160/aol.2019.110302.

Blažková, I., Dvouletý, O. (2018) Sectoral and Firm-Level Determinants of Profitability: A Multilevel Approach. *International journal of entrepreneurial knowledge.* 6, 2, 32--44. ISSN 2336-2952

Čechura, L., Kroupová, Z., Rudinskaya, T. (2015) Factors determining TFP changes in Czech agriculture. *Agricultural Economics – Czech*, 61, 2015 (12): 543–551. doi: 10.17221/14/2015-AGRICECON

Dorward, A. (2013) Agricultural Labour Productivity, Food Prices and Sustainable Development Impact and Indicators. *Food Policy*, 2013. doi: 10.1016/j.foodpol.2012.12.003

Ďurčová, J., Oravcová, D. (2019). Structural Changes and Agricultural Sector in V4 Countries – Input-Output Analysis. *Journal of Environmental Management and Tourism*, (Volume X, Winter), 7(39): 1696-1705. doi:10.14505/jemt.v10.7(39).26

European Commission (2018). Farm Structures. Online retrieved from: https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/farm-structures_en.pdf

Eurostat – Economic Accounts for Agriculture. Online retrieved from: https://ec.europa.eu/eurostat/data/database

Fadn public database. Online retrieved from: https://ec.europa.eu/agriculture/rica/database/database_en.cfm

Fenyves, V., Pető, K., Szenderák, J., Harangi-Rákos, M. (2020): The capital structure of agricultural enterprises in the Visegrad countries. *Agricultural Economics*, 66, 160-167

Glowinkel, M., Mocan, M. & Külkens, M. (2021). The Common Agricultural Policy promotes a US-like development of the European agriculture. *Bulgarian Journal of Agricultural Science*., 27(1), 12–21

Hlavsa, T., Spicka, J., Stolbova, M., Hlouskova, Z. (2020): Statistical analysis of economic viability of farms operating in Czech areas facing natural constraints. *Agricultural Economics (Czech Republic)*, 66, 193–202

Kijek, A. a kol. (2019) Productivity and its convergence in agriculture in new and old European Union member states. *Agricultural Economics – Czech*, 65, 2019 (1): 01-09. doi: 10.17221/262/2017-AGRICECON

Latruffe, L., Diazabakana, A., Bockstaller, C., Desjeux, Y. and Finn, J. (2016). Measurement of sustainability in agriculture: a review of indicators. *Studies in Agricultural Economics*, 118 (3), 123-130.

Li, S.S., Fu, L., & Ma, Y. (2018). Higher Education and Productivity in China Educational Sciences: Theory & Practice, 18(5),1863-1875. http://dx.doi.org/10.12738/estp.2018.5.087

Lososová, J., Zdeněk, R., Kopta, D. (2017). Development of the main production and economic indicators of Czech farms. Custos e Agronegocio, 13, 2. ISSN 1808-2882.

Markowska-Przybyla, U., (2020). Does Social Capital Matter for Total Factor Productivity? Exploratory Evidence from Poland. *Sustainability* 2020, 12, 9978; doi:10.3390/su12239978

Meegahapola, P.A. & Prabodanie, R.A.R. (2018). Impact of environmental conditions on workers' productivity and health. *International Journal of Workplace Health Management*, 11(2), 74-84. https://doi.org/10.1108/IJWHM-10-2017-0082

Mináriková, D. (2021). *Úroveň konkurenceschopnosti slovenských podnikov živočíšnej výroby v rámci V4*. Diplomová práce. Mendelova univerzita v Brně.

Novotná M., Volek, T. (2016) The Signifi cance of Farm Size in the Evaluation of Labour Productivity in Agriculture. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 64(1), 333–340.

Nowak, A., Janulewicz, P., Krukowski, A., Bujanowicz-Haraś, B. (2016). Diversification of the level of agricultural development in the member states of the European Union. *EDP Sciences*. doi: 10.1051/cagri/2016040

Nowak, A., & Różańska-Boczula, M. (2019). Differentiation in the production potential and efficiency of farms in the member states of the European Union. Agricultural Economics (Zemědělská ekonomika). 65, 395-403. doi: 10.17221/378/2018-AGRICECON.

Ogryzek, M.; Rząsa, K.; Źróbek, R. Change in the Level of Agricultural Development in the Context of Public Institutions' Activities—A Case Study of the NASC Activities in Poland. Land 2021, 10, 187. https://doi.org/10.3390/land10020187

Pawlak, K.; Smutka, L.; Kotyza, P. (2021). Agricultural Potential of the EU Countries: How Far Are They from the USA? Agriculture 2021, 11, 282. https://doi.org/10.3390/agriculture11040282

Poczta-Wajda, A., Poczta, J. (2016). The role of natural conditions in qualified agritourism – case of Poland. *Agricultural Economics – Czech*, 62, 167-180. https://doi.org/10.17221/97/2015-AGRICECON

Podstawka, M.; Suchodolski, B. Assessment of the level of economic and social development of regions using the Hellwig taxonomic development measure. In *Proceedings of the VII International Scientific Conference Determinants of Regional Development*, PIła, Poland, 12–13 April 2018; 187–201. doi:10.14595/CP/01/013.

Rzasa, K.; Ogryzek, M.; Źróbek, R. The land transfer from the state treasury to local government units as a factor of social development of rural areas in Poland. Land 2019. doi:10.3390/land8110170.

Ryan, M.; Hennessy, T.; Buckley, C.; Dillon, E.J.; Donnellan, T.; Hanrahan, K.; Moran, B. (2016). Developing farm-level sustainability indicators for Ireland using the Teagasc National Farm Survey. *The Irish Journal of Agricultural and Food Research*. 2016, 55, 112–125.

Slavickienė, A., & Savickienė, J. (2014). The Evaluation of Small and Medium Farms' Economic Viability in the New EU Countries. *Economy & Business Journal*, 8(1), 843-855.

Szabo L., Grznar M., Zelina M. (2018): Agricultural performance in the V4 countries and its position in the European Union. *Agricultural Economics (Czech Republic)*, 64, 337–346.

Yao Yao, (2019) Does higher education expansion enhance productivity? *Journal of Macroeconomics*, 59, 169-194, ISSN 0164-0704, https://doi.org/10.1016/j.jmacro.2018.11.009.

Support for the expansion of selected protected animals within the framework of compensation

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Abstract: The landscape is used by many entities at the same time, leading to problems with property rights, environmental protection, biodiversity conservation and other interests. Both property rights and environmental protection are guaranteed by the state and regulated by law. It is completely undeniable and natural that there are conflicts between these interests. In recent decades, efforts to conserve the biodiversity have been characterized by increasing use of economic instruments, new sources of funding to support activities including monitoring, research, training, but also public events and promotion. Conflicts are relatively common when a property overlaps with the territory and home range of a predator. As users usually bear the costs, this leads to negative attitudes towards these species, even though some of them are protected by law. These conflicts can also lead to negative attitude towards conservation itself and its financial and political support. This paper quantifies the relationship between compensation for damage caused by selected protected animals and their abundance in the Czech Republic. A high statistical dependence between population development and compensation payments is found for wolves (r = 0.999) and otters (r = 0.921).

Keywords: protected animals, conflicts, compensation, investments, measures.
JEL Classification: H76, Q20, Q57

1 Introduction

The circular economy promises to address problems such as resource depletion and environmental degradation, but biodiversity protection is a crucial issue that should be emphasised in circular economy and bioeconomy policies (Buchmann-Duck and Beazley, 2020). Carnivores, especially the large ones, have an undeniable aesthetic and intrinsic value and a key role in ecosystems (López-Bao, Bruskotter and Chapron, 2017). They are also considered flagship species for conservation (Wolf and Ripple, 2017), yet when they are overabundant they can have negative impact on biodiversity (Fardell, Pavey and Dickman, 2020). Moreover, in the face of human-wildlife conflicts, their conservation is a management challenge (Morehouse and Boyce, 2017). Although many conflicts arise from interactions between predators and livestock,and their coexistence in a given area (Miller and Schmitz, 2019), there are also cases of attacks on humans (Bombieri et al., 2018). Apart from these cases, and the possible fatalities, the interaction can also cause economic damage (Widman and Elofsson, 2018).

One possible solution to these conflicts is the use of compensation schemes (Ravenelle and Nyhus, 2017). Compensating those who have to bear the costs of the damage caused by carnivores could lead to a higher acceptance of their presence (Kojola et al., 2018). There are two types of compensation schemes: ex-post compensation, where the damage is compensated only after it has occurred, and ex-ante compensation, where payments are based on an estimate of the potential damage and are made regardless of its actual occurrence (Schwerdtner and Gruber, 2007). Compensation shall cover the economic loss of depredation. The loss can be further divided into direct and indirect costs. Direct costs result from the depredation of biological resources, including game, fish, livestock and domestic animals both injured and killed (Gese, Hart and Terletzy, 2021; Widman, Steen and Elofsson, 2019), and from the economic losses caused by destroyed equipment such as fences, beehives, infrastracture, water systems etc. (Naves et al., 2018; Hariohay, Munuo and Røskaft, 2019). The costs of indirect damages are much more difficult to assess. They cover a wide range of problems, such as the consequences of fear and stress due to predation (Fardell, Pavey and Dickman, 2020), the loss of careful breeding work and effort (Wilkinson et al., 2020), or the loss of well-trained dogs where money cannot replace a lost emotional bond (Tikkunen and Kojola, 2020). The determination of total damage costs is always subject to a certain degree of uncertainty. In addition, there are search and information costs to obtain all the information needed to determine

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damage costs, including the extent and specification of species (Schwerdtner and Gruber, 2007). Other costs that arise are decision-making costs resulting from the inevitable imperfect assessment of damage (Yoder, 2000) and different perceptions of the extent of damage and the corresponding damage costs (Schwerdtner and Gruber, 2007). Difficulties in determining damage costs, leading to different estimates and disagreement between those bearing the costs and the authorities who provide compensation, can result in conflicts over appropriate compensation payments (Myšiak, Schwerdtner and Ring, 2004).

In the Czech Republic, the Act No. 115/200 Gazette on Providing Compensation for Damages Caused by Selected Specially Protected Animals aims to reduce conflicts between nature conservation and owners of land, livestock, fish ponds, beehives, etc. by compensating them for the damage, if the legal requirements are met. The selected protected animals are beaver (*Castor fiber*), otter (*Lutra lutra*), moose (*Alcer Alcer*), brown bear (*Ursos arctos*), lynx (*Lynx lynx*) and wolf (*Canis lupus*). Damage caused by great cormorant (*Phalacrocorax carbo*) in 2021, 2022 and 2023 can also be compensated, although several years later cormorant was removed from the list of selected protected animals due to its large population (Damohorský, 2019). However, the Czech law does not provide compensation for damage caused by these animals on game or pets. The aim of this paper is to quantify the relationship between the development of compensation for damage caused by selected protected animals and their abundance in the Czech Republic.

2 Methods

To quantify the relationship between the development of compensation for damage caused by selected protected animals and the development of their abundance in the Czech Republic, a simple linear regression based on annual time series was used, in the following form

$$y = \beta_0 + \beta_1 \times x + \varepsilon \quad (1)$$

where:

y is the dependent variable,

β_0; β_1 are parameters of the regression equation,

x is an independent variable,

ε is a residual.

Using this equation, the prediction of compensation payments for the year 2021 was calculated based on the populations as of 31 March 2021 (ČSÚ, 2021) to determine whether there is a dependency of compensation payments (y) on animal populations (x). Input data were provided by the Ministry of Finance on the basis of an application pursuant to Act No. 106/1999 Coll. (see Table 1) and Czech Statistical Office (see Table 2).

Table 1 Compensation for damages caused by selected protected animals (thousands of CZK)

Year	Otter	Cormorant	Beaver	Moose	Wolf	Lynx	Bear	Total
2010	9 652	40 989	7 876	56	9	11	0	58 593
2011	10 087	40 673	10 260	129	66	59	0	61 274
2012	11 549	41 348	9 895	103	17	61	0	62 973
2013	12 909	50 677	4 661	0	34	255	0	68 536
2014	10 344	4 868	13 755	214	99	88	9	29 377
2015	15 163	491	7 707	6	102	143	4	23 616
2016	13 643	0	6 197	0	293	119	0	20 252
2017	16 717	0	6 096	91	788	184	0	23 876
2018	22 793	0	4 985	0	1 530	129	164	29 601
2019	21 719	37 212	2 874	0	5 612	304	600	38 116
2020	23 803	73 612	5 485	0	6 196	213	34	109 343

Source: Ministry of Finance on the basis of an application pursuant to Act No. 106/1999 Coll., own processing

Table 2 The population numbers of selected protected animals as of 31 March 2021

Year	Otter	Cormorant	Beaver	Moose	Wolf	Lynx	Bear
2010	4 918	39 011	2 025	38	6	291	4
2011	5 299	42 752	2 758	25	6	290	5
2012	5 774	42 177	3 535	36	3	304	3
2013	6 327	46 037	3 929	38	10	316	3
2014	6 420	42 020	4 504	24	5	333	1
2015	6 802	46 869	5 192	18	13	327	4
2016	7 778	45 128	5 669	13	30	329	3
2017	8 256	46 251	6 140	12	61	347	4
2018	8 586	43 442	6 781	7	118	385	4
2019	9532	42 551	7151	12	334	381	11
2020	9 986	41 019	7 981	8	429	433	13
2021	10 446	45 782	8 448	7	593	438	12

Source: ČSÚ - Czech Statistical Office (2021), own processing

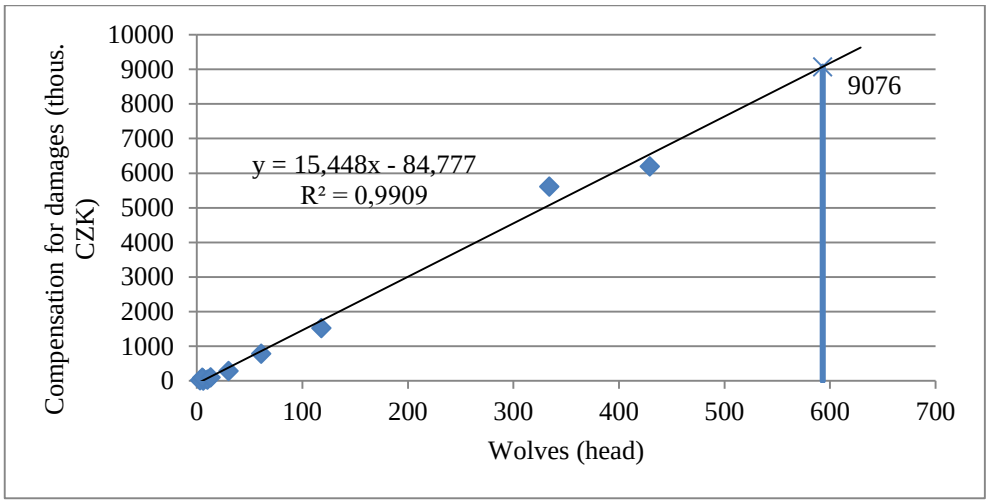
3 Research results

The data presented in Table 1 show that the highest amounts of compensation for damage caused by selected protected animals in the indicated period 2010-2020 were paid for damage caused by cormorants (289 870 th. CZK), otters (146 660 th. CZK), beavers (76 917 th. CZK), wolves (9 134 th. CZK), lynxes (1 566 th. CZK) and bears (811 th. CZK). The most abundant animals in this period were cormorants, otters and beavers, followed by lynx and wolves. The abundance of moose in the Czech Republic tends to decrease, while the abundance of bears has been slightly increasing recently. During this period, the populations of otter, beaver and lynx are increasing relatively steadily increases. The abundance of wolves has been increasing significantly since 2015. The amount of compensation for damage caused by cormorants varies considerably over time. A similar observation was made by Schwerdtner and Gruber (2007), who conclude that damage varies over the time depending on the number of migrating animals, but in our case the increased number of cormorants does not necessarily seem to lead to an increase in compensation payments, as it they may not be related to changes or decreases in damages but to changes in protection status and thus to changes in compensation for damages.

The correlation coefficient *r* shows a high statistical dependence between the development of populations and the development of compensation payments for wolves (r = 0.999) and otters (r = 0.921), a medium-high dependence for lynx (r = 0.616) and bears (r = 0.557). For moose, the statistical relationship between the occurrence of the species and the damages paid is low, for beavers and cormorants it is negative. However, this does not necessarily mean that there is no relationship between damages and the population numbers of these species, but may be influenced by unreported damages, non-recognition by the authorities, changes in the management of entitlements, changes in protection status (cormorant), etc.

The regression analysis from the available data on the development of abundance of species in Czech Republic and the development of compensation for damage caused by them, including the prediction of damage, is presented in Figures 1, 2 and 3.

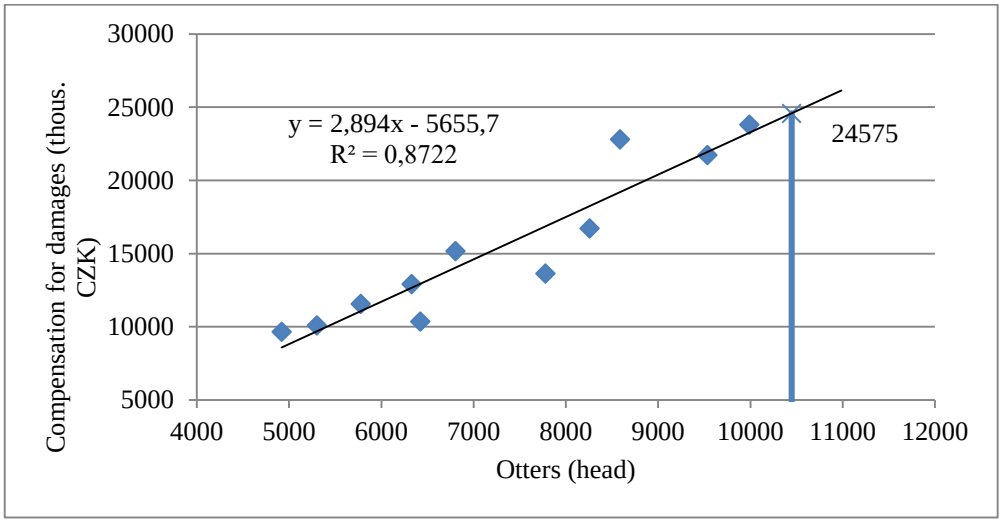
Figure 1 The relationship between the wolf population and compensation for damage caused by them



Source: Own processing based on the data obtained from ČSÚ and Ministry of Finance

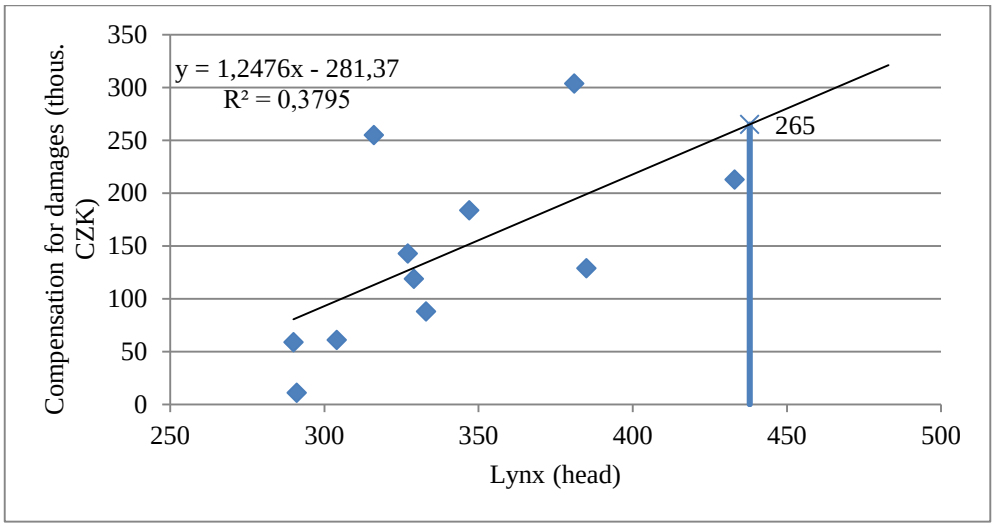
At the current level of compensation for damage caused by wolves, an increase in the number of wolves by one would increase compensation for damage by CZK 15,448 per year (Fig. 1). An increase in the number of otters by one piece increases the damages by CZK 2,894 per year (Fig. 2). In the case of the lynx (Fig. 3), an increase in the population by 1 head increases the damage compensation by CZK 1,248 per year. This model for wolf development was presented at a conference (Lososová et al., 2018) with an accuracy of 96.5 % and according to it, compensation for 2021 would increase by 46 % for wolves, 3 % for otters and 24 % for lynx compared to the previous year.

Figure 2 The relationship between the otter population and compensation for damage caused by them



Source: Own processing based on the data obtained from ČSÚ and Ministry of Finance

Figure 3 The relationship between the lynx population and compensation for damage caused by them



Source: Own processing based on the data obtained from ČSÚ and Ministry of Finance

4 Conclusions

For wolves and otters, a statistically strong relationship was found between population development and compensation payments, for lynx and bears a medium one, for moose a low relationship and for beavers and cormorants a negative one. Taking into account the relationship between populations and damage caused, we predict that compensation payments for 2021 would increase by almost half compared to the previous year for wolves, by a quarter for lynx and by only 3 % for otters. As the wolf population increases, harmful events with damage caused by them may occur more frequently, which may be associated with a growing negative attitude of the farmers and other people towards wolves. On the other hand, since the moose population is small, and rather declining, the damage caused by these animals is negligible and there are harmful events compensated in the last three years. In the case of bears, however, the damage costs can increase considerably if it is a conflict individual that learns to approach human dwellings, and it is questionable whether it is still a wild animal in such a case. Of course, such individuals can also occur among wolves.

Acknowledgement

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References

Bombieri, G., del Mar Delgado, M., Russo, L. F., Garrote, P. J., López-Bao, J. V., Fedriani, J. M., & Penteriani, V. (2018). Patterns of wild carnivore attacks on humans in urban areas. *Scientific Reports*, 8, 17728. doi: 10.1038/s41598-018-36034-7.

Buchmann-Duck, J., & Beazley, K. F. (2020). An urgent call for circular economy advocates to acknowledge its limitations in conserving biodiversity. *Science of The Total Environment*, 727, 138602. 10.1016/j.scitotenv.2020.138602.

ČSÚ (2021). Základní údaje o honitbách, stavu a lovu zvěře - od 1. 4. 2020 do 31. 3. 2021. [Online]. Available at: https://www.czso.cz/csu/czso/zakladni-udaje-o-honitbach-stavu-a-lovu-zvere-od-1-4-2020-do-31-3-2021 [Accessed: 29-09-2021]

Damohorský, M (2019). Protection of Charismatic Megafauna in the Law of Central European Countries. *Journal of International Wildlife Law & Policy*, 22(2), 159–172. doi: 10.1080/13880292.2019.1639289.

Fardell, L. L., Pavey, C. R., & Dickman, C. R. (2020). Fear and stressing in predator-prey ekology: considering the twin stressors of predators and people on mammals. *PeerJ*, 8, e9104. doi: 10.7717/peerj.9104.

Gese, E. M., Hart, J. P., & Terletzy, P. A. (2021), Gray Wolves. Wildlife Management Technical Series. Colorado: USDA, APHIS, WS National Wildlife Research Center.

Hariohay, K. M., Munuo, W. A., & Røskaft, E. (2020). Human–elephant interactions in areas surrounding the Rungwa, Kizigo, and Muhesi Game Reserves, central Tanzania. *Oryx*, 54(5), 612-620. doi: 10.1017/S003060531800128X.

Kojola, I., Hallikainen, V., Helle, T., & Swenson, J. E. (2018). Can only poorer European countries afford large carnivores? *Plos One*, 13(4), e0194711. doi: 10.1371/journal.pone.0194711.

López-Bao, J. V., Bruskotter, J., & Chapron, G. (2017).Finding space for large carnivores. *Nature Ecology & Evolution*, 1, 0140. doi: 10.1038/s41559-017-0140.

Lososová, J., Kouřilová, J., & Dohnalová, A. (2018). Assessment of Role and Efficiency of Subsidies Using an Example of Livestock Breeding and Selected Predator Type. In: *12th International Conference INPROFORUM 2018: Innovations*, Enterprises, Regions and Management, 223-230, ISBN 978-80-7394-726-2.

Miller, J. R. B., & Schmitz, O. J. (2019). Landscape of fear and human-predator coexistence: Applying spatial predator-prey interaction theory to understand and reduce carnivore-livestock conflict. *Biological Conservation*, 236, 464-473. doi: 10.1016/j.biocon.2019.06.009.

Morehouse, A. T., & Boyce, M. S. (2017). Troublemaking carnivores: conflicts with humans in a diverse assemblage of large carnivores. *Ecology and Society*, 22(3), 4. doi: 10.5751/ES-09415-220304.

Myšiak, J., Schwerdtner, K., & Ring, I. (2004). Comparative analysis of the conflicts between carp pond farming and the protection of otters (*Lutra lutra*) in Upper Lusatia and South Bohemia. Leipzig: UFZ-Umweltforschungszentrum.

Naves, J., Ordiz, A., Fernández-Gil, A., Penteriani, V., del Mar Delgado, M., López-Bao, J. V., Revilla, E. & Delibes, M. (2018). Patterns of brown bear damages on apiaries and management recommendations in the Cantabrian Mountains, Spain. *PLoS ONE*, 13(11), e0206733. doi:10.1371/journal.pone.0206733.

Ravenelle, J., & Nyhus, P. J. (2017). Global patterns and trends in human-wildlife conflict compensation. *Conservation Biology*, 31(6), 1247-1256. doi: 10.1111/cobi.12948.

Schwerdtner, K., & Gruber, B. (2007). A conceptual framework for damage compensation schemes. *Biological Conservation*, 134(3), 354–360. doi:10.1016/j.biocon.2006.08.010.

Tikkunen, M., & Kojola, I. (2020). Does public information about wolf (*Canis lupus*) movements decrease wolf attacks on hunting dogs (*C. familiaris*)? *Nature Conservation*, 42, 33-49. doi: 10.3897/natureconservation.42.48314.

Widman, M., & Elofsson, K. (2018). Costs of Livestock Depredation by Large Carnivores in Sweden 2001 to 2013. *Ecological Economics*, 143, 188-198. doi: 10.1016/j.ecolecon.2017.07.008.

Widman, M., Steen, M., & Elofsson, K. (2019). Indirect costs of sheep depredation by large carnivores in Sweden. *Wildlife Society Bulletin*, 43(1), 53-61. doi: 10.1002/wsb.951.

Wilkinson, C. E., McInturff, A., Miller, J. R. B., Yovovich, V., Gaynor, K. M., Calhoun, K., Karandikar, H., Martin, J. V., Parker-Shames, P., Shawler, A., Van Scoyoc, A., & Brashares, J. S. (2020). An ecological Framework for contextualizing carnivore-livestock conflict. *Conservation Biology*, 34(4), 857-867. doi: 10.1111/cobi.13469.

Wolf, C., & Ripple, W. J. (2017). Range contractions of the world´s large carnivores. *Royal Society Open Science*, 4(7), 170052. doi:10.1098/rsos.170052.

Yoder, J. K. (2000). Damage abatement and compensation programs as incentives for wildlife management on private land. In Clark, L., Hone, J., Shivik, J. A., Watkins, R. A., Vercauteren K. C., & Yoder, J. K. (Eds.), *Human Conflicts with Wildlife: Economic Considerations – proceedings of the thirds NWRC special symposium* (pp. 17–28). Fort Collins: National Wildlife Research Center.

The impact of extension services and policies on cocoa productivity in the western region of Ghana

Michael Amponsah Odei[1]

Abstract: Cocoa production dominates the agriculture sector in Ghana and plays a crucial role in the domestic economy and the world economy. However, over the past decade cocoa production in Ghana has been baffled with low productivity prompting successive governments and stakeholders to come up with policies and initiatives to improve production. However, despite these numerous policies, Ghana continuous to have the lowest average yield in relation to international comparisons. This study used the Structural Equation Model (SEM) and data for this study was sourced from 90 cocoa farmers in Juaboso, Bia West and Bibiani districts in the Western region of Ghana using semi structured questionnaires and the simple random and purposive sampling techniques. The Structural Equation Model results have also demonstrated that the most significant factors (policies) affecting cocoa productivity in the study area were the fertilizer subsidies offered by the government and the extension services provided by the ministry of agriculture in collaboration with the Ghana COCOBOD. However, the CODAPEC mass spraying exercise didn't contribute significance to cocoa productivity.

Keywords: Cocoa production, COCOBOD, efficiency, Ghana, productivity, subsidies.

1 Introduction

Agricultural extension or agricultural advisory services plays an essential role in improving the agricultural sector and farmers livelihoods (Kwapong et al., 2020). Extension services facilitate increased productivity, food security and enhancing pro-poor economic growth (Birner et al., 2009; Walo, 2017). Agricultural advisory services are an indispensable element that provides market and non-market agents with requisite flows of information that can improve the welfare of farmers and other rural folks. Extension services provide farmers with new technologies and information leading to innovative farming. Enhanced agricultural productivity predominantly rests on how farmers approve new technologies and how swiftly they get rid of cultural changes (Fadzim et al. 2017).

Extension services provide periodic education to urban and rural clientele on finding corrective measures to agriculture using farmers' limited resources (Jones & Kondylis, 2018). Agricultural extension has three main dimensions; the first comprises the educational component, which entails behavioural changes in people's attitudes and beliefs (Sanga et al., 2013). Secondly, the economic dimension entails an increase in income of farmers through improved crop yield as well as better financial management, better food preservation techniques (Miyata et al., 2009), and lastly, the social dimension also includes enhanced health of the farmers, farmers cooperation development, leadership development, better mentoring and increased enthusiasm for personal development (Grumbach & Mold, 2009).

Furthermore, extension services are mediums of research and technology transfers between science and farmers (Danso-Abbeam et al., 2018). Cocoa research institutions liaise with extension agents by developing recommended packages for farmers and then extension agents transferring to smallholder farmers, through farm demonstrations and farm visits. They also offer advisory services to farmers through gathering and farm visits. These services usually involve smallholder farmers in the decision making and problem-solving and process thus ensuring the disseminating valuable knowledge and information (Quisumbing & Pandolfelli 2010; Lukuyu et al. 2012).

Numerous studies on the effects of advisory services on cocoa production (Binam et al., 2008; Nyagaka et al., 2010; Onumah et al., 2013) concluded that cocoa farmers who had regular extension contacts are probable to increase their productivity compared to those with no or limited access to extension services. The rest of this paper is structured as follows. In the methodology section the methods and sources of data are explained. The results and discussion section

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elaborate on the empirical results. The conclusions and implications section conclude this paper by summarizing the most important findings, discussing several implications for policymakers, governments and farmers.

2 Methods

Researchers have used the PLS SEM model in the study of cocoa production and productivity (Sefriadi et al. 2013; Abbey et al. 2016). The SEM uses path diagram for easy graphical visualization. The model was chosen because of its distribution-free assumption, the predictive focus and the explanatory model development approach for understanding the determinants of cocoa productivity (Kock & Hadaya 2018). SEM results provides standardized regression coefficients outcomes (path coefficients) therefore it can be used to model the relationships among latent variables. The model specification of the partial least square is given by Zawojska (2010) as

$$z_k = \beta_0^{(k)} + \sum \beta_i{}^{(k)} z_i + v_k \qquad (1)$$

Where:

z_k *= explained variable (yield kg/ha)*

$\beta_0^{(k)}$ *= constant term*

$\beta_i{}^{(k)}$ *= regression coefficient*

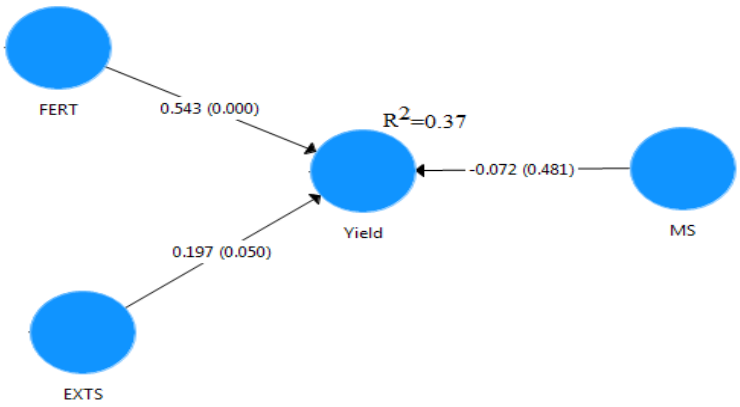
v_k *= residual term*

3 Research results

In pursuant to meeting objective of this study, which sought to examine the role of policies (e.g. such as the mass cocoa spraying and fertilizer policy) as well as extension services and their effects on cocoa productivity, the Structural Equation Model was used. The results of the analysis are shown below.

Table 1 Path coefficients

Variable relation-ships	Coefficients	Standard Er-rors	t- statistics	p-values	Remarks
MS=>yield	-0.072	0.106	0.680	0.481	insignificant
EXTS=>yield	0.197	0.107	1.846	0.050*	significant
FERT=>yield	0.543	0.132	4.121	0.000***	significant



Source: Own calculations

Legend: * p<0.05, ***p<0.001

In pursuant to meeting objective of this study, which sought to examine the role of policies (e.g. such as the mass cocoa spraying and fertilizer policy) as well as extension services and their effects on cocoa productivity, the Structural Equation Model was used. The results of the analysis are shown below.

The results show that the proposed model accurately predicts 37 % the influence of agricultural policies on cocoa productivity in the three cocoa districts of Ghana. The strongest determinant that that influenced overall cocoa productivity was the policy on fertilizer (β=0.543). This significantly influenced productivity. This was followed by the policy on extension services (β=0.197). Surprisingly, the policy that was targeted at reducing pets and diseases of the cocoa sector didn't influenced cocoa productivity. It rather had a negative influence on cocoa productivity in the three districts as can be seen by the negative coefficients (β=-0.072). The negative influence of this policy on cocoa output might be due to the frequency and the farmer's ability to sustain it themselves when that of the governments was not conducted at regular intervals. What this means is that farmers are still faced with the problem of low yields resulting from pest and disease infestation.

4 Conclusion

The focus of this paper was to examine how policies related to cocoa production such as fertilizer subsidization, CODAPEC mass spraying, and extension services policies affect cocoa productivity in the study districts. The cocoa sector is the bedrock of Ghana's agricultural sector, sustaining the economy. Cocoa is second to gold in foreign exchange earnings, contributing more than 50 % of Ghana's gross revenue from exports.

The study also observed that among all the three policies implemented to boost cocoa production in Ghana, fertilizer subsidization and the extension services provided to farmers were the key policies that influenced cocoa productivity in the three districts. However, the CODAPEC mass cocoa spraying program initiated by the government to curb diseases and pests in the cocoa sector rather had a negative effect on cocoa productivity in the study area.

Limitation of the study

This study narrowly focused on cocoa production in three districts in the Western region of Ghana. This Studies can be replicated in other cocoa growing regions to serve as a cross validation to verify and improve the findings of this study.

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References

Abbey, P., Tomlinson, P. R., & Branston, J. R. (2016). Perceptions of governance and social capital in Ghana's cocoa industry. *Journal of rural studies*, 44, 153-163.

Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., ... & Cohen, M. (2009). From best practice to best fit: a framework for designing and analyzing pluralistic agricultural advisory services worldwide. *Journal of agricultural education and extension*, *15*(4), 341-355.

Danso-Abbeam, G., Ehiakpor, D. S., & Aidoo, R. (2018). Agricultural extension and its effects on farm productivity and income: insight from Northern Ghana. *Agriculture & Food Security*, *7*(1), 1-10.

Fadzim, W. R., Aziz, M. I. A., & Jalil, A. Z. A. (2017). Determinants of Technical Efficiency of Cocoa Farmers in Malaysia. *International Journal of Supply Chain Management*, *6*(1), 254.

Grumbach, K., & Mold, J. W. (2009). A health care cooperative extension service: transforming primary care and community health. *JAMA*, *301*(24), 2589-2591.

Jones, M., & Kondylis, F. (2018). Does feedback matter? Evidence from agricultural services. *Journal of Development Economics*, *131*, 28-41.

Kwapong, N. A., Ankrah, D. A., Boateng-Gyambiby, D., Asenso-Agyemang, J., & Fening, L. O. (2020). Assessment of agricultural advisory messages from farmer-To-farmer in making a case for scaling up production: A qualitative study. *The Qualitative Report*, *25*(8), 2011-2025.

Lukuyu, B., Place, F., Franzel, S., & Kiptot, E. (2012). Disseminating improved practices: are volunteer farmer trainers effective? *The Journal of Agricultural Education and Extension*, *18*(5), 525-540.

Miyata, S., Minot, N., & Hu, D. (2009). Impact of contract farming on income: linking small farmers, packers, and supermarkets in China. *World development*, *37*(11), 1781-1790.

Nyagaka, D. O., Obare, G. A., Omiti, J. M., & Nguyo, W. (2010). Technical efficiency in resource use: Evidence from smallholder Irish potato farmers in Nyandarua North District, Kenya. *African Journal of Agricultural Research*, *5*(11), 1179-1186.

Onumah, J. A., Al-Hassan, R. M., & Onumah, E. E. (2013). Productivity and technical efficiency of cocoa production in Eastern Ghana. *Journal of Economics and Sustainable Development*, *4*(4), 106-117.

Quisumbing, A. R., & Pandolfelli, L. (2010). Promising approaches to address the needs of poor female farmers: Resources, constraints, and interventions. *World Development*, *38*(4), 581-592.

Sanga, C., Kalungwizi, V. J., & Msuya, C. P. (2013). Building an agricultural extension services system supported by ICTs in Tanzania: Progress made, Challenges remain. *International Journal of Education and Development using Information and Communication Technology*, *9*(1), 80-99.

Sefriadi H, Villano R, Fleming E, Patrick I. 2013. Production constraints and their causes in the cacao industry in West Sumatra: from the farmers' perspective. *International Journal of Agricultural Management*, 3: 30-42.

Walo, M. T. (2017). Unpacking Local Economic Development: A Case Study from Nekemte Town and Its Hinterlands, Oromia, Ethiopia. *International Journal of Public Administration*, *40*(12), 1000-1012.

Zawojska A. 2010. Determinants of farmers' trust in government agricultural agencies in Poland. *Agricultural Economics*, 56: 266-283.

The impact of the application of the CAP on the market environment and the formation of the commodity vertical of sugar and sugar beet in the agricultural market

Martin Vaněk[1], Věra Bečvářová[2]

Abstract: The paper deals with the impact of measures of the Common Agricultural Policy (CAP), namely the Common Organization of the Sugar Market (CMO), which regulated the production of sugar quotas and sugar production in the Member States of the European Union (EU). The key reform step of the CMO was to end sugar quotas, originally by 2015, practically from 2017, when EU countries are no longer restricted in sugar production. Based on the performed analyzes and comparisons, the consequences of these measures and their influence on individual phases of this commodity vertical are characterized. Within the compared period 2005 - 2019, the different impact of individual reforms in selected countries and the effect of quota termination are also specified.

Keywords: sugar beet, sugar, Common agricultural policy, Common organization of sugar market, sugar reform.
JEL Classification: Q10, Q18

1 Introduction

The European Union (EU) has consistently been one of the key producers of beet sugar and currently accounts for 50 % of total sugar beet production. In the final scale, sugar beet accounts for 20 % of total sugar production, the rest being sugar cane production.

The development of the business environment, market conditions and achieved results for commodities of sugar and sugar beet within the EU is monitored on the basis of the Common Organization of the Sugar Market CMO (European Commision, 2021).

The application of the CMO as one of the key strategies of the EU in the agricultural sector, which regulated the sugar market and thus directly influenced sugar beet production since 1968, responded to the development and changes of the business environment. The main goal was to ensure a fair income for European growers and to protect them from cheap imports from third countries. The main elements of these regulations were mainly market interventions in the form of import quotas, customs duties, intervention prices, quotas, etc. (European Commision, 2021).

One of the key CMO reforms entered into force in 2006. This reform aimed to effectively curb the growth of overproduction, increase the competitiveness of European growers, while reducing overall sugar production. The specific measures were a reduction in the minimum purchase price for sugar beet, a reduction in the reference price for sugar and, as the most significant element, a reduction in the quantitative quotas for sugar production. The reform itself was announced for the period from 1 July 2006 to 30 September 2015, but the most important changes in the form of a reduction in sugar production by 6 million tonnes, ie by approximately 27 %, were to be implemented by 30 June 2010 by compensatory payments paid per tonne of quota surrendered. Compensation payments had 3 price levels, the highest being at the beginning of the reform and gradually decreasing. Increased pressure on competitiveness led to a clear decline in all phases of this vertical (decrease in the number of farmers growing sugar beet, decrease in acreage, decrease in the number of sugar factories), when uncompetitive growers and sugar factories stopped growing sugar beet, hence sugar production. (Krouský, 2008). Šustrová (2014) adds that the adoption of the reform in 2006 was a conclusion derived from the decision of the World Trade Organization (WTO), which stated that the set subsidy system is in conflict with international trade rules and the EU must reconsider its policy on this commodity.

The end of the sugar quotas was to enter into force with the end of the 2006 reform, ie from 2015, when the sugar market was to be liberalized. Based on difficult negotiations, the European Commission finally decided to end the sugar

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quotas on 30 September 2017. After more than 49 years, the conditions for free trade in sugar were created (Ministerstvo zemědělství, 2017).

The aim of the paper is therefore to evaluate how the measures taken by the CMO have been reflected in the development of the business environment, as reflected in the specific response in securing production in terms of dimension of sugar beet production and subsequent processing specific EU Member States.

2 Methods

The paper deals with the evaluation of the impact of the Common Agricultural Policy on the commodity vertical of sugar and sugar beet, which was regulated until 2017 by measures intervening in the market under the CMO Regulation, its specific effects on the development of sugar beet areas and white sugar production in the individual Member States and thus the position on the sugar market.

The analysis compared selected basic indicators of individual phases of this commodity vertical in the period 2005-2019 in ten Member States, which were among the largest sugar producers in the European Union in 2015. The evaluation of indicators is based on basic indices, when the starting year is 2015. For analysis and evaluation, this year was chosen as the starting point due to the fact that the individual vertical entities in the Member States have long known about the end of regulations on the sugar market by this year. In practice, the regulation was terminated on the 30th of September 2017, but due to the fact that the sugar beet harvest and subsequent sugar production take place mainly during autumn and winter, the data from the period when the end of the harvest would be captured within one year would be distorted with the regulations in force and the start of a new harvest already in a liberal environment.

3 Research results

3.1 Development of sown areas of sugar beet

The sown area was chosen as a basic indicator, on the basis of which it is possible to assess the importance of the commodity, here specifically sugar beet, in the agricultural primary production of individual countries. As the acreage cannot be compared for different countries, table 1 specifies the development of sown areas using a basic index, which allows to show what change occurred in the acreage of sugar beet compared to the established base year 2015 in the individual compared countries.

Table 1 Development of sown areas of sugar beet in selected countries according to the basic index (2015 = 1)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Belgium	-	-	-	-	1,20	-	1,19	1,17	1,14	1,12	1,00	1,06	1,19	1,20	1,10
Czech Republic	1,14	1,06	0,94	0,87	0,91	0,98	1,01	1,06	1,08	1,09	1,00	1,05	1,15	1,12	1,03
Germany	1,34	1,14	1,29	1,18	1,23	1,16	1,27	1,29	1,14	1,19	1,00	1,07	1,30	1,32	1,31
Spain	2,71	2,27	1,81	1,39	1,32	1,15	1,19	1,04	0,85	1,02	1,00	0,87	0,98	0,94	0,80
France	0,98	0,98	1,02	0,91	0,97	1,00	1,02	0,99	1,02	1,06	1,00	1,05	1,26	1,26	1,16
Italy	6,64	2,39	2,25	1,62	1,59	1,64	1,63	1,19	1,07	1,36	1,00	0,85	1,00	0,90	0,79
Netherlands	1,56	1,40	1,41	1,24	1,24	1,21	1,26	1,25	1,25	1,28	1,00	1,21	1,46	1,46	1,36
Austria	0,97	0,87	0,93	0,95	0,97	0,99	1,03	1,08	1,12	1,11	1,00	0,96	0,94	0,69	0,61
Poland	1,59	1,45	1,37	1,04	1,11	1,15	1,13	1,18	1,08	1,10	1,00	1,13	1,29	1,33	1,34
England	1,65	1,45	1,39	1,33	1,27	1,31	1,26	1,33	1,30	1,29	1,00	0,96	1,23	1,27	1,20

Source: Eurostat, own processing

Based on the analysis of the development according to the above data of table 1, we can determine two key periods that significantly affected the size of the sown area of sugar beet in individual countries. In most countries, except France and Austria, the values of the basic index are higher before 2015. The values of the basic index generally have a slightly decreasing tendency. In terms of the level of the index and its decline in the period 2005-2010, the development is particularly marked in Spain and Italy. The declining trend in most countries is due to the application of sugar quotas for sugar production since 2006 and at the same time the EU's goal of reducing sugar production by 2010. The already mentioned Italy and Spain have made significant use of sugar quota specifically reflected in a significant decrease in the values of the basic index. Another factor was the gradual reduction of the minimum purchase price of sugar beet by 2015. By 2015, the minimum purchase prices were to end and for less efficient growers, this commodity may no longer be financially interesting.

The difficult negotiations and the resulting uncertainty with the situation after 2015 mostly led to the stagnation of acreage before the key year 2015. On the other hand, the postponement of the end of quotas and the setting of a fixed deadline in most countries resulted in a slight increase in sown areas, as farmers tried to prepare their production for a liberal market environment.

Since the end of regulation based on sugar quotas in 2017, we can see rather stagnation in the acreage of sown areas in most Member States. There is again a more significant decline, especially in Italy and Spain, which may be due to inefficient production of local growers who were unable to accept the fall in prices that occurred after 2017. The decline in the case of Austria is mainly due to its orientation towards involvement in subsequent phases of the commodity vertical.

Some distortions about possible declines in sown areas, in response to sugar quotas and reductions in support, may also be due to a shift in the focus of sales of those growers who have started selling sugar beets to distilleries for the production of bio-alcohol, which is supported as biofuel.

3.2 Development of sugar production

The 2006 reform also directly affected sugar production, as a certain amount of quota sugar could be sold on the EU internal market and was subject to a guaranteed minimum purchase price. If a sugar factory wanted to produce more sugar than the quota allocated to it, that sugar had to be placed outside the internal market, where, however, the price was often lower than on the internal market.

The specific situation is documented in table 2, which shows a basic index showing the development of sugar production (including out-of-quota production). Within the evaluation according to the table, we can see year-on-year fluctuations in most countries in the period 2005/2006 - 2009/2010, which were caused both by the surrender of sugar quotas, but also by the possibility of their repurchase. A typical example of a repurchase is the Czech Republic, where the British company Eastern Sugar surrendered a sugar quota using compensatory payments, but the Czech Republic repurchased part of the quota again (2007 / 2008-2008 / 2009). Again, a significant decrease related to the use of compensatory payments is for Italy and Spain, which have decided to abandon sugar production. The stabilization in sugar production occurred after 2010, when the possibility to surrender the sugar quota using the compensatory payment ended. Fluctuations after this year are rather related to the changing amount of out-of-quota sugar.

Table 2 Development of the basic index of sugar production incl. non-quota in selected EU countries (2015 = 1) according to the sugar campaign in individual years

	2005/ 2006	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020
Bel- gium	1,15	1,07	1,09	0,90	1,03	0,94	1,06	0,95	0,98	0,99	1,00	0,96	1,22	1,03	0,99
Czech Repub- lic	1,10	0,93	0,70	0,82	0,94	0,91	1,20	1,13	1,03	1,09	1,00	1,20	1,29	1,13	1,03
Ger- many	1,11	0,89	1,07	1,00	1,13	1,00	1,08	1,10	1,00	1,03	1,00	1,04	1,41	1,16	1,18
Spain	2,12	2,01	1,39	1,19	1,07	1,04	1,17	1,02	0,94	1,03	1,00	1,20	1,08	0,77	0,80
France	0,88	0,88	0,95	0,87	1,05	0,96	1,09	1,00	0,98	1,04	1,00	1,02	1,33	1,08	1,06
Italy	3,55	1,29	1,32	0,98	1,00	1,03	1,01	1,03	1,00	1,11	1,00	1,00	0,60	0,43	0,36
Nether- lands	1,05	0,94	0,96	0,93	1,05	0,96	1,06	1,06	1,00	1,00	1,00	0,97	1,42	1,19	1,18
Austria	1,20	1,00	0,90	1,01	0,95	1,09	1,34	1,15	1,19	0,96	1,00	1,20	1,16	0,80	0,74
Poland	1,24	1,03	1,16	0,84	0,99	0,89	1,11	1,10	1,03	1,03	1,00	1,24	1,40	1,32	1,25
England	1,18	1,02	0,93	1,01	1,16	0,98	1,11	1,04	1,13	1,07	1,00	0,96	1,20	1,01	1,05

Source: Eurostat, Faostat, own processing

A comparison of the data in table 2 shows that the originally expected end of sugar quotas in 2015 did not have a significant effect on the amount of sugar produced. For some countries, we can already see a slight increase before the key year of 2017, which can be attributed to certain preparations related to the preparation for the transition to the market environment, when Member States will no longer be limited in their sugar production.

In most countries, however, a year-on-year increase can be seen in 2017/2018, which is undoubtedly a reaction to the end of sugar quotas. For the largest sugar producers such as France, Germany, Poland, an increase of 0.26-0.37 basis

points is recorded. The liberalization of the sugar market has allowed sugar factories in the Member States to produce unlimited quantities of sugar, but the internal market has not been able to find use for such quantities of sugar.

Due to the world sugar surplus, where the world price of sugar was lower than in the EU internal market, there was again a significant overproduction of sugar, which was reflected in the fall in agricultural producer sugar prices (see Chapter 3.3 below). A significant drop in world and domestic sugar prices led to a reduction in sugar production again in the following years, as sugar factories were not able to accept such low prices in the long run, especially in terms of production costs.

However, in most countries, the increase in production was so marked that sugar production alone was higher than before 2006, when there was a significant reduction due to the introduction of sugar quotas. There has been a different development since the end of quotas in Spain and Italy, which, unlike other countries, did not increase their production by 2017, but instead reduced their sugar production by 0.12-0.4 basis points year-on-year. One factor may be the low competitiveness of local sugar factories, which have not been able to cope with the pressure on the price level that the transition to a market environment has brought.

3.3 Agricultural and industrial producer prices

In terms of the development of the agricultural producer price for sugar beet, table 3 shows that in virtually all countries the price decreased in 2006 as a result of the reform. However, despite this reduction, the reform provided farmers with a guaranteed income in the form of minimum purchase prices for sugar beet. Their amount has been gradually reduced in order to increase the competitiveness of European sugar beet growers. The set minimum purchase prices ended in 2017, together with the abolition of sugar quotas. As can be seen from the development of the basic index values shown in table 3, the decrease in the price and the decrease in the production of sugar produced a positive effect, which was reflected in the stabilization of the price or its slight increase.

The very end of quotas in 2017 caused an increase in the price of agricultural producers, but due to the overproduction of sugar, as shown in table 3, it is subsequently reduced. Nevertheless, based on a comparison of basic indices, it can be stated that in most countries, with the exception of Spain, Italy and Austria, prices did not fall below the values from 2015, when farmers were still guaranteed minimum purchase prices for sugar beet.

Table 3 Development of the price of sugar beet of agricultural producers expressed by the basic index for selected EU countries (2015 = 1)

	2005/ 2006	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020
Belgium	1,15	1,07	1,09	0,90	1,03	0,94	1,06	0,95	0,98	0,99	1,00	0,96	1,22	1,03	0,99
Czech Repub-lic	1,10	0,93	0,70	0,82	0,94	0,91	1,20	1,13	1,03	1,09	1,00	1,20	1,29	1,13	1,03
Ger-many	1,11	0,89	1,07	1,00	1,13	1,00	1,08	1,10	1,00	1,03	1,00	1,04	1,41	1,16	1,18
Spain	2,12	2,01	1,39	1,19	1,07	1,04	1,17	1,02	0,94	1,03	1,00	1,20	1,08	0,77	0,80
France	0,88	0,88	0,95	0,87	1,05	0,96	1,09	1,00	0,98	1,04	1,00	1,02	1,33	1,08	1,06
Italy	3,55	1,29	1,32	0,98	1,00	1,03	1,01	1,03	1,00	1,11	1,00	1,00	0,60	0,43	0,36
Nether-lands	1,05	0,94	0,96	0,93	1,05	0,96	1,06	1,06	1,00	1,00	1,00	0,97	1,42	1,19	1,18
Austria	1,20	1,00	0,90	1,01	0,95	1,09	1,34	1,15	1,19	0,96	1,00	1,20	1,16	0,80	0,74
Poland	1,24	1,03	1,16	0,84	0,99	0,89	1,11	1,10	1,03	1,03	1,00	1,24	1,40	1,32	1,25
England	1,18	1,02	0,93	1,01	1,16	0,98	1,11	1,04	1,13	1,07	1,00	0,96	1,20	1,01	1,05

Source: Eurostat, own processing

It is indisputable that sugar beet is a beneficial commodity in terms of the sustainability of soil fertility, of which the individual states are aware. Therefore, some Member States have made use of the possibility to pay so-called voluntary coupled production aid (VCS) for sugar beet, which is a financial amount paid per hectare of sugar beet Prior to the payment of the VCS, a transitional national aid (Top-Up) was paid. Pulkrábek (2007) has a similar opinion, stating that the Top-Up payment has a positive impact on the economy of sugar beet growing.

The Czech Republic, Italy, Spain and Poland have made use of this opportunity from these countries. A common feature of these states is the provision of subsidies in the form of a single area payment scheme (SAPS). None of the countries paying this basic support used the form of the farm payment scheme (SPS).

The comparison of industrial sugar producer prices in table 4 had to be simplified due to the unavailability of data from the available national databases. On the other hand, finding prices through national national statistics could lead to some distortion of the situation due to different methodologies. Until 2016, the prices presented by the European Commission are presented as the overall average within the EU. This way of evaluating the data may to some extent be due to the established minimum purchase price of sugar, which guaranteed the lowest price level for industrial producers. Then it depended on the demand how much it was willing to pay for the price of sugar. With the end of quotas, sugar prices are assessed on the basis of three regions, with region 1 being the countries of Central and Northern Europe (Austria, the Czech Republic, Poland) and region 2 being the countries of Western Europe and the Benelux (Belgium, France, Germany, England and the Netherlands)., region 3 is composed of southern European countries (Spain, Italy).

Table 4 Development of the price of industrial producers of white sugar (crystal sugar) expressed by the basic index for selected EU countries (2015 = 1)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Belgium	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,97	0,82	0,74
Czech Republic	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,98	0,84	0,79
Germany	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,97	0,82	0,74
Spain	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	1,08	0,92	0,91
France	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,97	0,82	0,74
Italy	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	1,08	0,92	0,91
Netherlands	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,97	0,82	0,74
Austria	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,98	0,84	0,79
Poland	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,98	0,84	0,79
England	-	1,51	1,48	1,42	1,3	1,15	1,34	1,69	1,67	1,28	1	1,06	0,97	0,82	0,74

Source: European Commission, own processing

The 2006 reform essentially increased the price of agricultural producers due to a relatively high minimum purchase price, which fell over time to € 404 per tonne of sugar in 2009. The declining trend is also confirmed by the declining base indices in table 4. Since 2010, there have been large year-on-year fluctuations, which are largely related to rising input costs for sugar production and sugar production in other regions.

The key end of sugar quotas has led to an increase in the sown area of sugar beet and sugar production, as tables 1 and 2 document. However, this increase in production had a significant negative effect on industrial sugar producer prices. Their price is gradually declining and according to the given regions it is a difference of 0.09 - 0.26 basis points compared to 2015. Industrial producers are therefore forced to optimize their costs in the current conditions to withstand the liberal environment for which they should prepare aid through minimum purchase prices.

4 Conclusions

Sugar beet is an integral part of European agriculture, together with subsequent processing for the production of sugar in sugar factories and ensuring its sale. In order to avoid overproduction of sugar, which could cause a significant drop in prices within the sugar beet and sugar vertical, market measures were introduced in 2006 through the CMO to prevent this situation. At the same time, the reform aimed to increase the competitiveness of European sugar beet growers and sugar producers on the world market, which is also key to maintaining competitiveness with other sugar beet and sugar producers after the planned end of sugar quotas by 2015.

The very end of quotas and other market measures came into force in 2017. The transition to a liberal environment has led to an increase in sown areas and sugar production itself to higher levels than before 2006. Analyzes show that a jump in production without a proportional increase consumption caused with a one-year lag the fall in prices in 2018, which deepened even further in 2019, when the price of sugar fell significantly below 2015 prices.

The comparison shows that the more significantly affected part of this commodity vertical are industrial processors, who are forced to face a significant drop in prices, to which they respond by a slight decline in production, but rather by reducing production costs, including the closure of unprofitable operations. The sugar industry seeks to maintain the production dimension in order to maintain a market position that would be replaced by another processor in this highly competitive environment.

The development is somewhat different in the case of agricultural producers, where the sown areas practically did not fall in most countries and the price of agricultural producers did not fall below the price of sugar beet in 2015. It can be concluded that growers are better able to cope European budget resp. within the framework of national subsidies, which can partially compensate them for the fall in prices, but above all through the growth of yields and thus the efficiency of production of this commodity.

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References

European Commission. (n.d.). *Cukr*. https://ec.europa.eu/info/food-farming-fisheries/plants-and-plant-products/plant-products/sugar_en

European Commission. (2004, 1. July). EU sugar sector: Facts and figures. https://ec.europa.eu/commission/presscorner/detail/en/MEMO_04_177

Eurostat (n.d.). *Database.* https://ec.europa.eu/eurostat/data/database

Faostat (n.d.) *Crops and livestock products*. http://www.fao.org/faostat/en/#data/QCL

Krouský, J.(2008). Cukerní reforma je jednou z etap vývoje řepařství. *Listy cukrovarnické a řepařské*, 124(7-8), 191-195

Ministerstvo zemědělství (2017, 15. září). *V Evropské unii končí výrobní kvóty cukru, české cukrovary patří mezi evropskou špičku*. http://eagri.cz/public/web/mze/tiskovy-servis/tiskove-zpravy/x2017_v-evropske-unii-konci-vyrobni-kvoty.html

Pulkrábek, J., Kavka, M., Rataj, V., Humpál, J., Nozdrovický, L., Trávníček, Z., Pačuta, V. (2012). The assessment of the economic risks level of sugar beet growing for the farm economy. *Agricultural Economics-Czech*, 58(7), 41-48. https://doi.org/10.17221/111/2010-AGRICECON

Šustrová, M. (2014). Vývoj systému společné organizace trhu s cukrem v EU od roku 1968 po současnost. *Listy cukrovarnické a řepařské*, 130(7-8), 231-234

Price Transmission in the Ukrainian Meat Market

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Abstract: Meat production is one of the essential parts of the Ukrainian agricultural sector. At the beginning of the 90s, Ukraine was one of the biggest meat producers in Eastern Europe. However, after the fall of the Soviet Union planning economy and the privatisation processes, the Ukrainian meat sector has experienced drastic changes. The concentration among meat processors and retailers has increased substantially during the last decade. Therefore, investigating how this meat sector transformation influenced the competitive environment within the meat supply chains is crucial. One of the ways to examine this phenomenon is to analyse the transmission of prices through the supply chains. To do so, we use monthly price series of beef, pork and poultry producers and consumers from 2013 till 2020. We employ the Threshold Autoregressive, Momentum-Threshold Autoregressive and Vector Error Correction models. The results of our analysis suggest that there is not enough evidence to conclude the presence of price transmission asymmetries in any of the examined supply chains, even though the test statistics for pork and poultry lie close to the 10% significance level. Furthermore, we found limited evidence that retailers in Ukrainian meat supply chains might exercise market power towards food producers and processors. These findings should be further investigated and verified by the subsequent research.

Keywords: Market Power, Food Supply Chain, Bargaining Power, Price Asymmetries
JEL Classification: D43, L13, L16, L66

1 Introduction

The research of price transmission mechanism has a long history in the economic literature and has drawn much attention of scholars during the last few decades. During this time, considerable literature was devoted to the research of price transmission in agricultural food markets (see the recent meta-analysis of Kouyaté and Cramon-Taubadel (2016) with 492 unique studies using "price transmission" as a search word). The price transmission mechanism can be horizontal (among various markets) and vertical (along the supply chain). Studying price transmission in food supply chains is of crucial importance. First of all, the speed and magnitude of price adjustment of price pass-through are vital indicators of the overall functioning of the food supply chain. Moreover, price transmission asymmetries may indicate the presence of unfair trading practices (UTPs) or/and market power (MP) abuse in the particular supply chain. In the recent survey of 23 OECD countries, OECD (2015) reports that price transmission and its link to UTPs gained high priority in most countries.

Furthermore, price transmission is considered as one of the fundamental mechanisms governing the inflationary process, particularly important within agricultural supply chains since food inflation is one of the most volatile elements of general inflation (Leibtag, 2009).

Finally, an extensive body of empirical literature on the price transmission process primarily focuses on the U.S. and European agricultural and food sectors. However, there is relatively scarce evidence from developing countries, which might bias the literature and distort the understanding of market power and price transmission mechanisms. As it is mentioned by Deconinck, (2021) in his review of price transmission literature: "… not all sectors and regions have been equally well-represented in the empirical literature to date. Even if there is little evidence of systematic and widespread competition problems, important competition issues may still exist in specific markets."

We aim to fill this gap and contribute to the up-to-date literature with the analysis of price transmission between the meat processing industry and consumer (retailer) prices in Ukraine. It is essential to pay attention to the price transmission mechanism in the Ukrainian meat sector, as imperfect competition is remarkably relevant in this case. First of all, there is some indication that the developing Eastern European countries are more predisposed to MP and UTPs than the developed countries (Deconinck, 2021, p. 18). Secondly, there have been numerous economic reforms and changes happening in Ukraine, particularly the rise of the sector's concentration. Since the beginning of the 90s, Ukraine has undergone a rapid market and trade liberalisation in the agricultural markets for meat and other food products. At the

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same time, there have been various cases of government interventions that directly affected the pricing and contributed to imperfect competition in that market. This process has contributed to the development of competitive relations in the agricultural and food markets. However, it should be noted that both private farms and agricultural enterprises created due to privatisation might have limited influence on the retailer's purchasing prices. On the other hand, during the last decade, the share of small farmers in the meat sector has decreased in favour of big enterprises. Thus, the concentration of this sector had increased considerably compared to the mid-90s (Perekhozhuk et al., 2011).

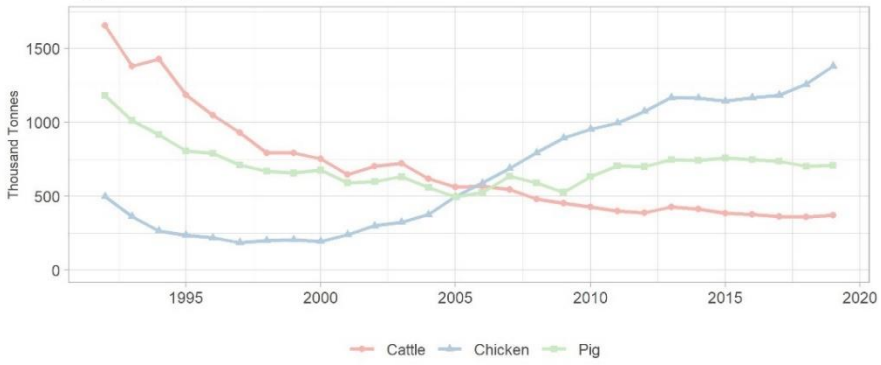
The paper is organised as follows. The following section encompasses the historical overview of liberalisation and privatisation processes and market developments in the Ukrainian meat sector. The third section briefly describes the data and the methodology used for the analysis of price transmission. In section four, we describe the results of our analysis. Finally, the conclusions are briefly presented in the last section.

The Evolution of Meat Supply Chains in Ukraine

Throughout the last 30 years, the meat sector in Ukraine has experienced drastic changes. Generally, the development of the Ukrainian meat market might be broken into two distinct stages. The first starts at the beginning of independence in 1992 to the mid-00s, when the industry underwent a dramatic transformation and the decline in production of most meat commodities. The second starts from the mid-00s and lasts until the current time. During the second period, the industry experienced a steady rise of consolidation and concentration with the decline of small farmers' share of production. In the 90s, during the transition from a centrally-planned to a market-oriented economy, the price formation of agricultural products and consumer goods was liberalised. This process ended the state regulation of meat production and the administrative establishment of prices and logistics policies. The next step to a market economy was privatising state and collective companies and processing enterprises. Privatisation put an end to state monopolies and gave birth to competitive relationships in the Ukrainian agricultural sector.

The production structure of meat products had also been shifting during the first decades of independence. In the 90s, because of high unemployment, thus many workers had to engage in some form of agricultural production. Therefore, in Ukraine two main kinds of agricultural entities have been formed: (1) agricultural enterprises that usually have ten or more heads of cattle or pigs, or more than 100 heads of poultry; (2) so-called family farms, with 1-3 heads of cattle or pigs, or up to 30 head of poultry which used most of their products for own consumption and sold the surpluses on the local market (Perekhozhuk et al., 2011).

Figure 1. Dynamics of Meat Production in Ukraine



Source: State Statistics Service of Ukraine

After 2005 the situation in the meat market began to change (see Figure 1). The production of poultry has grown markedly since the beginning of the early 2000s. Until 2020, poultry production reached a threefold increase compared to the beginning of the 90s. Such rapid growth of poultry production might be explained by the change of consumer preferences and the low purchasing power of the average Ukrainian consumer. However, with the rise of poultry production, it has become more concentrated among main agricultural holdings.

At the same time, beef and pork production did not experience such dramatic growth in the last 20 years. On the contrary, it can be said that beef and pork production levels have declined noticeably during the first 15 years of independence and have remained relatively stable throughout the last 15 years. However, the production volumes have also become more concentrated within large agricultural enterprises (Perekhozhuk et al., 2011).

Therefore, the rise of producer concentration in the Ukrainian meat market causes concerns about the possible presence of market power and unfair trading practices among meat processors or food retailers. We will analyse the price transmission between producer and consumer (retailers) prices to check this hypothesis.

2 Method and Data

In our work, we employ Threshold Autoregressive (TAR) models and Momentum-Threshold Autoregressive (M-TAR) models to explain the price transmission mechanism in meat supply chains in Ukraine. This methodology proposed by Enders and Siklos (2001) extends the Engle and Granger (1987) procedure. Equation 1 can describe the general TAR model:

$$\Delta\mu_t = I_t\rho_1\mu_{t-1} + (1 - I_t)\rho_2\mu_{t-1} + \sum_{i=1}^{p}\gamma_i\Delta\mu_{t-i} + v_t \quad (1)$$

The term I_t is an indicator variable defined by the following equation:

$$I_t = \begin{cases} 1 \; if \; \mu_{t-1} \geq \tau \\ 0 \; if \; \mu_{t-1} < \tau \end{cases} \quad (2)$$

where τ is a threshold value and, I_t is equal to 1 when μ_{t-1} is larger than the threshold value, otherwise it is equal to zero. The adjustment is modelled by $\rho_1\mu_{t-1}$, if μ_{t-1} is above the threshold and by the term $\rho_2\mu_{t-1}$, if μ_{t-1} if it is below the threshold.

The M-TAR model has a similar structure as the TAR in equation (1), but in M-TAR, the term μ_{t-1} in the equation (2) is replaced by its first differences $\Delta\mu_{t-1}$ as follows:

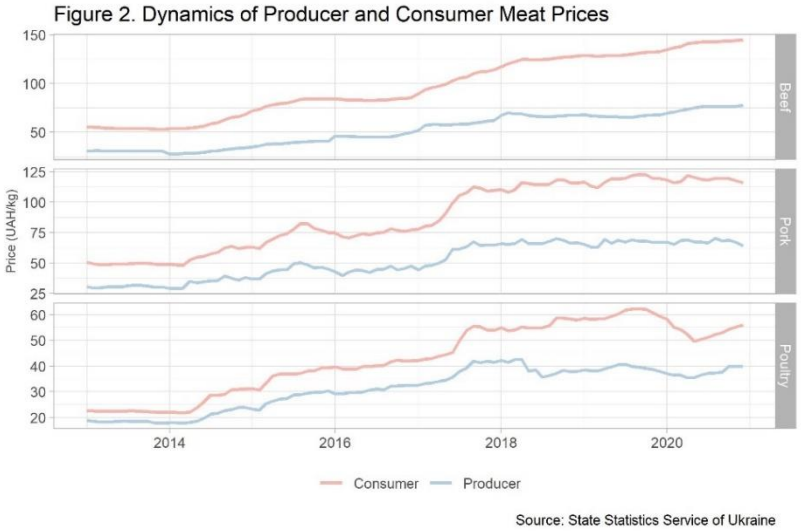
$$I_t = \begin{cases} 1 \; if \; \Delta\mu_{t-1} \geq \tau \\ 0 \; if \; \Delta\mu_{t-1} < \tau \end{cases} \quad (3)$$

Therefore, the main difference between TAR and M-TAR models is that the TAR model can capture a deep cycle process if, for example, the variation above the threshold level is more prolonged than below the threshold level. In contrast, the M-TAR is better suited for capturing sharp sequential movement and is especially valuable when the series exhibit more momentum in one direction than the other (Enders & Siklos, 2001). The threshold value $\boldsymbol{\tau}$ can be specified as zero, given that the regression deals with the residual series. Alternatively, Chan (1993) proposes a search method to obtain a consistent threshold value estimate. Researchers can get insights into the mechanism of the price adjustments in the context of a long-term cointegration relation with two tests. The first is the F-test, which is used to test the null hypothesis of no cointegration (*H0: ρ1=ρ2=0*) against the alternative of cointegration with either TAR or MTAR threshold adjustment. The second is a standard F-test to test the null hypothesis of symmetric adjustment in the long-term equilibrium (*H0: ρ1=ρ2*). Rejection of the null hypothesis in the first test indicates the presence of long term cointegration relation between variables, while the rejection of the null hypothesis in the second test indicates the existence of an asymmetric adjustment process.

If there is a cointegration relation between the variables, the Granger representation theorem (Engle and Granger, 1987) states that an error correction model can be estimated. When the null hypothesis of symmetric adjustment in the long-term equilibrium can be rejected, it is possible to estimate an asymmetric error correction model with/or without threshold cointegration. However, if there is no evidence for price transmission asymmetries, the asymmetric error correction model might produce biased results, so the symmetric error correction model should be used (Equation 4):

$$\Delta Y_t = \theta_Y + \delta_Y E_{t-1} + \sum_{j=1}^{J}\alpha_{Yj}\Delta X_{t-j} + \sum_{j=1}^{J}\beta_{Yj}\Delta Y_{t-j} + \vartheta_{Yt} \quad (4)$$

where ΔY_t is the dependent variable price in first difference; *t* indexes time; θ is an intercept; α and β are coefficients for each lag term for every used time-series prices; δ is the error correction term; *J* is the number of lags; and ϑ is a noise term. The maximum lag *J* is chosen with the AIC statistic and Ljung–Box Q test, so the residuals have no serial correlation.



The data for this study was collected from the State Statistic Service of Ukraine. Dataset can be described as monthly time series related to the producer and consumer (retailer) prices. Each time series consists of 96 observations; the sample period starts from January 2013 to December 2020. For this paper, we focused our attention on three types of meat products: poultry, beef, and pork, as they are the most popular and traditional among Ukrainian meat consumers. The graphical representation of the data can be seen in Figure 2. For the analysis, we used the *R* programming language (R Core Team, 2020), including the **"apt"** package developed by Sun, (2011).

3 Research results

Before starting our analysis, we used the augmented Dickey-Fuller test (Dickey and Fuller, 1979) to test all the price pairs for stationarity. All the original time series were found to be non-stationary. However, the Johansen two-step cointegration test (Johansen, 1991) revealed that pork prices have a long term cointegration relationship, while beef and poultry do not. Therefore, we took the first difference of beef and poultry price series, and the tests indicated that all variables become stationary in first differences and all product pairs become cointegrated. We do not report the stationarity and cointegration test out of brevity consideration; this data can be sent upon request.

As all the price pairs were cointegrated, we investigated possible asymmetric price adjustment between the upstream and downstream prices. The lags of the dependent variable were selected using the Akaike Information Criterion (AIC), and the threshold parameter τ for TAR and MTAR models was chosen via minimising the sum of squared errors, the procedure suggested by Chan (1993). Table 1 shows the results for the best fitting model based on the AIC value.

Table 1 Threshold cointegration test results.

	Model	Threshold	Lags	$\Phi(H_0: p_1 = p_2 = 0)$	$F(H_0: p_1 = p_2)$
Beef	cTAR	-0.01	1	21.77*** (0.000)	0.774 (0.381)
Pork	cMTAR	0.028	1	28.67*** (0.000)	2.49 (0.118)
Poultry	cTAR	-0.015	1	65.45*** (0.000)	2.03 (0.158)

*Note: *, **, *** denote significance at the 1%, 5% and 10% significance levels, with p-values in brackets.*
Source: Estimated by authors.

From Table 1, we can see that all of the price pairs are strongly cointegrated. At the same time, there is not enough evidence to conclude the presence of price transmission asymmetries in any of the analysed supply chains, even though the results for pork and poultry lie close to the 10% significance threshold. Since we observe strong evidence of a cointegration relationship between producer and consumer prices for beef, pork and poultry, we can estimate a vector error correction model for all these commodities (Table 2).

Table 2 Summary of Symmetric Error Correction Model

	Beef		Pork		Poultry	
	Consumer	Producer	Consumer	Producer	Consumer	Producer
(Intercept)	0	0	0.005**	0.006	0	0
$\beta cons_{t-1}$	-0.282***	-0.074	0.151	0.07	-0.293**	-0.226*
$\beta prod_{t-1}$	-0.011	-0.001	0.299***	0.224	0.248*	-0.021
δ	0.027	-0.913***	-0.161	-0.784***	-0.086	-1.011***
R^2	0.087	0.428	0.256	0.103	0.092	0.431
AIC	-577.438	-427.035	-428.265	-314.754	-402.212	-396.169
Q(4)	0.068	0.872	0.566	0.68	0.340	0.862
Q(8)	0.106	0.552	0.613	0.709	0.050	0.884
Q(12)	0.042	0.228	0.516	0.422	0.170	0.44

*Note: *, **, *** denote significance at the 1%, 5% and 10% significance levels;*
Q4 denotes the significance level for the Ljung–Box Q statistic; it tests serial correlation based on p autocorrelation coefficients (p = 4, 8, 12); δ represents the error correction term.
Source: Estimated by authors.

From Table 2, it can be seen that the Ljung–Box Q test statistic indicates no additional autocorrelation in the models' residuals. Moreover, the error correction term (δ), as the key variable of interest, is significant at the 1% level in at least one equation for each price pair indicating that prices are adjusting back to their long term equilibrium. The speed of adjustment is 91%, 78% and 100% per month for the beef, pork and poultry supply chains, respectively. In other words, for the poultry, the prices will adjust to the long term equilibrium level in one month, while for other products, price adjustments will take a bit more than one month.

The results show that the error correction term is only significant for the equations where producer prices are used as a dependent variable and not statistically significant when we use consumer prices as a dependent variable. This indicates that retail prices determine the prices of meat producers in Ukraine. At the same time, this might suggest that retailers possess higher bargaining power, indicating the presence of buyer power in the meat market of Ukraine.

According to price determination theory, producer prices determine consumer (retail) prices and the direction of causality runs from upstream to downstream sectors. However, the empirical results for different commodities in different countries do not provide such clear evidence about the causality along the food supply (Saghaian 2007). If the causality runs from consumer to producer prices, the shocks at the retail level are transmitted to the producer level in the food supply chain. A similar result we observe in our analysis.

After investigating Ukrainian meat supply chains, we can conclude that changes in consumer prices might determine the producer prices for all the analysed commodities. However, the fluctuation in producer prices seems to have low or no influence on a consumer (retailers) price. This observation might suggest that retailers in Ukraine might exercise market power towards food producers and processors. However, as noted in Lloyd (2017), the price transmission analysis results should be perceived with great caution. Such studies should be perceived as the first step in understanding how a price mechanism works in a particular food supply chain. Therefore, further investigation of the competitive environment in the Ukrainian meat supply chains is required.

4 Conclusions

In this paper, we analysed price transmission between beef, pork and poultry producer and consumer (retailer) prices in Ukraine. We found out that all of the product pairs contain a long-term cointegration relationship. However, in our research, we did not observe enough evidence to conclude the presence of price transmission asymmetries on any of the analysed supply chains, even though the results for pork and poultry lie close to the 10% significance threshold.

Our analysis also suggests that in the presence of shock that alters the prices out of their long-run equilibrium level, the prices will adjust back to their long term equilibrium with the speed of adjustments 91%, 78% and 100% per month for beef, pork and poultry supply chains respectively. In other words, for the poultry, the prices will adjust to the long term equilibrium level in one month, while for other products, price adjustments will take a bit more than one month.

Finally, we can conclude that changes in consumer prices can determine the producer prices for all of the analysed commodities, but not the other way around. The fluctuation in producer prices seems to have a low or no effect on a consumer (retailers) price. This observation might suggest that retailers in Ukraine might exercise market power towards food producers and processors. However, we need to underline, the results of price transmission analysis should be perceived with great caution as the first step in understanding how the price formation mechanism works in a particular food supply chain. Therefore, we suggest that the meat and other food supply chains in Ukraine require further, more thorough investigation to understand the degree of competition on the example of a developing Eastern European country.

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References:

Chan, K.S., 1993. Consistency and limiting distribution of the least-squares estimator of a threshold autoregressive model. The Annals of Statistics 21, 520–533. https://www.jstor.org/stable/3035605

Deconinck, K., 2021. Concentration and market power in the food chain. https://doi.org/10.1787/3151e4ca-en

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49(4), 1057–1072.

Dickey, D.A. & Fuller, W.A., 1979. Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, 74(366a), 427–431.

Enders, W., Siklos, P.L., 2001. Cointegration and threshold adjustment. *Journal of Business and Economic Statistics* 19, 166–176.

Engle, R.F., Granger, C.W.J., 1987. Cointegration and error correction: representation, estimation, and testing. *Econometrica* 55, 251–276.

Johansen, S., 1991. Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica* 59, 1551–1580. https://doi.org/10.2307/2938278

Kouyaté, C., Cramon-Taubadel, S. von, 2016. Distance and Border Effects on Price Transmission: A Meta-analysis. *Journal of Agricultural Economics* 67, 255–271. https://doi.org/10.1111/1477-9552.12145

Leibtag, E., 2009. How Much and How Quick? Pass through of Commodity and Input Cost Changes to Retail Food Prices. *American Journal of Agricultural Economics* 91, 1462–1467.

OECD. Food Price Formation, Paper presented to the 7th Food Chain Analysis Network Meeting (Paris: OECD, 2015). Retrieved from: http://www.oecd.org/site/agrfcn/meetings/agrfcn-7-food-price-formation-paper-October-2015.pdf.

Peltzman, S., 2000. Prices rise faster than they fall. *Journal of Political Economy* 108, 466–502. https://doi.org/10.1086/262126

Perekhozhuk, O., Matyukha, A., Glauben, T. (Eds.), 2011. Estimating the Degree of Buyers' Market Power: Evidence from the Ukrainian Meat Processing Industry. https://doi.org/10.22004/ag.econ.114782

Pokrivcak, J., Rajcaniova, M., 2014. Price transmission along the food supply chain in Slovakia. Post-Communist Economies 26, 555–568. https://doi.org/10.1080/14631377.2014.937111

R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Saghaian, S.H., 2007. Beef safety shocks and dynamics of vertical price adjustment: the case of BSE discovery in the US beef sector. *Agribusiness*, 23 (3), 333–348.

Sun, C., 2011. Price dynamics in the import wooden bed market of the United States. Forest Policy and Economics 13, 479–487. https://doi.org/10.1016/j.forpol.2011.05.009

Agricultural Commodity Prices during the Covid-19 Pandemic

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Abstract: This study investigates the development of agricultural commodity prices during the Covid-19 global pandemic. The main objective is to examine whether the Covid-19 indicators have an impact on the development of sugar prices. We analyse daily prices of sugar by using the ARDL model over the period 1 January 2020 to 29 June 2021. We use Covid-19 daily cases, daily deaths, panic index, media hype index, fake news index, infodemic index and media coverage index to represent the evolution of the Covid-19 pandemic. Our findings show that although there is a cointegration relationship confirmed when modelling sugar price, selected Covid-19 indicators, do not enter the long-run relationship and do not influence sugar prices significantly. However, the impact of Covid-19 on sugar prices may be indirect, as we observe the sensitive reaction of prices on near term volatility expectations and equity market volatility.

Keywords: Covid-19, pandemic, sugar, prices
JEL Classification: C32, G19, Q02

1 Introduction

Undoubtedly the most significant event that affected our lives in 2020 was the spread of the novel coronavirus Covid-19. The novel coronavirus has been a widely monitored and discussed topic among media, policymakers, researchers, and the general public. Apart from the fact that Covid-19 represents a challenge for the global public health community, it is also a threat to the world economy and international markets. Indeed, international commodity markets have been significantly influenced by the ongoing pandemic. Since the outbreak of the coronavirus, the world economy and commodity markets have seen a major slump more than during the 2008 financial crisis (Ahmed & Sorkadie, 2021). Commodity markets are sensitive to not just the demand and supply, macroeconomic variables, and political events (Wang et al., 2011), but also to pandemic determinants (Ichev and Marinč, 2018, Mensi et al., 2020) and pandemic news (Atri et al., 2021). In an attempt to limit contagion, national governments have implemented restrictive actions on business and society. For instance, closed borders and cities under quarantine reduced the trade of goods and commodities and the supply chain flow of all goods and services (Borgards et al., 2021). Moreover, the world supply chains were severely disrupted. The Covid-19 pandemic caused a massive shock on the whole supply chain since the various types of commodities are heavily involved in the chain. On the other hand, the Covid-19 outbreak decreased consumption, and investment in the commodities (Shaikh, 2021). Thus, the pandemic has severely influenced both sides of commodity markets worldwide, demand and supply (Ji et al., 2020, Farid et al., 2021; Borgards et al., 2021). Such events had an impact on commodity prices. For instance, commodity prices fluctuated wildly, with oil prices plummeting due to a demand reduction, and gold prices reaching all-time highs in expectation of a sluggish economic recovery after the pandemic (Le et al., 2021). As a result of the slowdown in global economic activity, base metal prices decreased as well. Thus, the demand for energy and metals have been affected the most by the pandemic. In contrast, there was no substantial decline in the prices of agricultural commodities that are not immediately connected to economic growth (Ezeaku et al., 2021). Therefore, due to its higher income elasticity, energy and metals demand is more sensitive to the economic downturn than agricultural commodities. Thus, as the Covid-19 pandemic has begun to influence the real economy, it caused a fall in both financial and commodity markets.

As a result, a large literature has emerged examining the impact of Covid-19 on commodity markets. Dmytrów et al. (2021) evaluate the resemblance between the daily Covid-19 cases and the energy commodity price time series. Similarly, Mhalla (2020) finds that pandemic has major implications on the global crude oil market. Sharif et al. (2020) investigate

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the relationship of spreading the coronavirus, oil price volatility shock, stock market risk, geopolitical risk, and economic policy uncertainty in the USA. Likewise, Musa et al. (2020) find a negative impact of coronavirus infected cases on oil prices, but a positive impact on the food price index in the long run. In the short run, both oil prices and the food price index were significantly negatively influenced. On the other hand, the study of Cui et al. (2021) analyses time-frequency dependency, high-risk spillovers, and dynamic links between the future of oil and commodities markets in China using the DECO-FIAPARCH Model, wavelet coherence method, and quantile connectedness approach respectively. Similarly, Lin and Su (2021) examine the effects of the Covid-19 pandemic on cross-market linkages. Findings show that there is a significant increase in total connectedness in energy markets during the first two months of the Covid-19 outbreak, although afterwards, it decreased back to the prior level. In contrast, Hung (2021) studies the effects of oil prices on agricultural commodity markets pre and during the Covid-19 pandemic. Similarly, Zhu et al. (2021) study the sector-induced risk contagion effect between global energy and agricultural sectors during the global coronavirus crisis. Wang et al. (2020) find that Covid-19 influences the cross-correlation between crude oil and agriculture futures markets. Moreover, according to the study of Ge and Tang (2020) commodity prices are significantly affected by uncertainty shock. Shaikh (2021) shows that commodity markets throughout the world have been shaken by fears of illness Covid-19 more than common stocks as new confirmed cases started to rise globally. There is a consequent increase in the level of uncertainty in the markets for natural resources such as crude oil, gold, and coronavirus-related disease outbreaks that have worsened the world's health crisis, resulting in decreased consumption and investment in commodities. On the other hand, the study of Sharif et al. (2020) examines the relationship of spreading the coronavirus, oil price volatility shock, stock market risk, geopolitical risk, and economic policy uncertainty in the USA. Likewise, Sun et al. (2021) explore the role of trade policy uncertainty in agricultural commodity prices by using bootstrap full and subsample rolling-window Granger causality tests. The results indicate both positive and negative impacts on agricultural commodity prices, which indicates that trade policy uncertainty might change the supply and demand for agricultural commodities, resulting in fluctuations in prices.

As was already mentioned since its emergence the new coronavirus has captured the wide attention of the media as it has been one of the most discussed topics worldwide. Pandemic related news and determinants are some of the factors that can influence commodity prices. There has been a lot of research done on the impact of Covid-19 indicators on the financial markets and commodity markets. For instance, the study of Atri et al. (2021) proves that oil prices were sensitive to bad pandemic news, unlike gold prices. Bannigidadmath and Narayan (2021) analyse if the economic news pessimism risk factor is priced by the investors in the cross-section of commodity futures returns. On the other hand, Salisu et al. (2020) find a positive relationship between commodity price returns and the Covid-19 global fear index, observing that commodity returns increase with growing fear from Covid-19. Umar et al. (2021) investigate the impact of Covid-19 fuelled panic on the volatility of commodity prices. Sadefo Kamdem et al. (2020) examine that the number of confirmed cases and fatalities due to the coronavirus influence the volatility of commodity prices. Yousef and Shehadeh (2020) prove that the growth of coronavirus cases increases the volatility of gold returns using the GARCH and GJR-GARCH models. While the extant literature has extensively demonstrated the effects of Covid-19 news and determinants on the oil and precious metal prices (e.g., gold), there is no specific study exploring the impact of Covid-19 on agricultural commodity prices. Thus, in this paper, we aim to expand the study of Covid-19 effects on the agricultural commodity markets, more specifically on sugar prices. The main objective of this paper is to examine if the selected Covid-19 indicators have an impact on sugar prices using the ARDL model. Alongside, we also test the impact of economic policy uncertainty and financial volatility on sugar prices. This paper is structured as follows: Section 2 contains empirical methods and data used in our research. The results of our study are presented and discussed in Section 3, and our conclusions are summarized in Section 4.

2 Methods

We employ the ARDL bounds test, developed by Pesaran et al. (2001) to test for the presence of a long-term relationship between sugar prices and selected Covid-19 indicators. The ARDL model is an autoregressive distributed lag model that allows long-term and short-term parameters to be estimated simultaneously and has several advantages over standard cointegration models. Pesaran and Shin (1999) argue that an appropriate ARDL model specification is sufficient to correct both the serial correlation as well as the endogeneity problem. In addition, another advantage is that the ARDL approach allows for a different number of delays for each regressor. Unlike other methods, the ARDL procedure does not require testing of the order of integration, as it can be used regardless of whether the time series are stationary I(0), stationary in direct differences I(1), or cointegrated with each other (Pesaran et al., 2001). To make sure that none of the variables are integrated of order I(2) or higher, we first test the stationarity of time series and their first differences using the Augmented Dickey-Fuller test. The existence of a long-term relationship is then tested based on the ARDL bounds testing procedure. The general form of the ARDL model (p, q, ..., q) is as follows:

$$y_t = c_0 + c_1 t + \sum_{i=1}^{p} \phi y_{t-1} + \sum_{i=0}^{q} \beta_i x_{t-1} + u_t \qquad (1)$$

where *y* is the dependent variable, *x* is the independent variable, *p* is the number of optimal lags of the dependent variable and *q* represents the number of optimal lags of each explanatory variable. The constant is c_0 and the trend c_{1t}. After reparameterization in the form of an error correction model we get:

$$\Delta y_t = c_0 + c_1 t - \alpha(y_{t-1} - \theta x_t) + \sum_{i=1}^{p-1} \psi_{yi} \Delta y_{t-i} + \sum_{i=0}^{q-1} \psi_{xi} \Delta x_{t-i} + u_t \quad (2)$$

where α expresses the rate of adjustment of the dependent variable to the short-term shock, θ represents the long-term and ψ short-term coefficients. Pesaran et al. (2001) proposed two types of critical values for a given level of significance. The first type assumes that all variables in the model are I(1), and the second assumes that all variables involved are I(0). The null hypothesis of no cointegration is rejected if the calculated F-statistic exceeds the upper limit. If the calculated F statistic is below the lower limit, the null hypothesis of no long-term relationship cannot be rejected and the ARDL model should be estimated in the first differences without the correction term. If the statistic F is between these two limits, the result is inconclusive. In addition, several diagnostic tests need to be performed to check model stability, serial correlation, heteroscedasticity, and error normality.

Table 1 shows the descriptive statistics of the used time series. Sugar prices represent daily prices of US Sugar #11 Futures (SBH2) in USD currency, and the data were retrieved from the investing.com website.[4] Moreover, to test for the impact of the Covid-19 pandemic on sugar prices, we use selected Covid-19 indicators: daily cases of newly infected patients, daily deaths, panic index, media hype index, fake news index, infodemic index and media coverage index. The Covid-19 pandemic data about the daily cases of newly infected patients and new daily deaths in the USA were retrieved from the ourworldindata.org website. [5] The data about the panic index, media hype index, fake news index, infodemic index and media coverage index were obtained from the ravenpack.com website.[6] Firstly, the coronavirus panic index tracks the level of news coverage that mentions panic, hysteria, or coronavirus. Secondly, the percentage of news articles regarding the novel coronavirus is measured by the media hype index. Thirdly, along with Covid-19, the coronavirus fake news index analyses the amount of media conversation about the novel virus that refers to disinformation or fake news. Fourthly, the coronavirus sentiment index examines the level of sentiment toward all entities featured in the news in addition to the coronavirus. Fifthly, the coronavirus infodemic index determines the proportion of all entities that are related to Covid-19 in some way. Finally, the proportion of all news outlets that cover the novel coronavirus is calculated using the media coverage index. Furthermore, to control for the impact of financial volatility and economic and policy uncertainty we incorporate the following variables into our models: economic policy uncertainty index (epu), and Chicago Board Options Exchange's (CBOE) Volatility Index or simply financial volatility index (vix). Epu is an index based on articles in major newspapers about policy uncertainty. The data about epu in the USA were retrieved from policyuncertainty.com.[7] Moreover, vix is a real-time market indicator that measures market expectations for volatility over the next 30 days. We obtained data about vix from finance.yahoo.com. [8]

Table 1 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
sugar price	546	14.114	2.247	9.240	18.780
cases daily	546	61319.680	63629.750	0.000	299579.000
deaths daily	546	1101.511	995.765	0.000	4566.000
panic index	546	3.092	1.648	0.000	10.670
media hype index	546	32.566	13.665	0.000	68.700
fake news index	546	0.761	0.469	0.000	2.800
sentiment index	546	-3.093	14.393	-50.170	39.880
infodemic index	546	47.356	15.354	0.000	69.590
media coverage index	546	67.302	16.621	0.000	84.620
epu	546	278.331	104.322	141.300	503.960
vix	546	26.155	10.901	12.100	82.690

Source: own calculation

[4] https://www.investing.com/commodities/us-sugar-no11-historical-data
[5] https://ourworldindata.org/coronavirus
[6] https://coronavirus.ravenpack.com/
[7] https://www.policyuncertainty.com/
[8] https://finance.yahoo.com/quote/%5EVIX/

Table 2 Estimated models (sugar price as the dependent variable)

Variable	M1	M2	M3	M4	M5	M6	M7
cases daily	*						
deaths daily		*					
panic index			*				
media hype index				*			
fake news index					*		
infodemic index						*	
media coverage index							*
epu	*	*	*	*	*	*	*
vix	*	*	*	*	*	*	*

Source: own elaboration, M1-M7 refers to seven versions of estimated models

3 Research Results

In the first step, we used the Augmented Dickey-Fuller test to check for the stationarity of time series as the ARDL model requires all variables to be stationary at levels or stationary at first differences. The number of lags was chosen based on Akaike Information Criterion. Our results[9] show that although some of the series were non-stationary at levels, they became stationary after taking the first differences and we could proceed to the ARDL model. Using the ARDL bounds testing procedure we found out, there is a cointegration relationship in all of our estimated models. The second row in Table 3 refers to the calculated F-statistic of the ARDL bounds test. As seen from the results, the F-statistic exceeds the upper bound at a 1% significance level for all estimated models and we can conclude that the null hypothesis of no cointegration is rejected. Error correction terms are negative and highly significant validating the long-run relationship. However, none of the Covid-19 indicators is significant indicating there is no long-run impact of the Covid-19 pandemic on sugar prices. The signs of the last two variables economic policy uncertainty (epu) and financial volatility (vix) are negative, meaning that an increase of uncertainty and financial volatility leads to a decrease in sugar prices. In the case of financial volatility, the results are significant at a 1% or 5% significance level.

Table 3 ARDL estimates

Variable	M1	M2	M3	M4	M5	M6	M7
F-statistic	5.903***	6.194***	5.844***	6.233***	5.612***	5.787***	5.837***
ECT	-0.026***	-0.025***	-0.024***	-0.022***	-0.026***	-0.023***	-0.024***
Long run coefficients							
cases daily	0.000						
deaths daily		0.001					
panic index			0.453				
media hype index				0.060			
fake news index					-0.186		
infodemic index						0.033	
media coverage index							0.032
epu	-0.005	-0.004	-0.006	-0.005	-0.006	-0.004	-0.004
vix	-0.216***	-0.231***	-0.284**	-0.301**	-0.216***	-0.262***	-0.255***

Source: Own calculations, Note: the critical values for the ARDL bounds test are 4.327 for I(0) and 5.572 for I(1) at 1% significance level, ECT is the Error correction term

4 Conclusions

This paper aims to contribute to the debate on the impact of Covid-19 on commodity prices. We use daily observations of sugar prices and seven different Covid-19 indicators, specifically new daily cases of covid positive patients, daily deaths, panic index, media hype index, fake news index, infodemic index and media coverage index. We also control for

[9] Unit root test results are available upon request from the authors

economic policy and financial uncertainty. Our results bring evidence that there is not a significant direct impact of the Covid-19 pandemic on sugar prices. We observed the sensitive reaction of sugar prices to market expectations of near-term volatility conveyed by stock index option prices. As noted by Atri et al. (2021) Covid-19 pandemic is dual health and economic crisis, and commodity prices react to changing economic conditions caused by the pandemic situation. This makes the research of commodity prices formation during Covid-19 rather challenging and requires further attention of researchers and policymakers.

Acknowledgement

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References

Ahmed, M. Y., & Sarkodie, S. A. (2021). How COVID -19 pandemic may hamper sustainable economic development. *Journal of Public Affairs*. Published. https://doi.org/10.1002/pa.2675.

Atri, H., Kouki, S., & Gallali, M. I. (2021). The impact of COVID-19 news, panic and media coverage on the oil and gold prices: An ARDL approach. *Resources Policy*, *72*, 102061. https://doi.org/10.1016/j.resourpol.2021.102061

Bannigidadmath, D., & Narayan, P. K. (2021). Economic news and the cross-section of commodity futures returns. *Journal of Behavioral and Experimental Finance*, *31*, 100540. https://doi.org/10.1016/j.jbef.2021.100540

Borgards, O., Czudaj, R.L., Van Hoang, T.H., 2020. Price overreactions in the commodity futures market: An intraday analysis of the Covid-19 pandemic impact, *Resources Policy*, 71, 2021, ISSN 0301-4207, https://doi.org/10.1016/j.resourpol.2020.101966.

Cui, J., Goh, M., & Zou, H. (2021). Coherence, extreme risk spillovers, and dynamic linkages between oil and China's commodity futures markets. *Energy*, 225, 120190. https://doi.org/10.1016/j.energy.2021.120190

Dmytrów, K., Landmesser, J., & Bieszk-Stolorz, B. (2021). The Connections between COVID-19 and the Energy Commodities Prices: Evidence through the Dynamic Time Warping Method. *Energies*, *14*(13), 4024. https://doi.org/10.3390/en14134024

Ezeaku, H., Asongu, S., & Nnanna, J. (2020). Volatility of International Commodity Prices in Times of COVID-19: Effects of Oil Supply and Global Demand Shocks. *SSRN Electronic Journal*. Published. https://doi.org/10.2139/ssrn.3754734

Farid, S., Kayani, G. M., Naeem, M. A., & Shahzad, S. J. H. (2021). Intraday volatility transmission among precious metals, energy and stocks during the COVID-19 pandemic. *Resources Policy*, *72*, 102101. https://doi.org/10.1016/j.resourpol.2021.102101

Ge, Y., & Tang, K. (2020). Commodity prices and GDP growth. *International Review of Financial Analysis*, *71*, 101512. https://doi.org/10.1016/j.irfa.2020.101512

Hung, N. T. (2021). Oil prices and agricultural commodity markets: Evidence from pre and during COVID-19 outbreak. *Resources Policy*, *73*, 102236. https://doi.org/10.1016/j.resourpol.2021.102236

Ichev, R., & Marinč, M. (2018). Stock prices and geographic proximity of information: Evidence from the Ebola outbreak. *International Review of Financial Analysis*, *56*, 153-166.

Ji, Q., Zhang, D., & Zhao, Y. (2020). Searching for safe-haven assets during the COVID-19 pandemic. *International Review of Financial Analysis*, *71*, 101526.

Le, T. H., Do, H. X., Nguyen, D. K., & Sensoy, A. (2021). Covid-19 pandemic and tail-dependency networks of financial assets. *Finance Research Letters*, *38*, 101800. https://doi.org/10.1016/j.frl.2020.101800

Lin, B., & Su, T. (2021). Does COVID-19 open a Pandora's box of changing the connectedness in energy commodities? *Research in International Business and Finance*, *56*, 101360. https://doi.org/10.1016/j.ribaf.2020.101360

Mensi, W., Sensoy, A., Vo, X. V., & Kang, S. H. (2020). Impact of COVID-19 outbreak on asymmetric multifractality of gold and oil prices. *Resources Policy*, 69, 101829. https://doi.org/10.1016/j.resourpol.2020.101829

Mhalla, M. (2020). The Impact of Novel Coronavirus (COVID-19) on the Global Oil and Aviation Markets. *Journal of Asian Scientific Research*, *10*(2), 96–104. https://doi.org/10.18488/journal.2.2020.102.96.104

Musa, K.S., Rabiu, M., Nafisa, M., Muktari, 2020. COVID-19 pandemic, oil price slump and food crisis nexus: an application of ARDL approach. *Open Access Library Journa*l 7, e6403.

Pesaran, M.H., Shin, Y., 1999. An autoregressive distributed lag modelling approach to cointegration analysis. In: Strom, S. (Ed.), *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium.* Cambridge University Press, Cambridge.

Pesaran, M.H., Shin, Y., Smith, R.J., 2001. Bounds testing approaches to analysis of level relationships. *Applied Econonomics* 16 (3), 289–326. https://doi.org/10.1002/jae.616

Sadefo Kamdem, J., Bandolo Essomba, R., & Njong Berinyuy, J. (2020). Deep learning models for forecasting and analyzing the implications of COVID-19 spread on some commodities markets volatilities. *Chaos, Solitons & Fractals*, *140*, 110215. https://doi.org/10.1016/j.chaos.2020.110215

Salisu, A. A., Akanni, L., & Raheem, I. (2020). The COVID-19 global fear index and the predictability of commodity price returns. *Journal of Behavioral and Experimental Finance*, *27*, 100383. https://doi.org/10.1016/j.jbef.2020.100383

Shaikh, I. (2021). On the relation between Pandemic Disease Outbreak News and Crude oil, Gold, Gold mining, Silver and Energy Markets. *Resources Policy*, *72*, 102025. https://doi.org/10.1016/j.resourpol.2021.102025

Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International Review of Financial Analysis*, *70*, 101496. https://doi.org/10.1016/j.irfa.2020.101496

Sun, T. T., Su, C. W., Mirza, N., & Umar, M. (2021). How does trade policy uncertainty affect agriculture commodity prices? *Pacific-Basin Finance Journal*, *66*, 101514. https://doi.org/10.1016/j.pacfin.2021.101514

Umar, Z., Gubareva, M., Naeem, M., & Akhter, A. (2021). Return and volatility transmission between oil price shocks and agricultural commodities. *PLOS ONE*, *16*(2), e0246886. https://doi.org/10.1371/journal.pone.0246886

Wang, J., Shao, W., & Kim, J. (2020). Analysis of the impact of COVID-19 on the correlations between crude oil and agricultural futures. *Chaos, Solitons & Fractals*, *136*, 109896. https://doi.org/10.1016/j.chaos.2020.109896

Yousef, I., Shehadeh, E., 2020. The impact of COVID-19 on gold price volatility. *The International Journal of Economics & Business Administration.* VIII (4), 353–364.

Zhu, B., Lin, R., Deng, Y., Chen, P., & Chevallier, J. (2021). Intersectoral Systemic Risk Spillovers between Energy and Agriculture under the Financial and COVID-19 Crises. *Economic Modelling*, 105651. https://doi.org/10.1016/j.econmod.2021.105651

Management of Small and Medium- Sized Enterprises in Times of Turbulent Changes

Product Distribution in Microbreweries during the COVID-19 pandemic

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Abstract: The microbrewery market in the Czech Republic was stunned by the Pandemic COVID-19 crisis after a dramatic boom in the last fifteen years. Microbreweries as small and medium-sized enterprises have been forced to seek new channels to provide products to customers. In this paper, we examine the product distribution channels, including the possibilities of using online sales. The methodological approach is based on a questionnaire survey of 106 microbreweries. We analyzed relation of enterprise characteristics (localization, range of activities, production volume and number of years in business) and between distribution methods. The results show that production volume, partially localization of breweries, and range of activities related to the distribution channels selection on a statistically significant level. The age of a microbrewery was not identified as a factor significantly related to distribution channel preference.

Keywords: Distribution Places, Micro Breweries, Tourism, COVID-19 Pandemic.
JEL Classification: L66, Q10, Z33

1 Introduction

The Czech Republic is one of the countries with the highest beer consumption per capita (Czech Association of Breweries and Maltsters, 2021). History has contributed to this tendency, with breweries founded by the nobility and the monarch to obtain additional money sources to finance their goals. However, the trend in beer consumption is downwards. In particular, the coronavirus pandemic, which caused the closure of restaurants and beer could only be drunk at restaurant counters or homes, has at least significantly contributed to this trend. Another reason for this downfall in beer consumption is the decrease in the number of tourist arrivals drop. Fotiadis et al. (2021) predicted the loss in 2021 in the range between 30.8% and 76.3%. Similar impacts of COVID-19 on tourism are reported from Portugal (Lopes, Sargento, & Carreira, 2021), Romania (Volkmann, Tokarski, Dinca, & Bogdan, 2021), and other countries. During the pandemic, supply chain and logistics issues were caused by the closure of the brewing industry and the support services (Pitts & Witrick, 2021).

Chládek (2007) describes the history of restaurant breweries, which dates back to the 18th century. So-called "home brewers", or people who made their beer at home, began to emerge in the U. S. The microbreweries have contributed significantly to diversifying the range of the local beers. Microbreweries' opportunity lies in various product portfolios on a niche market (Moore, Reid, & McLaughlin, 2016). Until the coronavirus crisis, the number of microbreweries in the Czech Republic grew at a rate that experts did not anticipate in the past. It was mainly due to the interest in local products and the higher purchasing power of the population. According to Swinnen & Garavaglia (2018), microbreweries focus more on the increase in quality than production volume. It is linked to fashionable phenomena such as the production of top-fermented beers, which some microbreweries have focused on exclusively and others have included in their offer alongside conventional production. The non-alcoholic version of beer production has one significant advantage for brewers - no excise duty is paid on this beer. It remains to be seen what the following trends in the industry will be. The microbreweries market is a dynamically developing, with new entries every month. The reason for setting up a microbrewery can be the change in consumer habits, which lead to further development of the craft brewing industry due to the growing popularity of low-alcohol beers, deep brewing traditions and rising brewery revenues, for example as in Poland (Wojtyra, Kossowski, Březinová, Savov, & Lančarič, 2020). However, the COVID-19 pandemic could lead in future to the period of extensive market concentration and entereprenurship stabilization.

Distribution focuses on where the products are sold and what options customers can choose when buying them. Microbreweries sell to the public in one or more of the following ways: a traditional three-tier system (brewery to wholesaler to retailer to consumer); a two-tier system (brewery acts as a wholesaler to retailer to consumer); and direct-

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to-consumer sales through taprooms or restaurants (Brewers Association, 2020). Bennison, Clarke, & Pal (1995) distinguish different distribution strategies: contagion (distribution is expanded from the already served areas), hierarchy (the brewery expands distribution depending on the population size of the city), defence/aggression (distribution is done in advance of competitors), avoidance/collusion (distribution to localities not attractive/occupied by competitors), acquisition (expansion of distribution by buying, taking over or merging the networks of another brewery) and segmentation (specialization of distribution volume or range according to location, city size, customer population, etc.).

Online sales are considered to be the modern method of distribution. The use of online sales in distribution depends on the distinctiveness of businesses. Retailers are being replaced by more modern ways of distributing (Brewer & Sebby, 2021). These new forms of distribution are essential for microbreweries as they can save the business. Especially breweries (known as "flying breweries"), who do not have their own permanent brewing facilities, but have their beer brewed by other breweries or brew their own beer according to their own recipe in a rented brewery may used these distribution forms. However, online channels will most likely never completely replace offline channels. Offline shopping is about using the five senses to experience products and services before committing to purchase (Kotler, Kartajaya, & Setiawan, 2017).

In this paper, we focus on the distribution of microbreweries and try to find out which factors related to them. Related research shows that geographical factors, the diversification of a company's activities or size (measured, for example, through production volume), related to distribution habits. With our research, we want to find out how distribution changed during the COVID-19 pandemic.

2 Methods

The paper's main objective is to identify distribution patterns of microbrewery products during the COVID-19 pandemic in the Czech Republic. Our research examined the effects of various enterprise characteristics on distribution channels.

The data collection method was a questionnaire survey. The survey was conducted electronically in January 2021 (19% return rate) in 106 microbreweries from the Czech Republic. All enterprises in the survey can be classified as small or micro-enterprises with less than 50 employees. According to the number of employees, the most represented group has the range of 2 to 4 employees (43.40%). The questionnaire contained questions for which respondents could choose from one or more options. The questionnaire sought to find out the places of products distribution (directly in-home sales, retail, online shop, wholesale, other). For statistical comparisons, we choose four criteria of enterprise characteristics (brewery location, range of brewery activities, number of years in brewery business, annual volume of beer production). These characteristics (see Table 1) describe the surveyed enterprises better than the number of employees.

Table 1 Research sample characteristics

Characteristics	Category	Number (n)	Frequencies (%)
Location of microbrewery facility	Village	34	32.08
	Smaller town	42	39.62
	Large town	23	21.70
	Brewery without place (flying brewery)	7	6.60
Range of microbrewery activities	Microbrewery only	35	33.02
	Microbrewery with refreshments	39	36.79
	Microbrewery with accommodation	21	19.81
	Other activities	11	10.38
Number of years in brewery business	Up to three years	26	24.53
	3 – 5 years	42	39.62
	Over five years	38	35.85
Annual volume of beer production (exhibitions)	Up to 100 hl	18	16.98
	100 – 500 hl	26	24.53
	501 – 1000 hl	25	23.58
	More than 1000 hl	37	34.91

Source: Own processing

We established two-sided statistical hypotheses, which we subsequently tested:

- H1: Distribution methods used by microbreweries are related to the brewery location.
- H2: Distribution methods used by microbreweries are related to the range of their activities.
- H4: Distribution methods used by microbreweries are related to the year in the brewery business.
- H3: Distribution methods used by microbreweries are related to the beer production volume.

The dependence of frequencies between selected multivalued responses (places of products distribution) and frequencies of enterprise characteristics (location, range of activities, production volume and years on the market) was

evaluated. Multi-value responses were transformed into dichotomous yes/no variables. Pearson chi-square test was used to assess the relationship. We performed calculations through contingency tables of absolute and theoretical frequencies constructed for each response according to each characteristic. The chi-square test criterion is given below (Hendl, 2006):

$$\chi^2 = \sum_{i=1}^{k} \frac{(n_i - np_i)^2}{np_i}, \quad (1)$$

where:

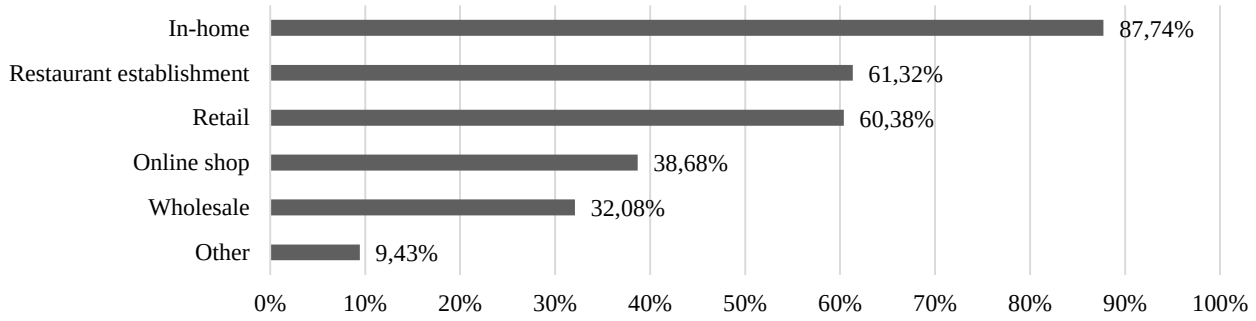
k	the number of possible values of the categorical variable
n	the sampling range
n_i	observed frequency in category i
p_i	the theoretical probability of type i
np_i	the theoretical (expected) frequency in category i calculated assuming null hypothesis validity

Statistical evaluation was performed using the R software. In the case of a significant difference in multiple comparisons of relative frequencies, a pairwise comparison test for proportions (with Holm's method of adjusting the significance level reached) was used to determine differences in particular categories. We evaluated the respective *p*-values for all tests at the 5% significance level. We do not report the values of the test criteria in the results but only the resulting *p*-values.

3 Research results

Respondents were asked to indicate any number of responses that were consistent with their method of product distribution. The most common form of distribution with 87.74% is in-home sales (see Figure 1). This type of sale is probably the most advantageous from the enterprise's point of view, as it does not have to transport the products to the end consumer and, as a rule, does not have to set up a separate shop for this purpose. On the other hand, it is more likely to reach local customers, tourists and people in the vicinity of the business in this way. Many microbreweries distribute their products through restaurants (61.32%), which are not always linked establishments (restaurant and microbrewery together). If this method had been included among the basic options, more respondents would probably have chosen it. It is because many microbreweries distribute their products through retail (60.38%). It may be a nearby establishment, but it may also be a more distant establishment with which the microbrewery agrees to supply products regularly. The modern form, in this case, is thought to be online sales, which is used by around 38.68% of respondents. Wholesale distribution with 32.08% allows retailers to purchase not only for the retail sector but also for many restaurants or bars. The remaining respondents ("other") gave their answers. These are mainly local sales in operation through local outlets (bakery, café, etc.). Another answer was stall selling, which is likely to be used at events, exhibitions, markets, festivals, etc.

Figure 1 Places of products sales distribution (in %)



Source: Own processing

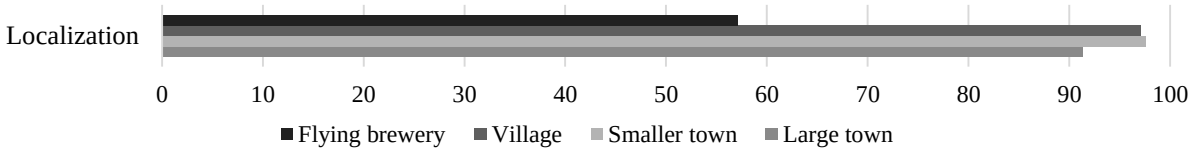
3.1 Brewery localization

The results showed that the classification of respondents by brewery location partly related to the way they use distribution. Hypothesis H1 was confirmed for in-home (*p*-value = 0.0007) and online sales (*p*-value = 0.04403) distribution types. For the other distribution forms, this factor was not statistically significant.

In-home sales are the primary form of distribution for microbreweries, where products are distributed directly to the final consumer. In the pandemic era, this form is implemented through stalls and to this end, enterprises have been forced to invest in new packaging materials. Most non-located enterprises (flying breweries) use only minimums of the in-home sales form. Figure 2 shows the relationship between location and the in-home form of distribution. We can see that this form is used most often in smaller towns (97.06%) and villages (97.62%). The pairwise comparison further revealed the

main differences between breweries without a specific location (flying breweries) and breweries in smaller towns (*p*-value = 0.0240). Breweries in smaller and larger cities prefer in-home sales. In contrast, flying breweries and breweries located in rural areas are more likely to use retail sales.

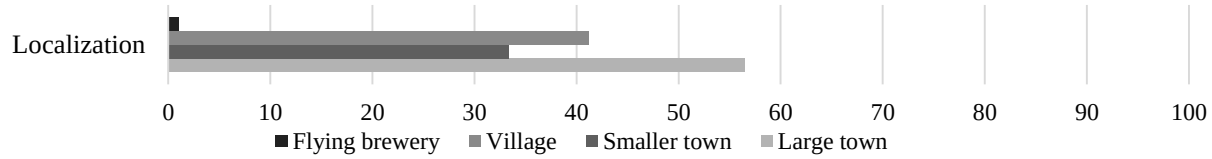
Figure 2 In-home sales (in %)



Source: Own processing

Companies less use the online form of sales. Figure 3 shows roughly the percentage frequencies for location-specific placements. Breweries in large cities often choose this type of distribution (56.52%). The online form is then used less in small towns and villages. Flying breweries, on the other hand, do not prefer this distribution method.

Figure 3 Online shop (v %)



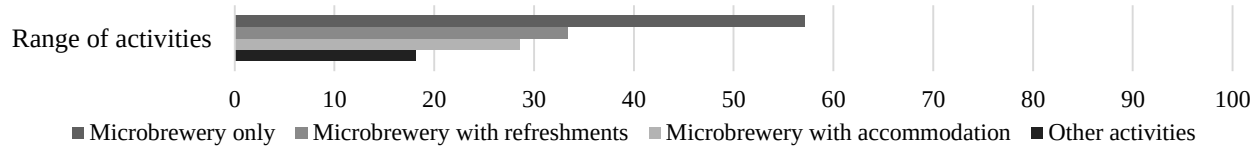
Source: Own processing

3.2 Range of brewery activities

We found that the factor range of brewery activities partially related to the distribution. Hypothesis H2 was confirmed for the distribution forms online sales (*p*-value = 0.0392) and restaurant facilities (*p*-value < 0.0001). For the other distribution types, this factor was not statistically significant.

The analysis of online distribution shows that 57.14% of core microbreweries (focusing only on brewing) use it most often. Other groups of enterprises with a different portfolio of activities do not make much prefer the online environment. Figure 4 shows that the more distant the diversification of activities from the primary mission of the microbrewery, the less modern electronic forms of distribution are chosen. We can conclude that the situation of "pure" microbreweries is not bad in terms of technology. Other enterprises have enough customers through traditional distribution channels.

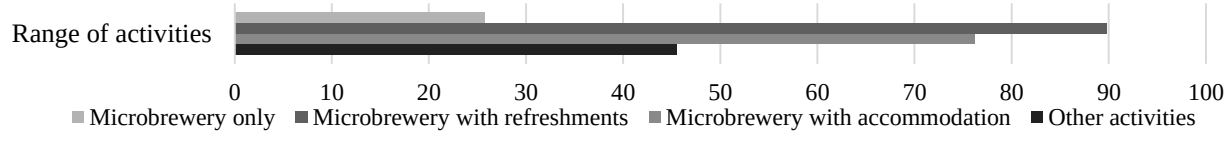
Figure 4 Online shop



Source: Own processing

A deeper analysis of sales through various restaurant facilities also yielded exciting results. Figure 5 shows that companies most often use this sales method with added restaurant (89.74%) or accommodation activities (76.19%). Much less is this distribution method present in traditional microbreweries. Pairwise comparisons confirmed differences between pure microbreweries and microbreweries with accommodation (*p*-value = 0.0034), core microbreweries and microbreweries with refreshments (*p*-value < 0.0001). Differences were statistically significant for microbreweries with snacks and establishments with other diversified activities (*p*-value = 0.0194).

Figure 5 Restaurant facilities



Source: Own processing

3.3 Years in business

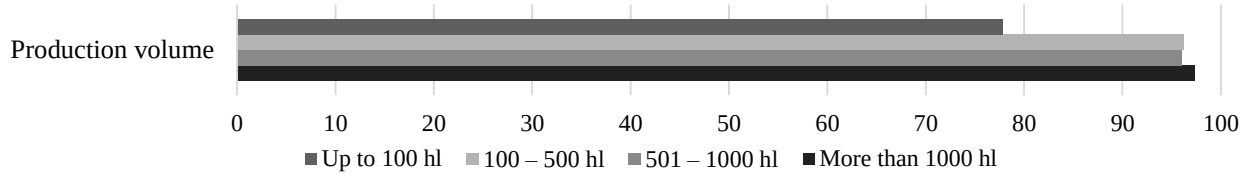
The least important factor related to distribution patterns in microbreweries is the number of years in business. In this case, we cannot accept hypothesis H3.

3.4 Annual production volume

The closest relation with the form of distribution was identified in the case of production volume. Hypothesis H4 was confirmed for the three types of distribution in-home sales (p-value = 0.0345), retail (p-value = 0.0014) and wholesale (p-value = 0.0049). For the remaining distribution types, this factor was not statistically significant.

Figure 6 shows at a glance that the in-home sales form is prevalent in microbreweries despite their size. More than 96% of microbreweries use in-home sales. Only 77.78% of the smallest enterprises (up to 100 hl) prefer this form. Thus, for smaller enterprises, other types of distribution are more likely to exist.

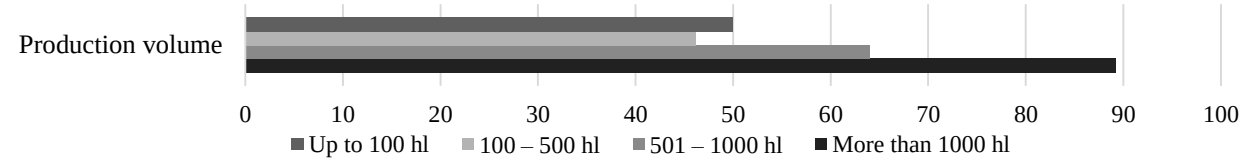
Figure 6 In-home sales



Source: Own processing

The results in Figure 7 indicate that the larger the microbrewery, the more often the retail form of sales is used. The retail channel is used by 89.19% of companies over 1,000 hectoliters to distribute their products. On the other hand, smaller enterprises apply this form only 45-65%. In pairwise comparisons, the differences between the up to 100 hl and more than 1000 hl groups (p-value = 0.0204) and the take between the 100-500 hl and more than 1000 hl groups (p-value = 0.0035) were particularly statistically significant.

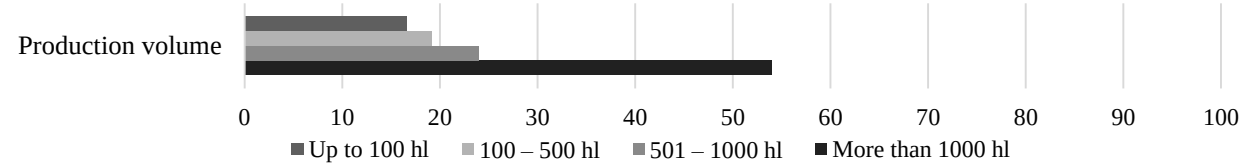
Figure 7 Retail



Source: Own processing

The situation is similar in the wholesale sector. The largest enterprises prefer a wholesale form of 54.05%, while the rest only 24%. However, wholesaling is not the main form of distribution for microbreweries, while most enterprises do not produce large beer volumes.

Figure 8 Wholesale



Source: Own processing

4 Conclusions

One of the most affected segments due to the COVID-19 pandemic was the hospitality industry and its strongly related sectors, including the brewing industry. However, the Czech Republic still maintains its global leadership in beer consumption. Declining brewery sales drove the overall losses in the brewing industry's supply and demand chain, reduced purchases of goods and services from suppliers, and declining beer sales in the hospitality industry. In the crisis, breweries began to make production more efficient, improve marketing, and look for new sales channels. Distribution ways are being sought to make the offer more attractive and accessible to customers. Each form of distribution has its advantages and disadvantages, and it is often best to combine different types. We investigated distribution patterns during the COVID-19 pandemic and analyzed the effect of companies' characteristics on their selection.

Overall, the research results show that the closest relation with the form of distribution was identified in case of beer production volume. The approach of microbreweries to product distribution varies primarily in connection with to this criterion. The size of the production volume reflects the size of the enterprise. Larger enterprises can use more distribution channels than in-home sales, in particular retail and wholesale. The trend for the coming years will be to expand capacity and increase the size of established microbreweries. We expect successful microbreweries to become industrial breweries with an annual production of over 10,000 hectolitres. However, as the size of current microbreweries grows, the market may also become saturated, and at the same time, there may be a shortage of qualified employees (especially brewers).

The results showed that sorting the groups according to the number of years in business did not affect the results, unlike the other characteristics. Nevertheless, we have partially confirmed that localization and a higher range of company activities related to some types of distribution, especially online shopping. In villages, this may be due to a desire to make products more accessible to consumers. In large cities, online sales are a tool for differentiation. An interesting finding was that online sales are most often used by microbreweries focused on core brewing activities. Local breweries emphasize local distinctiveness over large producers. However, these breweries have to deal with different logistics. Their deliveries are oriented towards many customers requiring smaller volumes. They operate on a regional scale, and distribution is over shorter distances. The return of production to historic places is a nationwide trend sparked by beer culture.

References

Bennison, D., Clarke, I., & Pal, J. (1995). Locational decision making in retailing: an explora-tory Framework for analysis. *The International Review of Retail, Distribution and Consumer Research*, 5, 1, 1–20.

Brewer, P., & Sebby, A. G. (2021). The effect of online restaurant menus on consumers' purchase intentions during the COVID-19 pandemic. *International Journal of Hospitality Management*, 94. doi: 10.1016/j.ijhm.2020.102777

Brewers Association. (2020). Craft Beer Industry Market Segments. Retrieved 15 July, 2021, from https://www.brewersassociation.org/statistics-and-data/craft-beer-industry-market-segments/

Czech Association of Breweries and Maltsters. (2021). Spotřeba piva v Česku je nejnižší za posledních 60 let [In Czech, Beer consumption in the Czech Republic is the lowest in 60 years]. Retrieved July 15, 2021, from http://ceske-pivo.cz/tz2021/spotreba-piva-v-cesku-je-nejnizsi-za-poslednich-60-let

Fotiadis, A., Polyzos, S., & Huan, Tctc. (2021). The good, the bad and the ugly on COVID-19 tourism recovery. *Annals of Tourism Research*, 87. doi: 10.1016/j.annals.2020.103117

Hendl, J. (2006). *Přehled statistických metod zpracování dat: analýza a metaanalýza dat [In Czech, Overview of statistical methods of data processing: data analysis and meta-analysis]*. Praha: Portál.

Chládek, L. (2007). *Pivovarnictví* [In Czech, Brewing]. Praha: Grada Publishing.

Kotler, P., Kartajaya, H., & Setiawan, I. (2017). *Marketing 4.0: Moving from Traditional to Digital* New Jersey: John Wiley & Sons.

Lopes, A. S., Sargento, A., & Carreira, P. (2021). Vulnerability to COVID-19 unemployment in the Portuguese tourism and hospitality industry. *International Journal of Contemporary Hospitality Management*. doi: 10.1108/ijchm-11-2020-1345

Moore, M. S., Reid, N., & McLaughlin, R. B. . (2016). The Locational Determinants of Microbreweries and Brewpubs in the United States. In I. Cabras, D. Higgins & D. Preece (Eds.), *Brewing, Beer and Pubs.* London: Palgrave Macmillan.

Pitts, E. R., & Witrick, K. (2021). Brewery Packaging in a Post-COVID Economy within the United States. *Beverages, 7*(1). doi: 10.3390/beverages7010014

Swinnen, J., & Garavaglia, C. (2018). *Economic Perspectives on Craft Beer. A revolution in the global beer industry*. Cham, Switzerland: Palgrave Macmillan.

Volkmann, C., Tokarski, K. O., Dinca, V. M., & Bogdan, A. (2021). The impact of Covid-19 on Tourism in Romania. Exploratory Case Study on the Prahova Valley Region. *Amfiteatru Economic,* 23(56), 163-173. doi: 10.24818/ea/2021/56/196

Wojtyra, B., Kossowski, T. M., Březinová, M., Savov, R., & Lančarič, D. (2020). Geography of craft breweries in Central Europe: Location factors and the spatial dependence effect. *Applied Geography,* 124, 102325. doi: https://doi.org/10.1016/j.apgeog.2020.102325

Competitive Advantage and Resources Barriers of Companies under the Fourth Industrial Revolution

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Abstract: In an era of rapid change driven by the Fourth Industrial Revolution, achieving a competitive advantage is critical for a company's survival in the marketplace. However, enterprises currently face a multitude of barriers and constraints. This contribution aims to evaluate the competitive advantage and resources barriers of enterprises. The research is based on a questionnaire survey of 164 enterprises conducted in 2018. The methodology is concerning the statistical evaluation of hypotheses concerning the effects of size and industry of the enterprise. The results show that enterprises mainly consider product and process improvement as their competitive advantage, especially in the production of food and mechanical and electrical engineering. The most significant barrier for enterprises is human resources, particularly the lack of skilled workers. Large enterprises tend to focus on the introduction of new technologies and lean production methods. Small enterprises mainly implement tailor-made production, which is typical for the production of household products. Small enterprises perceive higher restrictions from the state.

Keywords: Competitive Advantage, Market Barriers, Industry 4.0.
JEL Classification: D40, L60

1 Introduction

The term Industry 4.0 or the fourth industrial revolution refers to the changes that are currently accompanied by scientific and technological advances in computing, artificial intelligence, automation, robotics and digitalisation. Industry 4.0 is considered a tool to achieve competitive advantage through knowledge learning from big data, high flexibility, new technologies and machine-to-machine communication (Mařík & et al., 2016). However, it is not enough to introduce these new technologies in companies to achieve a competitive advantage. They need to be linked to processes and become new resources and capabilities, bringing benefits and increased performance. It cannot be predicted whether supplier relationships, information technology, finance, production facilities, human resources or other market barriers are a potential competitive advantage or current disadvantage for companies. Untapped competitive advantage, resources or capabilities, on the other hand, can be a constraint to further development. Companies should, therefore, identify those resources and capabilities that limit them in their current activities and could potentially be replaced by new ones or improved with modern technologies.

Competitive advantage comes from the discrete activities a company performs in designing, producing, marketing, delivering, and supporting its product. The company gains a competitive advantage by performing strategically important activities differently or more cheaply than competitors (Porter, 1998). A business that competes on cost can improve its cost position by collaborating with suppliers and sales channels and exploiting opportunities for all parties to gain profit by coordinating and jointly optimising their value chains to reduce the product's final cost. A business using a differentiation strategy could reconfigure its value chain to create natural or perceived value for its buyers (Bhatnagar & Teo, 2009). Investment in practices such as joint decision-making, planning, new products and planning with suppliers and partners increase a company's competitiveness (Mellat-Parast & Spillan, 2014). All company activities and processes can be targeted for improvement through various methods such as lean manufacturing, Kaizen, tailored production, Six Sigma etc.

The resource-based view of the company assumes that the resources and capabilities that a company owns or controls, which are both valuable and scarce, will enable it to gain a competitive advantage. Moreover, suppose these resources and capabilities are inimitable and unmistakable. In that case, the company will retain these advantages, allowing it to have a sustainable competitive advantage to improve short-term and long-term performance (Newbert, 2008). Resources and capabilities are the tangible and intangible assets that companies use for development and implementation. In resource-based research, business processes are the dependent variable because overall performance depends, among

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other things, on the net effect of these business processes on companies' market position (Ray, Barney, & Muhanna, 2004). The organisation of resources is essential for the development and implementation of many corporate strategies. All competitive advantages are temporary, and managers must orchestrate corporate assets and configure capabilities to achieve them (Sirmon, Hitt, Ireland, & Gilbert, 2011).

Digitalisation enables better management of production and logistics, tracking and collecting customer expectations and wishes, monitoring customer satisfaction, or creating various predictions and models, thus contributing to expanding market share and increasing business efficiency in international markets (Lee & Falahat, 2019). A critical capability for maintaining the company's current position or gaining a competitive advantage to transform its current business models and introduce new ones. Competitive advantage 4.0 will be more of a system of highly advanced technologies, technological and organisational competitive advantages, rather than being a uniquely identifiable, single activity that differentiates a given company (Adamik, 2019). Intelligent networks, machines, processes, systems, products, supply chains or factories can create a multi-dimensional offering that brings flexibility, availability, and customisation (Gaub, 2016). Companies are implementing various digital technologies such as big data analytics, e-commerce, the Internet of Things, machine learning, virtual reality and others to create value (Nambisan, 2017).

This paper seeks to find an answer to what businesses currently consider to be their competitive advantage. We address the barriers of resources that prevent companies from exploiting the hitherto potentially competitive advantages associated with the Industry 4.0 concept. We find it interesting to look at comparisons between large and small companies or businesses in different sectors. Many competitive advantages are hidden from companies because they are based on new approaches and business models. Therefore, the paper's contribution can also be the awareness of the company's own weaknesses that need to be overcome to transform them into strengths.

2 Methods

The main objective of the paper is to evaluate the contemporary competitive advantage and market barriers of companies. A partial-objective is to analyse the impact of company characteristics (company size, business sector) utilising statistical validation. The data is based on a questionnaire survey conducted on a sample of 164 enterprises in the Czech Republic in 2018. This sample is part of the first wave of research (Vrchota & Pech, 2019), and 164 enterprises participated.

The sample was stratified by enterprise size and sectoral characteristics of enterprises. The classification of enterprise size is based on the methodology (European Commission, 2003). Groups of small enterprises (10-49 employees), medium-sized enterprises (50-249 employees) and large enterprises (over 250 employees) were analysed. The breakdown of enterprises by industry sector (specialisation) is based on the predominant sectoral focus. This category defined the groups based on the CZ-NACE classification (Czech Statistical Office, 2019) into Engineering and Electro technical industry (groups 24-30), Manufacture of Household Products (groups 13-16, 31-32; household supply), Food Processing (groups 10-12), Chemical Manufacture of Paper and Non-metallic Products (groups 17-23). By size (number of employees), the distribution of enterprises is roughly the same, i.e. 39.0% small enterprises (n = 62), 28.7% medium-sized enterprises (n = 47) and 32.3% large enterprises (n = 53). More than half of the enterprises in the sample belong to the engineering and electro technical industry (49,.4 %, n = 81). Approximately 18.9 % of enterprises are household goods enterprises (n = 31) and 16.5 % are food manufacturing enterprises (n = 27). Other industries (chemical, paper and non-metallic manufacturing, agriculture) account for about 15.2 % (n = 25).

The questionnaire covers competitive advantage and market barriers in the context of Industry 4.0. The questionnaire items were defined with the input of 34 managers and their expert judgement within the framework of qualitative research focused on Industry 4.0. The competitive advantage is based on the answers: "What form of competitive advantage does your company mainly seek?". Resources barriers are examined based on the question: "What limits you the most in your activity?". These two questions were asked in the context of the introduction of Industry 4.0 technologies. The processing of the answers is based on frequencies that give weight to each answer.

The results obtained were subjected to statistical analysis using the Z-test (Field, Miles, & Field, 2012) with Yates' correction for linkage (Pearson Chi-square statistic). The null hypothesis is that there are no differences between groups of companies. That is, their frequency shares do not differ. Hypotheses were tested based on company size and then by industry characteristics. The total number of enterprises and the total number of observations are compared by enterprise size or industry characteristics. The calculation is based on the weighted sum of squared deviations between the observed shares in each group and the total share. The test statistic is defined as follows:

$$z = \frac{p_A - p_B}{\sqrt{pq/n_A + pq/n_B}} \tag{1}$$

where:

p_A the proportion observed in group A with size n_A
p_B is the proportion observed in the group B with size n_B
p the overall proportions of group A
q the overall proportions of group B

Statistical evaluation was performed in the programming environment R 3.6. The level of statistical significance of differences was set at 0.05. Significant results (including the achieved significance level *p*-value) are presented in the text. In the case of significant differences between proportions in the treatment groups, Holm's adjustment method (Holm, 1979) was used.

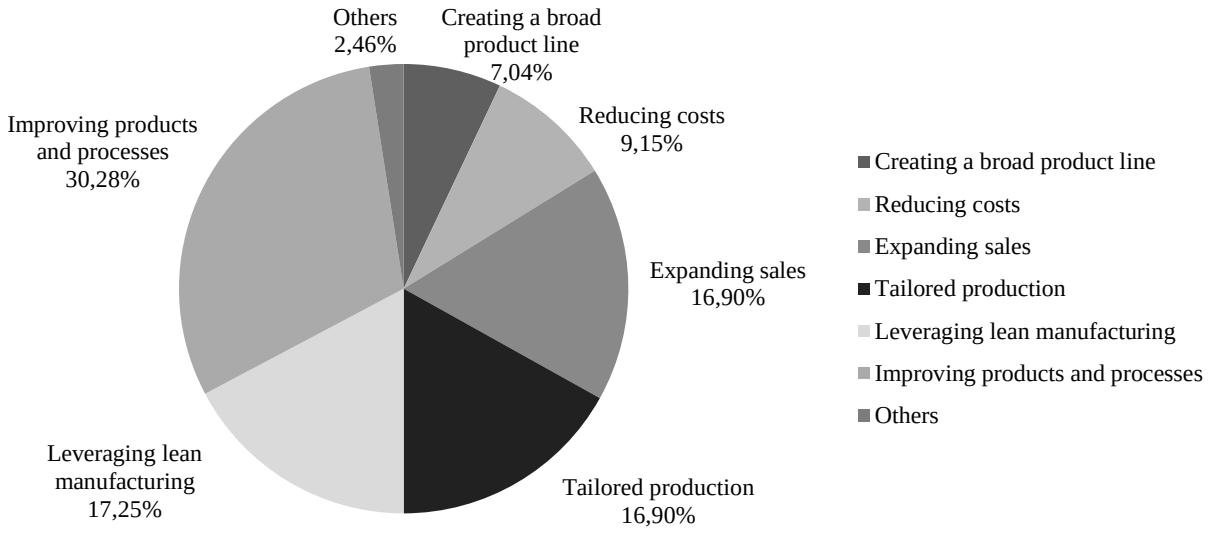
3 Research results

This section summarises and discusses the main findings of the work in two parts: competitive advantage and resource barriers and limitations in the context of Industry 4.0.

3.1 Competitive Advantage

In the first part of the research, managers were asked about their company's competitive advantage in the context of Industry 4.0. From Figure 1, it can be seen that enterprises consider product and process improvement as their competitive advantage most of the 30.28%. It is a degree of innovation and a benefit that is based on skilled human resources. Other significant sources of competitive advantage are lean production and elimination of waste (17.25%), tailor-made production to order (16.90%) and the ability to expand sales through the ability to find new markets (16.90%). This is followed by possibility of expanding sales (9.15%) and reducing costs (7.04%) as a form of financial advantages. For 'other', respondents mentioned outsourcing or moving some production to cheaper destinations.

Figure 1 Competitive advantage (in %)



Source: Own processing

Next, we statistically evaluated the question in terms of business size and industry (Table 1). In establishing working hypothesis H1, we hypothesised that "*there is a relationship between company characteristics (by size or industry) and competitive advantage (for categories A-F)*".

Table 1 Results of hypothesis testing for competitive advantage

	Enterprise Size		Sector of Industry	
Sub-category of question	*Z*	*p*-value	*Z*	*p*-value
H1A: Creating a broad product line	0.1596	0.9233	3.2185	0.3592
H1B: Reducing costs	2.1618	0.3393	2.0950	0.5529
H1C: Expanding sales	0.9697	0.6158	6.9495	0.0735
H1D: Tailored production	16.9680	0.0002*	14.1160	0.0028*
H1E: Leveraging lean manufacturing	16.9460	0.0002*	1.2507	0.7409
H1F: Improving products and processes	1.3193	0.5170	12.0230	0.0073*

Source: Own processing

From a company size perspective, we can accept the H1D and H1E hypotheses. From the results for each type of competitive advantage, it is clear that there were statistically significant differences between companies in only two cases.

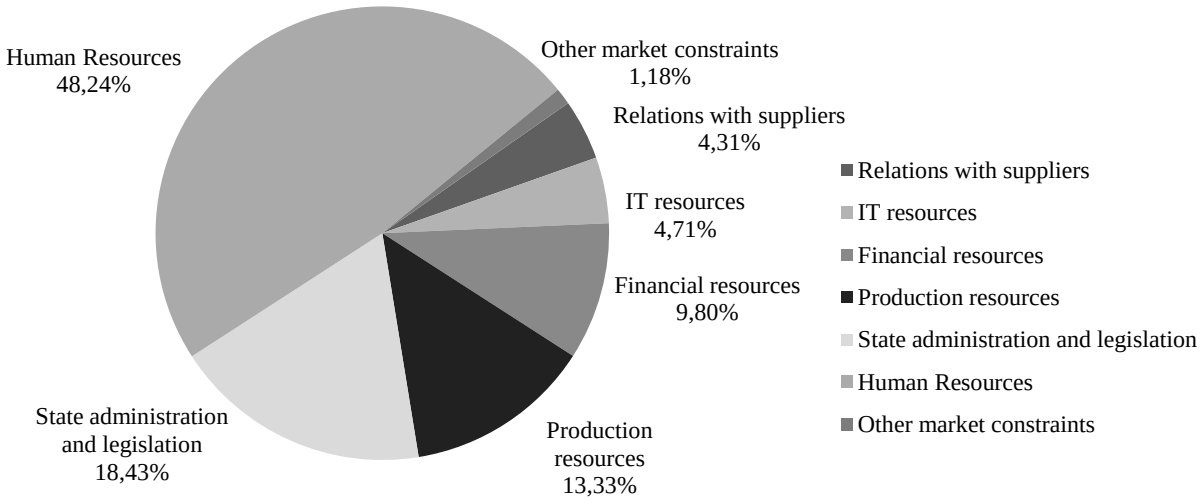
These are tailored production (H1D, *p*-value = 0.0002) and lean manufacturing (H1E, *p*-value = 0.0002). Closer pairwise analysis show that lean manufacturing is the preferred domain of large enterprises. It is thus different from small enterprises (*p*-value = 0.0003). The main reason for this is that enterprises implement lean manufacturing through a variety of methods that require time and resources to implement. Larger enterprises have an advantage in this area. On the other hand, tailored production is found mainly in small enterprises, which are more flexible and implement the product or service on demand. The differences for tailored production were significant in the pairwise comparison against both medium (*p*-value = 0.0394) and large enterprises (*p*-value = 0.0007).

In terms of industry, we can accept the H1D and H1F hypotheses. The results suggest that the differences between sectors are only in tailored production (H1D, *p*-value = 0.0028) and product and process improvement (H1F, *p*-value = 0.0073). For tailored production, the differences in the food manufacturing sector, which differs from the household products and engineering and electrical manufacturing sectors, are apparent at first glance. Pairwise comparisons showed that this type of production is more typical in manufacturing household products (*p*-value = 0.0028) or in the engineering sector (*p*-value = 0.0468). For product and process improvement, the significant differences resulting from the pairwise comparison are for household product manufacturing, which is different from engineering and electrical manufacturing (*p*-value = 0.0468) and food manufacturing (*p*-value = 0.0028). In these industries, improvement and innovation are seen more like a systematic process and a tool to achieve competitive advantage. On the other hand, the production of household products is more focused on the tailor-made type of production.

3.2 Resources of Barriers

The next question dealt with competitive disadvantages and barriers that constrain the business in the context of Industry 4.0. The individual responses were grouped into seven areas (Figure 2). The largest share includes human resources, which at 48.24% represent the most significant barrier for businesses. These are mainly a lack of qualified staff or low support from the management of the enterprise. Government administration and legislation is also a significant constraint with 18.43%, which is perceived as bureaucratic and includes various legal requirements, including emission reduction requirements. Production resources with 13.33% are a constraint for the enterprise if machinery and workshop equipment is outdated. Other reasons are challenging production flexibility and the enterprise's lack of space for equipment or unavailable material resources. Financial resources cover about 9.80% of the problems. These are mainly lack of finance for investments and uncertainty about their impact on profit. IT resource constraints with 4.71% mean insufficient data protection (also concerning GDPR), lack of standards for collaboration, lack of IT infrastructure and problems in implementing new IT systems. Relationships with suppliers are a barrier to further development for businesses at 4.31%. Finally, enterprises also mentioned various "other market constraints" (1.18%) related to competition, manufacturers' monopolies, the position of multinational companies or the risk of weak demand.

Figure 1 Barriers and limitations (in %)



Source: Own processing

We statistically evaluated the results of the question by company size and industry (Table 2). In establishing working hypothesis H2, we hypothesised that "*there is a relationship between company characteristics (by size or industry) and barriers constraining company activity (for categories A-F)*".

In terms of company size, the hypothesis can be accepted for H2E and H2F. However, there were statistically significant differences in the perception of constraints from government and legislation (H2E, *p*-value = 0.0459) and human resources (H2F, *p*-value = 0.0003). Higher levels of bureaucracy and barriers from the state are perceived especially by small enterprises, which often do not have sufficiently qualified staff familiar with legislation or relations with the state. It is also primarily a human resources problem that most constrains businesses. In a pairwise comparison, it was found that there are statistically significant differences in human resources. These differences are especially between small and medium-sized enterprises (*p*-value = 0.0473) and large enterprises (*p*-value = 0.0008). The results showed that large and medium-sized enterprises suffer from a shortage of skilled labour more than small enterprises. It can be a significant barrier to the uptake of Industry 4.0 and new technologies.

From an industry perspective, the hypothesis cannot be accepted in any case. No statistically significant differences between sectors could be demonstrated. Therefore, it can be concluded that companies perceive barriers and constraints in the same way regardless of the industry in which they operate. It is perhaps only worth noting the insignificant differences for limitations in production resources. Here, the perception is higher in the food and household products manufacturing sector. Otherwise, with exceptions, the results for other barriers and constraints are similar.

Table 1 Results of hypothesis testing for competitive advantage

	Enterprise Size		Sector of Industry	
Sub-category of question	*Z*	*p*-value	*Z*	*p*-value
H3A: Relationships with suppliers	1.1027	0.5762	1.1699	0.7602
H3B: Information technology (IT) resources	2.6716	0.2630	5.3673	0.1468
H3C: Financial resources	1.9517	0.3769	1.0123	0.7983
H3D: Production resources	0.2957	0.8626	6.7497	0.0803
H3E: State administration and legislation	6.1615	0.0459*	1.9364	0.5957
H3F: Human resources	16.5660	0.0003*	5.7097	0.1266

Source: Own processing

4 Conclusions

The area of networking, communication and information sharing has always been close to the elements of industrial communication. But only Industry 4.0 is giving a whole new meaning to the use of information data. Automation and robotics, especially when combined with artificial intelligence, will significantly change business processes. The right combination of modern technology and skilled people will lead to a step-change for companies and customers. These changes offer businesses the opportunity to exploit unthinkable competitive advantages that may be permanent and difficult to replicate. However, with the implementation of new technologies, new challenges and resource barriers are also emerging.

The current period is extraordinary in that it no longer just requires companies to make some "minor cosmetic" adjustments, but that they must undergo a comprehensive, radical reengineering journey in order to succeed in the ongoing Industry 4.0 era (Patrucco, Ciccullo, Pero & Margherita, 2020). The advances are reflected in both competitive advantages and barriers to doing business. It is expected that there will be changes of supply chains by process of deglobalisation where possible. Instead of cheap supplies from Asia, it will be more profitable to look for European, local suppliers (Rainnie, 2021). In manufacturing, where wages are still rising due to a shortage of workers, there must be more digitisation and robotisation. This paper intends to shed light on how companies currently perceive their competitive advantage and what is preventing them from further development in the context of the fourth industrial revolution.

In conclusion, the study highlights the competitive advantage of product and process improvement. In the process area, the changes will transfer control intelligence from individual industrial components to the Cloud and lead to industrial automation of solutions and services. The future products will have full functionality only when they are integrated into the entire digital ecosystem, which will bring a higher level of know-how and customer experience. The most significant resource barrier for companies today is human resources, especially the lack of skilled workers. Companies must consider whether to address this shortage through robotics and new technologies or through new digital processes that free up people's capacity to work in more creative ways.

The results showed that large enterprises are more likely to focus on introducing new technologies and lean production methods. It is associated with higher capital intensity and the need to equip human resources with unique competencies. Small enterprises are more oriented towards implementing tailored production, which brings greater flexibility or the possibility to implement a product or service on customer demand. Business conditions are different for small and large enterprises in terms of access to resources. Therefore, bureaucracy and government restrictions are also more significant barriers for small businesses. It will probably be the future scenario with subsidies or state support for improving processes or Industry 4.0 technologies in small and medium-sized enterprises.

Industry 4.0 and new technologies are not advancing evenly across sectors. Each sector has specificities that distinguish it from other sectors. Thus, perceptions of competitive advantage may differ by industry. Our research has shown that tailored production is much more typical for the production of household products. It becomes a competitive advantage for the company. Then the consumer will be satisfied, leading him to purchase repeatedly. Product and process improvement is a major competitive advantage for the food, mechanical, and electrical engineering industries. These sectors can achieve this through incremental or rapid change based on process transformation and new technologies. Based on the research, it appears that resource barriers are familiar to all sectors and that businesses are currently dealing with similar issues. Thus, to move towards new technologies and Industry 4.0, companies can follow the same and common path by overcoming barriers and creating unique competitive advantages.

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References

Adamik, A. (2019). Creating a Competitive Advantage in the Age of Industry 4.0. *Problemy Zarzadzania-Management Issues,* 17(2), 13-31. doi: 10.7172/1644-9584.82.1

Bhatnagar, R., & Teo, C. C. (2009). Role of logistics in enhancing competitive advantage A value chain framework for global supply chains. *International Journal of Physical Distribution & Logistics Management,* 39(3-4), 202-226. doi: 10.1108/09600030910951700

Czech Statistical Office (2019). Ekonomické subjekty podle převažující činnosti CZ-NACE v České republice. Retrieved 2019-10-10, from https://vdb.czso.cz/vdbvo2/

European Commission (2003). *Recommendation of 6 May 2003 Concerning the Definition of Micro, Small and Medium-Sized Enterprises (Text with EEA relevance notified under document number C(2003) 1422)*. Brussels, Belgium: European Commission.

Field, A., Miles, J., & Field, Z. (2012). *Discovering Statistics Using R*. London: Sage Publications Ltd.

Gaub, H. (2016). Customisation of mass-produced parts by combining injection molding and additive manufacturing with Industry 4.0 technologies. *Reinforced Plastics,* 60(6), 401-404. doi: https://doi.org/10.1016/j.repl.2015.09.004

Holm, S. (1979). A Simple Sequentially Rejective Multiple Test Procedure. *Scandinavian Journal of Statistics,* 6(2), 65-70.

Lee, Y. Y., & Falahat, M. (2019). The Impact of Digitalization and Resources on Gaining Competitive Advantage in International Markets: The Mediating Role of Marketing, Innovation and Learning Capabilities. *Technology Innovation Management Review,* 9(11), 26-38. doi: 10.22215/timreview/1281

Mařík, V. et al. (2016). *Průmysl 4.0. Výzva pro Českou republiku*. Praha: Management Press.

Mellat-Parast, M., & Spillan, J. E. (2014). Logistics and supply chain process integration as a source of competitive advantage An empirical analysis. *International Journal of Logistics Management,* 25(2), 289-314. doi: 10.1108/ijlm-07-2012-0066

Nambisan, S. (2017). Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship. *Entrepreneurship Theory and Practice,* 41(6), 1029-1055. doi: 10.1111/etap.12254

Newbert, S. L. (2008). Value, rareness, competitive advantage, and performance: A conceptual-level empirical investigation of the resource-based view of the firm. *Strategic Management Journal,* 29(7), 745-768. doi: 10.1002/smj.686

Patrucco, A., Ciccullo, F., & Pero, M. (2020). Industry 4.0 and supply chain process re-engineering. *Business Process Management Journal*, 26(5), 1093-1119. doi: 10.1108/BPMJ-04-2019-0147

Porter, E. M. (1998). *Competitive Advantage: Creating and Sustaining Superior*. London: The Free Press.

Ray, G., Barney, J. B., & Muhanna, W. A. (2004). Capabilities, business processes, and competitive advantage: Choosing the dependent variable in empirical tests of the resource-based view. *Strategic Management Journal,* 25(1), 23-37. doi: 10.1002/smj.366

Rainnie, A. (2021). I4.0, 3D printing, deglobalisation and new manufacturing clusters: The view from Australia. *Economic and Labour Relations Review*, 32(1), 115-133. doi: 10.1177/1035304620981429

Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects. *Journal of Management,* 37(5), 1390-1412. doi: 10.1177/0149206310385695

Vrchota, J., & Pech, M. (2019). Readiness of Enterprises in Czech Republic to Implement Industry 4.0: Index of Industry 4.0. *Applied Sciences,* 9(24), 5405. doi: https://doi.org/10.3390/app9245405

EU-27 SMEs during pre-Covid-19 and COVID-19 crisis: SME-related brief insights

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Abstract: This study aimed to evaluate Micro and Small- and medium-sized enterprises (SMEs) based on an analysis of the connections between SMEs and performance measured during pre-COVID-19 and COVID-19 pandemics. Secondary data was applied from the EU-27 SMEs annual reports to sampling European SMEs for ten consecutive years. The quantitative statistical technique was used to assess various SME practices' impact before and during the COVID 19 outbreak. In 2020, the number of EU-27 SMEs was significantly 10.54 % less than in 2018. SME productivity, measured as value-added, was 3.34 trillion EUR in EU-27, 26.49 % lower as compared to 2018. Moreover, EU-27 SMEs also employed people in 2020, significantly 16.99 % less than in 2018. Overall, the pandemic affected EU-27 SMEs' numbers and performance. EU-27 SMEs have been severely affected by the COVID-19 pandemic, with value-added dropping, employment declining in 2019 and 2020. SMEs' value-added and employment are expected to remain below their respective 2019 levels in 2021.

Keywords: COVID-19, value-added, EU-27, SME, and pandemic.
JEL Classification: G32, G33, C35

1 Introduction

Lockdown imposed due to COVID-19 pandemic across the European Union as well as the rest of the world, had a significant impact on 27 countries of European Union (EU-27) SMEs (Hedvičáková & Kozubíková 2021). Interruptions in the performance of EU-27 SMEs across a variety of sectors occurred especially at the beginning of 2020 during the COVID-19 crisis and specifically in the case of internationally oriented and complicated distribution channels (Pedauga et al. 2021). Furthermore, the outbreak has advantages for some economic sectors since SMEs have dramatically shifted their behaviour (Al-Fadly 2020). As the outbreak continues to spread across the globe, and a third or possibly even a fourth wave captures Europe and the rest of the world, it's just too early to determine the entire scope of this economic collapse, either beneficial or unfavourable (Cowling et al. 2020). The COVID-19 pandemic's influence on SMEs varied considerably among European member countries and the industrial sector (Juergensen et al. 2020). At the EU-27 level, the SMEs most harmed by the COVID-19 outbreak included food and accommodation services operations, storage and distribution, general administration, and the manufacturing sector (Hardilawati 2020).

SMEs suffer from liquidity-related issues and have a decline mainly on the demand side, undermining their long-term viability (Gregurec et al., 2021). Due to the COVID-19 pandemic, the problem in the supply of raw materials for EU-27 SMEs halted the production and operation of Micro, Small, and Medium-sized Enterprises (MSMEs) (Dai et al. 2021). As a result, if the suppliers experience difficulties, the MSMEs will have limited productivity and will be unable to provide employment and participate less in value-added (Aladejebi 2020). Therefore, the failure of certain MSMEs to reopen indicates that demand in the marketplace as a whole is lowered (Kalemli-Ozcan et al. 2020). The COVID-19 pandemic is still a barrier to beginning operations efficiently for SMEs; however, the salaries, rents, and interest paid by the MSMEs continue to be consumed, resulting in a massive increase in the businesses' capital expenditures (Hamburg 2021). Both input and output businesses have yet to restore entire operations (Priyono et al. 2020). Certain manufacturing has been limited; goods cannot be successfully marketed (Adiyoh et al., 2020). Some raw materials have not started operation at the purchasing end, resulting in operational problems for MSMEs (Klein & Todesco 2021).

SMEs suffered a drop due to the COVID-19 pandemic, with SMEs suffering losses in money, marketing, labour, and assets (Berisha, 2021). Employee layoffs, a financial crisis, worker health issues, a drop in revenue and turnover, and a drop in customer demand are the five major issues confronting SMEs during COVID-19 (Kritikos, 2020). SMEs, which

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were believed to be quite active economic firms, could not deal with the problem during the COVID-19 pandemic (Sungkawati, 2021). Considering the significance of SMEs in the economy, little study has been conducted on the consequences of the economic depression on SMEs and how they might cope with a problem (Aribisala et al. 2020).

2 Methods

This study used quantitative techniques in conjunction with secondary data collected from a decade's Annual report on European SMEs from the government's official sources. The COVID-19 pandemic has been responsible for a worldwide economic disaster, with the effects appearing in the labour marketplace. In this study, we evaluated the impact of the covid-19 pandemic on EU-27 SMEs. We focused specifically on pre-COVID-19 and during the COVID-19 crises from for SEMs 2010 to 2020.

2.1 Data collection

Micro, Small, and Medium-sized enterprises were selected, including important sectors such as food and accommodation services operations, storage and distribution, general administration, and industries. The Research used a purposive sampling technique to identify the effect of the COVID-19 pandemic on EU-27 SMEs. This approach was chosen primarily owing to the separation of the sample units. Performance indicators such as the number of enterprises, value-added, and the number of employments were used to estimate the EU-27 SMEs. For a more extensive knowledge of economic activity in the EU, an overview of the SMEs is enough. Retrieved from the EU-27 data set (EU-27 Annual Report 2021), the European Union is expected to have less than ten employees for Micro SMEs, 10 to 50 employees for Small SMEs, and 50 to 250 employees for Medium-sized SMEs having 2, 10, and 50 million €, respectively.

Table: 1 Definition of SMEs

Enterprises Category	Employees	Turnover	Balance Sheet Total
Micro SME	0 to < 10	< €2 million	< €2 million
Small SMEs	10 to <50	< €10 million	< €10 million
Medium-sized SME	50 to <250	< €50 million	< €43 million

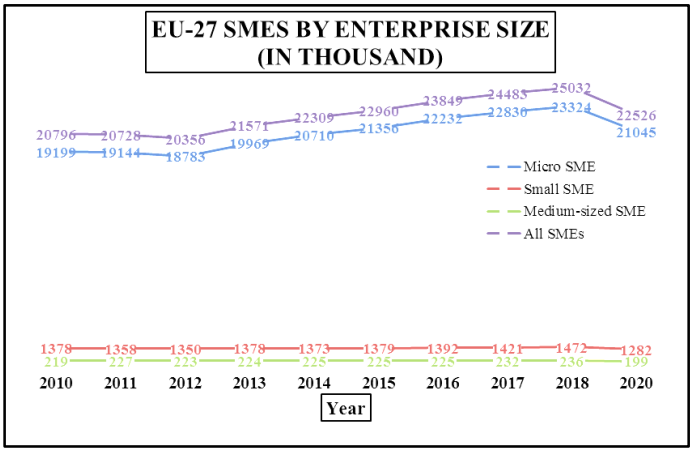
Source: Official Journal of the European Union, L 124/36, 20 May 2003

3 Research results and Discussion

3.1 EU-27 SMEs profiling by enterprise size during pre-pandemic and pandemic

Figure 1 illustrates the numbers of Micro, Small, and Medium-size Enterprises, including food and accommodation services operations, storage and distribution, general administration, and industrial zone in EU-27 for the period 2010- and 2020. The number of Micro SMEs steadily increased from 2010 to 2012, then the number increased from 2014 to 2018, continuously.

Figure 1 EU-27 SMEs Profiling by Enterprise size



Source: Own processing

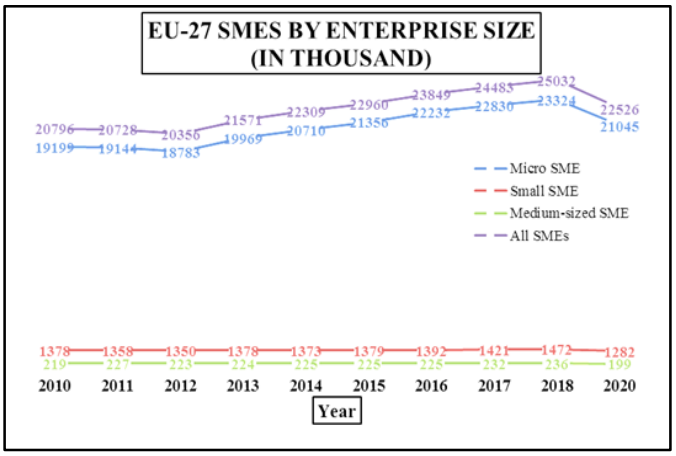
During the COVID crisis, the number of Micro SMEs had a significant decline in the year 2019 and 2020. However, there was no significant increase in the number of Small and Medium-sized SMEs during the pre-pandemic era (2010 to

2018), but we observed that they were also affected in 2019/2020 due to the COVID-19 imposed lockdown. In 2018, a total of 25032 thousand MSMEs was active, whereas, in 2020 total number of MSMEs was 22526 thousand. There was a significant decline (2506 thousand) in the total numbers of all MSMEs due to the pandemic. The COVID -19 pandemic had a significant impact on labour markets, economy, businesses, and a worldwide distribution network, causing massive economic disruptions, especially for Micro SMEs.

3.2 Value-added contribution of EU-27 SMEs during pre-pandemic and pandemic

The value-added participation delivers concrete benefits for MSMEs. The value-added contributions (figure 2) that provide tangible outcomes for MSMEs, contribute to a better environment for the workplace, maximise profits, and also involve contribution to long-term sustainability. The Value-added outcome in all MSMEs was constant from 2010 to 2013. It increased in 2014 and remained constant till 2017. A rapid decline was observed in 2018, and from 2013 to 2017, the record increase was calculated for value-added that was upraised from 3.72 to 4160.71 trillion Euros, cumulatively, for all MSMEs.

Figure 2 Contribution of Value-added in EU-27 SMEs



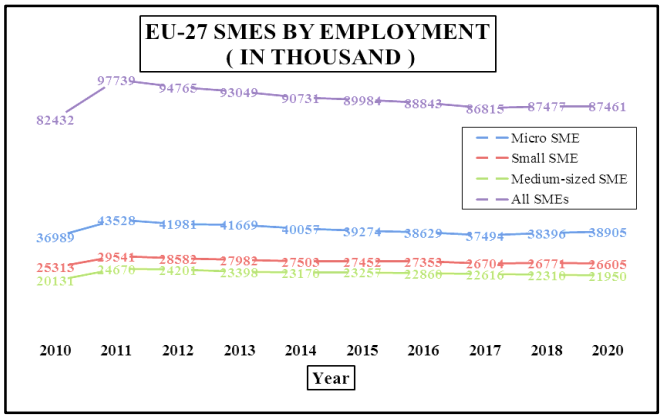
Source: Own processing

In 2018/19, a rapid decline was recorded from 4160.71 to 4.36 trillion Euros, whereas during a pandemic situation in 2020, the value-added was recorded up to 3.34 trillion Euros with continuing to decline. A similar contribution of either Micro or Small and Medium-sized Enterprises was observed, with respective ten years, in terms of value-added during pre-pandemic and pandemic. However, the consequences of the COVID-19 on MSMEs in the period of 2019/2020 were worse for value-added resulting in loss of income and a decrease in the economic growth of EU-27.

3.3 Rate of Employment of EU-27 SMEs during pre-pandemic and pandemic

Figure 3 compared the employment rate of EU-27 MSMEs during the period 2010-2020. The employment level in all MSMEs increased steadily from 2010 to 2017. In 2018, a significant increase was observed in the rate of employment. An increase in the rate of employment in EU-27 MSMEs resulted in favourable effects on the GDP growth of the European Union, as we discussed in figure 2. The hiring of human capital was high in Micro SMEs as compared to Small and Medium-sized SMEs during pre-pandemic. In contrast, during the pandemic, the hiring was less due to the less demand for services and products. Most of the SMEs' operations were closed due to lockdown and hygienic restrictions during the COVID-19 pandemic resulting in a decrease in employment level in EU-27 MSMEs and adverse effects on the GDP growth on the EU-27 economy.

Figure 3 Rate of Employment in EU-27 SMEs



Source: Own processing

3.4 Contribution of SMEs in EU-27 Economy during the pandemic

In EU-27, the % share of Micro SMEs during 2020 declined up to 10.27 % compared to the % share in 2018. At the same time, there was also a decline in the number of Small (13.82 %) and Medium-sized SMEs (17.01%). During the COVID-19 pandemic, the medium-sized SMEs were more intense than the Small and Micro SMEs. Overall, the total number of SMEs was 10.53% lower by 2020 than the pre-COVID-19. On value-added estimation, it was revealed that during the pandemic value-added contribution of Micro SMEs was 30.82% lower than in the pre-pandemic era. Whereas small and Medium-sized SMEs had to face 23.87 and 24.19 % value-added loss. Overall, the total value-added was 26.49% lower by 2020 than the value of 2018. The Medium-size SMEs appointed 20.26% lesser employees in 2020 than the previous year. While, regarding Micro and Small SMEs, their performance difference was 16.24 and 15.41% during the pandemic, respectively. In EU-27 SMEs, 16.99% of employees lost their jobs during the pandemic in 2020.

Table 2 The share of SMEs of EU-27 from 2018 to 2020 (in %)

Performance indicator	Enterprises Size	Difference	Mean	% Difference	Kruskal-Wallis test (*p*- value)
Enterprises No	Micro	2279	22184.5	10.27	25.4
	Small	190	1377	13.80	
	Medium	37	217.5	17.01	
	All SMEs	2506	23779	10.54	-
Value-Added	Micro	0.43	1.395	30.82	4.31
	Small	0.29	1.215	23.87	
	Medium	0.3	1.24	24.19	
	All SMEs	1.02	3.85	26.49	-
Employment	Micro	6539	40259	16.24	25.8
	Small	4228	27427	15.41	
	Medium	4539	22400.5	20.26	
	All SMEs	15307	90085.5	16.99	-

Source: Own processing

Data were evaluated for statistical significance using Kruskal – Wallis test to predict the effect of COVID-19 on the performance of SMEs in the EU-27. According to the statistical analysis, enterprises and employees of the EU-27 have the lowest level of self-evaluation (P-value: > 25.4 and p-value: > 25.8 on a 0.05 point scale), which are statistically insignificant. In comparison, value-added data was found statistically significant (p-value: < 4.31). This study contributed to the analysis of more integrated research of essential competencies for SMEs in the EU-27. It is obvious that additional research in this area is needed.

4 Conclusions

This study evaluated EU-27 SMEs based on an analysis of the connections between SMEs and performance measured during pre-COVID-19 and COVID-19 pandemics. The SME situation of EU-27 was stable and progressive before the pandemic, but during the pandemic, the total number of SMEs, value-add and the number of employment rates were affected and 10.5, 26.49, and 16.99% lower, respectively, by 2020. According to the Kruskal-Wallis test, the key competencies were found statistically insignificant in the case of the size of the enterprise size and employment number; however, value-added was found statistically significant. The COVID-19 outbreak significantly impacted EU-27 SMEs in 2020, with several, although not all, seeing significant revenue reductions. Supply interruptions, an increase in delayed payment, and running business operations at a loss were several major issues that many SMEs encountered in 2020. The SMEs most influenced by the disease outbreak were food and accommodation, service operations, storage and transport, general administration provider activities, and industrial production and manufacturing. SMEs employed a broad range of preventive strategies. Although some temporarily suspended trading, several others took advantage of the various assistance programs put in place by state governments, particularly to pay their salaries, solve liquidity difficulties, and decrease working time and/or personnel. But, COVID-19 mediated lockdown affected the performances of Micro, Small, and Medium-sized Enterprises of 27 countries of the European Union in 2019 and 2020. The world is still experiencing the fourth wave of COVID-19, and new variants of Coronaviruses are emerging from different countries; the outbreak's end is unpredictable. In this scenario, the performance of SMEs might decline in 2021/2022.

Recommendation

SMEs EU-27 must deal with the aftermath of COVID-19. The pandemic significantly impacted SMEs, exacerbating the well-known condition of inadequate resources and a proclivity to fail in their initial years of life. This structural crisis compromises SMEs in several ways, and it is critical to identify strategies to rise and survive from that as well. Considering the significance of SMEs in the economy, little study has been conducted on the consequences of the economic depression on SMEs and how they might cope with a problem. However, the COVID-19 pandemic situation could also open up new chances for Small and medium enterprises in the case of distance e-commerce services. SMEs may benefit from digitalization and innovation. SMEs EU-27 may survive in the COVID-19 pandemic when providing their budgetary, organizational, workforce, and consumer policies are reimagined. However, moving past the outbreak and into a post-COVID future depends on the enterprise's capacity to adapt and address its consumers' demands in new and different ways. Policymakers and distribution network authorities may help EU-27 SMEs by issuing stimulus programs and corporate interests by paying their suppliers on time, not cancelling transactions, and planning better for the future. It is critical to maintaining solid distribution channels.

References

Adiyoh, I. S. et al. (2020). Effect of COVID-19 Pandemic on Small and Medium Scale Businesses in Nigeria. *International Journal of Research Publications*, 56(1).

Aladejebi, O. (2020). Managing Small Businesses in Nigeria during Covid-19 Crisis: Impact and Survival Strategies. *Journal of Business and Management*. 22(8), 24–34.

Al-Fadly, A. (2020). Impact of covid-19 on SMEs and employment. *Entrepreneurship and Sustainability Issues*, 8(2), 629–648.

Aribisala & Olufolarin, O. (2020). Economic impact of COVID-19 lock down on small medium enterprise (smes) in lagos state. *International Journal on Integrated Education*, 3(7), 62–68.

Berisha Qehaja, A. (2021). Response strategies for SMEs in the time of pandemic COVID-19. *Revista Latinoamericana de Investigación Social*, 4(1), 57–64.

Cowling, M., Brown, R. & Rocha, A. (2020). Did you save some cash for a rainy COVID-19 day? The crisis and SMEs. *International Small Business Journal: Researching Entrepreneurship*, 38(7), 593–604.

Dai, R. et al. (2021). The impact of COVID-19 on small and medium-sized enterprises (SMEs): Evidence from two-wave phone surveys in China. *China Economic Review*, 67, 1-20.

Gregurec, I., Furjan, M.T. & Tomičić-pupek, K. (2021). The impact of covid-19 on sustainable business models in SMEs. *Sustainability (Switzerland)*, 13(3), 1–24.

Hamburg, I. (2021). Impact of COVID-19 on SMEs and the Role of Digitalization. *Advances in Research*, 22(3), 10–17.

Hardilawati, W.L. (2020). The Survival Strategy Of Smes During The Covid-19 Pandemic. *Jurnal Akuntansi & Ekonomika*, 10(1), 89–98.

Hedvičáková, M. & Kozubíková, Z. (2021). Impacts of COVID-19 on the labour market - evidence from the Czech Republic. In *Proceedings of the international scientific conference Hradec Economic Days 2021*. 232–241.

Juergensen, J., Guimón, J. & Narula, R. (2020). European SMEs amidst the COVID-19 crisis: assessing impact and policy responses. *Journal of Industrial and Business Economics*, 47(3), 499–510.

Kalemli-Ozcan, S. et al. (2020). COVID-19 and SME Failures. *IMF Working Papers*, 20(207), 1-60.
Klein, V.B. & Todesco, J.L. (2021). COVID-19 crisis and SMEs responses: The role of digital transformation. *Knowledge and Process Management*, 28(2), 117–133.
Kritikos, M. (2020). Ten technologies to fight coronavirus. *European Parliamentary Research Service*, *(April)*. 1–20.
Pedauga, L., Sáez, F. & Delgado-Márquez, B.L. (2021). Macroeconomic lockdown and SMEs: the impact of the COVID-19 pandemic in Spain. *Small Business Economics*.
Priyono, A., Moin, A. & Putri, V.N.A.O. (2020). Identifying digital transformation paths in the business model of SMEs during the covid-19 pandemic. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(4), 1–22.
Sungkawati, E. (2021). SMEs Creative economy in the COVID-19. *Archives of Business Research*. 9(1), 97–105.

The Knowledge Management and Learning Organization

Veronika Zábojníková[1]

Abstract: The aim of the article is to analyze the current state and use of Knowledge Management in companies operating in the car industry in the Slovak Republic. We wanted to focus on employee training, tools for knowledge sharing and knowledge transfer. The article contains a methodology according to which all the necessary calculations are performed and the aim of the work is described and several statistical hypotheses are set. The added value of this thesis lies in the submission of several proposals to improve the state of knowledge management in car companies in Slovakia and to increase efficiency and prosperity in the companies examined.

Keywords: knowledge management, knowledge, education, knowledge sharing
JEL Classification: D83, D80, M53

1 Introduction

According to Mládková (2012), knowledge can be defined in many ways: as information plus intuition and experience or as a changing system with interactions among experience, skills, facts, relations, values, thinking processes and meanings. Many authors distinguish term knowledge from terms of data and information. Brinkley (2008) stated in his publication that information is the way in which knowledge empowers actors with the capacity for intellectual or physical activity. As stated in the article written by Navoni (2015), data is an atomic representation of a concept, an observed fact, a sign or symbol, being natural or artificial.

As stated in a book written by Richter and Weber (2013), knowledge management (KM) is mostly considered as a part of general management in organizations. From this point of view, knowledge is considered as an abstract collection of assets. As with other managed assets, it has to be made clear how the knowledge is obtained, formulated, stored and used for different purposes. The knowledge management, according to Pytel and Strzelecka (2008) affects profits and success of an organization, focuses on the management of intellectual capital of the organization, which embraces structural capital (knowledge), human capital (knowledge of employees) and creation of customer capital.

Authors Šajbidorová, Lušňáková and Hrdá (2018) define Knowledge Management as a strategy that transforms the intellectual capital of an organization, both by recording information and the talents and knowledge of employees, into higher productivity, new values and higher competitiveness. In current management approaches, we encounter the terms: innovation management, product design, processes and more. According to Kapsdorferová and Švikruhová (2020), the innovation process is based on the need to obtain data on the performance of the process, the subsequent processing of information and the need for knowledge through which the innovation process can be achieved. The basic method of acquiring knowledge is learning, which is inextricably linked to knowledge. according to Dvořák (2012). Folwarczná (2010) defined learning organization as follows: Under organizational learning, one can imagine an effort to create an environment that is conducive and supports learning. Education is an activity, learning is a personal result, increasing the skills and abilities of a worker, so the education system must lead to the achievement of the given goals, which also corresponds to the view of knowledge as a certain action, as explained by Horváthová, Wojčák and Poláková (2019). After setting the goals of the company, which wants to achieve through training, it is necessary to choose the appropriate method, according to Child and Ihrig (2013). Although knowledge is the most important resource of an organization, according to Monte (2020), it is very difficult to document and access knowledge, there is a risk that it will be lost and the knowledge will disappear.

2 Objectives, Methods of research and Material

The main aim of the article was to map what forms of education, tools for knowledge transfer, and resources are used by car companies, how they perceive the flow of information in their companies between management and employees, and whether companies invest in employee education and preservation of their acquired knowledge and skills. Moreover, we wanted to find out if the organizational structure affects the flow of information within the organizations or not. We collected the data with the help of an online questionnaire survey, as the paper version of the questionnaire was not

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possible due to the ongoing pandemic. This online questionnaire was sent to about forty companies in the Slovak Republic, which focus directly on automotive production or are among the key suppliers to automakers, but the return of responses was lower than we expected The method meets the requirements of simplicity and efficiency, like the ability to obtain all the data needed to examine the attitude of companies to the issues of knowledge management, according to Bačíková and Janovská (2018).

The article aimed to confirm or reject four hypotheses. Testing statistical hypotheses is one of the most important tools of mathematical statistics, as stated by Aleš Kozubík in his online publication (2017). The Chi-Square Test of Goodness-of-Fit is used to find out how the observed value of a given phenomena is significantly different from the expected value, defined by Otipka and Šmajstrla (2012). The formula is:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

where: c=Degrees of freedom; O=Observed value(s); E=Expected value(s)

The Chi-Square Test of Independence is commonly used to test the statistical independence or association between two or more categorical variables, as defined by Otipka and Šmajstrla (2012).

First of all, we needed to calculate and interpret the results of the selected hypotheses, which we determined in the objectives of this work. In the following 3 hypotheses, we used for calculations the Chi-Square Test of Independence.

The first hypothesis is:

H0: The flow of information in the organization does not depend on the structure of the organization

H1: The flow of information in the organization depends on the structure of the organization

Figure 1 Results of statistical examination of the first hypothesis

TEST STATISTICS	8,888889
CRITICAL VALUE	**5,991465**
P-VALUE	**0,011744**

Source: Own Elaboration

Based on the Chi-Square Test we accepted H1 and rejected H0 because TS>CV. Based on these results, we can say that there is a certain relationship between the organizational structure and the flow of information. The type of organizational structure has an influence on the flow of information in the companies, but it is not that significant influence.

The second hypothesis is:

H0: Provided education by the companies for employees does not depend on the view of the companies over employees.

H1: Provided education by the companies for employees depends on the view of the companies over employees.

Figure 2 Results of statistical examination of the second hypothesis

TEST STATISTICS	5,461309524
CRITICAL VALUE	12,59158724
P-VALUE	0,486145255

Source: Own Elaboration

Based on the Chi-Square Test we accepted H0 and rejected H1 because of TS <CV. Based on these results, we can conclude that whether the companies invest or not into education and training activities for their employees, it does not have an influence on how companies perceive their employees.

The third hypothesis is:

H0: Employees willingness to share knowledge does not depend on the willingness of companies to promote a culture of sharing the knowledge.

H1: Employees willingness to share knowledge depends on the willingness of companies to promote a culture of sharing the knowledge.

Figure 3 Results of statistical examination of the third hypothesis

TEST STATISTICS	3,696969697
CRITICAL VALUE	5,991464547
P-VALUE	0,157475585

Source: Own Elaboration

Based on the Chi-Square Test we accepted H0 and rejected H1 because of TS <CV. According to these results, we can say that willingness of employees to share their knowledge does not depend on what culture companies promote. We could say that such sharing is completely individual and it differs from employee to employee. For example: If a company wants and supports sharing the information, not all employees do so.

Interpretation of the hypothesis calculated by the Chi-Square Test of Goodness-of-Fit is:

H0: In the Chi-Square goodness of fit test, the null hypothesis assumes that there is no significant difference between the observed and the expected value.

H1: In the Chi-Square goodness of fit test, the alternative hypothesis assumes that there is a significant difference between the observed and the expected value.

Figure 4 Results of statistical examination of the Chi-Square Test of Goodness-of-Fit

CH-SQUARE TEST	**5,00**
DF	1
P-VALUE	0,025347

Source: Own Elaboration

Based on the Chi-Square Test we reject H0 and accept H1. That means that there is a significant difference between observed and expected values. We can conclude that our expectations were beyond, the reality is that more than 50 % of companies promote a culture of knowledge sharing, which is beneficial for both sides – companies and their employees. Employees can have better access to the information they need and the company can capture and store the knowledge in their system, so it will not get lost.

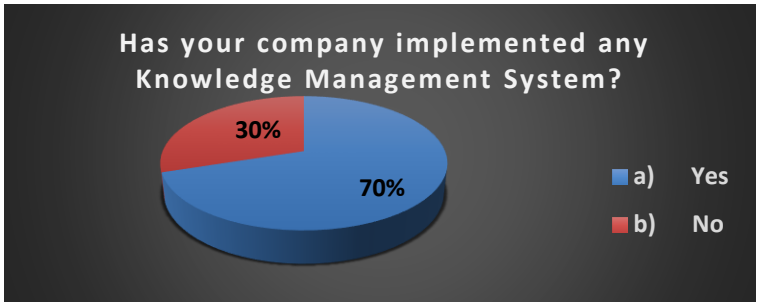
3 Research results

As previously mentioned, the focus of the survey was placed on car companies and their suppliers in Slovakia. Twenty companies took part in the survey, for example, all four car manufacturers in Slovakia – VW, Kia Motors, PSA, and Jaguar Land Rover. All of these companies are large multinational car producers employing thousands of people all over the world. We would like to note that all respondents answered only on behalf of the Slovak divisions of these multinational companies. Among the car suppliers, companies like Matador, Faurecia, Adient or Grupo Antolin took part in the survey, as well as smaller international and Slovak-based companies, such as SMP, SMRC, Wohrle, Ribe, Gestamp, Auria Solutions, Kongsberg Automotive, Slomatec, Marellu, Boge, Yanfeng, and Syncreon.

One of the questions was focused on the Knowledge Management System. The main aim of this question was to find out if companies have implemented any kind of KM systems, where knowledge can be stored and shared. Here, the respondents had an opportunity to fill in the optional question: If yes, please write, what kind of KM system the company implemented, where they could specify what kind of system their companies have implemented and use.

Graph 1 is showing, that 70 % of companies have implemented KM systems. From the answers available to us, from an optional open question, companies use various systems, like SAP, SharePoint, or Intranets. Few companies, however, do not use any Knowledge Management System which makes 30 % of all companies.

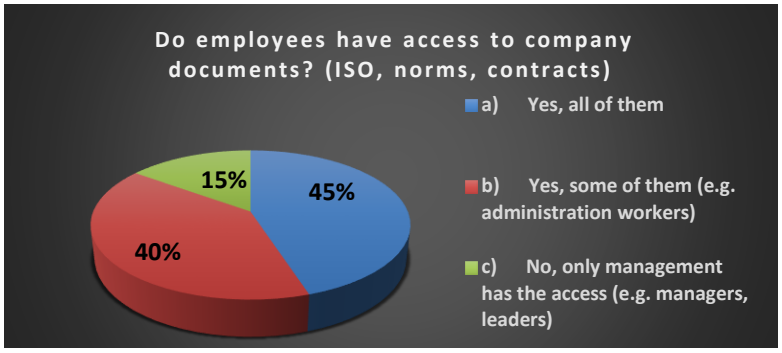
Graph 1 Knowledge Management System



Source: Own Elaboration

This question focused on how companies store information and knowledge and who has access to it. If the company restricts access, employees do not have enough knowledge to be able to perform work tasks properly. If the company does not store knowledge and information, it is highly probable that the employee will leave the company with his / her tacit knowledge and the organization will lose this knowledge. Graph 2 shows that 45 % of companies allow all employees to access the company documents. 40 % of companies stated that only some workers have access to the documents and 15 % of companies do not allow access to information to their employees, only the management can view such documents.

Graph 2 Documents access



Source: Own Elaboration

The following question is closely related to the previous one. Here we asked if employees are generally willing to share the results of their work, their knowledge, and know-how. Graph 3 shows the percentage distribution of responses. 40 % of companies said that their employees share their knowledge with others. As many as 55 % of companies admitted that only some employees are willing to share their knowledge, and 5 % of companies stated that employees do not share the knowledge they have acquired with each other.

Graph 3 Willingness of employees to share knowledge

Source: Own Elaboration

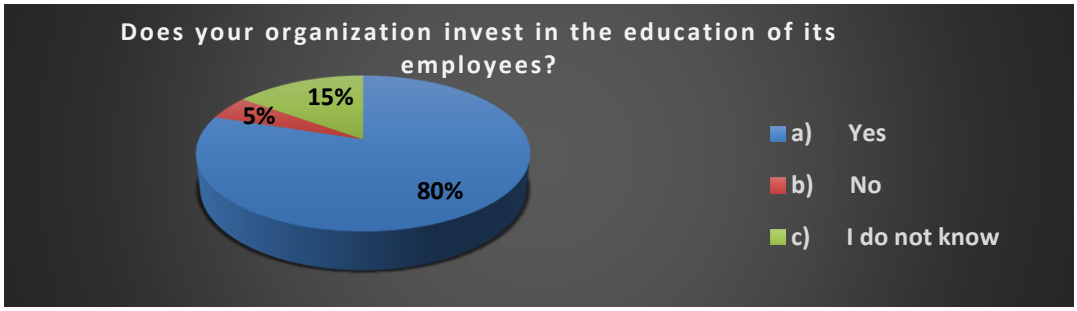
Here, we asked if companies generally support employees in sharing their knowledge and work results. Graph 4 shows that up to 75 % of organizations support and promote the sharing of information and knowledge between their employees and 25 % of companies do not promote such sharing.

Graph 4 Culture of sharing the knowledge

Source: Own Elaboration

In the following question, we found out whether companies invest in the education of their employees. Thanks to education, employees can create new knowledge. We can see in the graph that up to 80 % of companies invest in educational activities. 5 % of companies do not invest and in the case of the remaining 15 % respondents stated that they do not know whether the company invests in employee training.

Graph 5 Education of employees

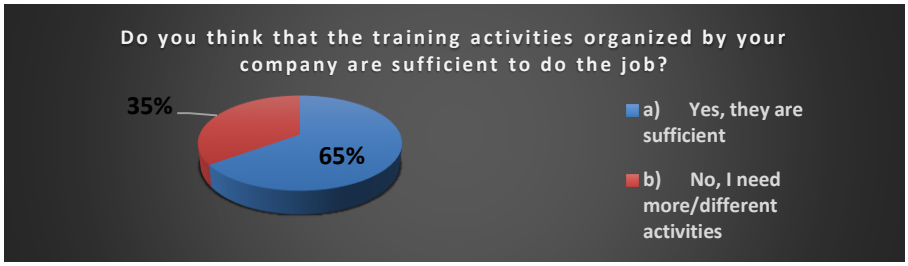


Source: Own Elaboration

In the next question, respondents were able to choose from several options for educational activities organized by their company. They could also tick more than one option, or in the item Others, they could also write another form of education if it was not in the list. The most common forms of training, knowledge creation and transfer of information in companies are instructions on how to do work (a) -17 answers, training and courses (n) – also 17 answers (in general) and workshops (f) – 12 answers. Other widely used forms of knowledge sharing are teambuilding (m) - 10 answers and coaching/mentoring (c) – also 10 answers. Slightly fewer companies use the method of brainstorming (h) - 8 answers and work rotation (k) - also 8 answers, then a delegation of tasks (i) with 7 answers and a demonstration (b) with 6 answers were placed. The least used forms of education and information transfer are assistance (g) - 5 answers, case studies (d) - 3 answers, even less used are simulations (j), role-playing (l), learning stations (o), and lectures (p) - all 2 answers. Only one single response was recorded at the possibility of storytelling (e) and only one respondent took advantage of the opportunity and scored other methods such as benchmarking and e-learning, whose importance and usage have multiplied during the pandemic. We can see that companies use a huge variety of trainings such different methods allow employees to find the most suitable way to learn new things and thus create new knowledge.

The following question builds on the previous questions about education. We wanted to know if the activities that the companies organize are sufficient to perform the work. Based on graph no. 6 we can assess that in 65 % of companies the educational activities are sufficient for employees. In 35 % of cases, training is not enough and respondents would welcome more training or other forms of education.

Graph 15 Sufficient trainings



Source: Own Elaboration

4 Conclusion

The main goal of the work was to find out how car companies in Slovakia work with the knowledge of their employees, how they support its sharing and creation, for example in the form of educational activities. We also wanted to know if companies are investing in employee training, what tools they use to share knowledge. Most companies stated that they have a Knowledge Management System in place, and some have even indicated what types of systems they use. However, 30 % of companies stated that they do not have any system. In this case, I would recommend companies to invest in such a system. The risk of losing unsaved knowledge and information is very high. There are multiple companies on the market offering various types of KMS, so companies can choose a KMS that would suit them and their operations, procedures and staff the most. Most companies stated that they have internal guidelines that employees should follow and at the same time, companies strive to give employees access to the documents they need to do their jobs.

We asked whether the companies themselves support the sharing of knowledge in their organizations, and as the results show, most companies really support it. So, we can see that companies want employees to share what they know. Yet despite companies' attempts to encourage knowledge-sharing, many employees withhold what they know. When it comes to the education of workers, the majority of companies invest in education, and all companies in our survey have provided some educational activities. Companies use various tools to share and create knowledge, they also provide various forms of education. In cases where respondents stated that the educational activities that their companies provide are not sufficient, I would recommend that these companies conduct a survey among employees about which courses they would be interested in and would actually help the workers with their work tasks and then try to provide them. Companies should divide the trainings to compulsory and optional, so employees can choose to create a new knowledge in a different field or expand their already existing knowledge. Such options offered by managements of companies could boost knowledge expansion and Innovation within the companies.

References

Brinkley, I. (2008). The Knowledge Economy: How Knowledge is Reshaping the Economic Life of Nations. In: Business and Management, 1.3. 2008 Retrieved from: https://www.bl.uk/collection-items/knowledge-economy-how-knowledge-is-reshaping-theeconomic-life-of-nations

Bačíková, M. & Janovská, A. (2018). Základy metodológie pedagogicko-psychologického výskumu. Sprievodca pre študentov učiteľstva. Košice: Univerzita Pavla Jozefa Šafárika v Košiciach; ŠafárikPress, 18.12.2018. ISBN: 978-80-8152-695-4

Child, J. & Ihrig, M. (2013). Knowledge, Organization, and Management. Oxford: Oxford University Press, 2013. ISBN: 978-0-19-966916-5

Dvořák, L. (2012). Management znalostí / Strategie předávání znalostí Část 2. In: HR News, 13.12.2012 Retrieved from: https://www.hrnews.cz/lidske-zdroje/rozvoj-id2698897/management-znalosti-strategie-predavani-znalosti-cast-2-id-174524

Folwarczná, I. (2010). Rozvoj a vzdělávání manažerů. Praha: Grada, 2010. ISBN: 978-80-247-3067-7

Horváthová, J. & Wojčák, E. & Poláková, M. (2019). Vzdelávanie a rozvoj zamestnancov. Košice: Elfa, s.r.o. 2019. ISBN: 978-80-8086-274-9

Kapsdorferová, Z. & Švikruhová? P. (2020). Manažment kvalit. Nitra: Vydavateľstvo SPU v Nitre, 2020. ISBN: 978-80-552-2230-1

Kozubík, A. (2017). Základy matematickej štatistiky. In: Katedra Matematických metód, Fakulta Riadenia a Informatiky, Žilinská Univerzita v Žiline, 13. 05. 2017. Retrieved from: https://invimath.fri.uniza.sk/images/slides/PaS/Testy_hypotez.pdf

Mládková, L. (2012). Management of Knowledge Workers. Bratislava: Iura Edition, p. 18 ISBN: 978-80-8078-463-8

Monte, J. (2020). What is Knowledge Management and Why is it Important to Your Company? In: Edsi Solutions, 8.4. 2020 Retrieved from: https://www.edsisolutions.com/blog/what-is-knowledge-management-and-why-is-itimportant-to-your-company

Navoni, L. G. (2015). About Data, Information, Knowledge Relationships and their representation. In: Medium. 28.1. 2015 Retrieved from: https://medium.com/@lorisnavoni/about-data-information-knowledge-relationships-andtheir-representation-b1599f70130b

Otipka, P. & Šmajstrla, V. (2012). Pravděpodobnost a statistika. In: TU, Ostrava, 2012, 269 s., ISBN 80-248-1194-4

Pytel, M. & Strzelecka, A. (2008). Knowledge Management in the Aspect of Creation of Work Potential of an Enterprise of the 21st Century. In: Management – International Conference 2008. Prešov: Prešovská Univerzita v Prešove, 128-134 p. ISBN: 978-80-8068-849-3

Richter M.M. & Weber R.O. (2013). Knowledge Management. In: Case-Based Reasoning. Springer, Berlin, Heidelberg. ISBN: 978-3-642-40166-4

Šajbidorová, M. & Lušňáková, Z. & Hrdá, V. (2018). Organizácia manažérskej práce. Nitra: Vydavateľstvo SPU v Nitre, 183-190 p. ISBN: 978-80-552-1916-5 Mundell, R. A. (1968). *International economics*. New York: Macmillan.

The Relationship between Managerial Accounting and Decision Making

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Abstract: The article deals with the issue of the relationship between managerial accounting and decision making which plays the central role when the managerial team is called to make important decisions in every enterprise. Decision making is one of the most important functions of managerial accounting. Any decision that needs to be made should not be treated as a single event. Any present behavior reflects a past but also announces the future results of a particular decision. The paper aims to identify the linkage between managerial accounting and decision making knowing that the decision making has, therefore, become an integral part of the managerial accounting process by providing information for managers who must plan, supervise and decide in a changing business environment, highly competitive, characterized by imperfect information, disparate objectives and control problems within the enterprise.

Key words: Managerial Accounting, Decision Making
JEL Classification: M41, D81

1 Introduction

Managerial accounting provides necessary information to assist management in decision making. According to Diaconu (Diaconu, 2006), managerial accounting is concerned with the future, and what will happen. Also, is the one that tends to decompose analytically as possible the activity of an entity and serves managers at different organizational levels for their information needs (Briciu and Teiuşan, 2006).

Managerial accounting is a fundamental part of decision making. It is a handy tool in decision making given that managers need, various information about the evolution of the economic within organizations they lead, from detailed knowledge of costs and to model the behavior of decision makers (Talpeş, 2010). One more characteristic of managerial accounting is that quantifies and reports financial and non-financial information, to help managers in making decisions to achieve organizational objectives.

Managerial accounting not only helps managers in decision making by providing the right information, but also by applying analytical techniques to different situations, from which executives chooses and makes the most appropriate decision (Dam et al., 2017).

2 Managerial Accounting

The financial problems that arise within a company are called to be solved with the help of managerial accounting techniques. Managerial accountants are the ones who are responsible for applying the techniques, setting the objectives and organizing the plans that control the operation, investment and financing activities of the company (Crosson and Needles, 2008). In order to perform these actions, they must have the knowledge and the appropriate skills that will help ensure the proper use of resources so that the operation of the company is in accordance with the regulations, obeys the laws and performs to the maximum. Therefore, managerial accounting acquires great importance from the constantly emerging financial issues.

The existence of managerial accounting over the past decades has shown its need and importance (Dam et al., 2017). The distinguished aspect of managerial accounting is that, it provides information for internal decision making (Üç, 2016). Nowadays, managerial accounting really becomes a scientific tool helping managers perform well in planning, organizing, controlling and evaluating business activities (Dam et al., 2017).

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So, the role of managerial accounting is to provide useful and relevant information to help management in planning all the activities of the enterprise, controlling the results and rational decision making to achieve organizational targets (Saremi and Nejad, 2013).

Managerial accounting measures and produces economical information which is useful to users for conscious decision making (Saremi and Nejad, 2013). This information helps managers to make operating, tactical, and strategic decisions, thus providing a uniform framework for developing decision-making skills.

Managerial accounting plays an important role in the development and substantiation of decisions within an entity because managerial accounting information helps the manager to give answer to two important questions. The first one is how to allocate resources entrusted by investors to achieve their stated objectives and the second one is the way they were used the allocated resources (Topor et al., 2011).

Some of the management philosophers consider the decision making as foundation and basis of duties of a manager and some consider decision making as one of the main duties of managers (Saremi and Nejad, 2013).

3 Decision Making in Managerial Accounting

According to Hulle the decision making is the most important function of managerial accounting (Hulle et al., 2011) and is a means of expressing the skills of those who run the business. The ability to make decisions at the right time and implement them respectively, are the elements that characterize a high-level management team.

Decision making has long been regarded as a cognitive process resulting in the selection of a course of action among several alternatives (Tichá et al., 2010).

Decision-making is defined as: "a choice between all the alternatives so that the administrative development reaches a certain what to play and what should not play in a certain position" (Awawda, 2007). There are those who believe that the decision-making process is "an alternative from among several alternatives to choose after extensive study (Al-Otaibi, 2004) and analysis of the aspects of the problem is the subject of the resolution (Alsayyed, 2015).

In managerial accounting, decision making can simply be defined as the choice of a particular course of action among the available alternatives. If there are no alternatives, then no decision needs to be made. A major assumption is that the best decision is the one that generates the most revenue or has the lowest cost. The obligation of the manager in cooperation with the managerial accountant of each company is to act in such a way that to lead taking the best of the alternatives that exist.

Decision making process is a process of creating value for business, through planning, controlling and evaluating performance. In other words, business value results from good management decision. Quality decision making can only consistently occur by reliance on valuable information. So, the relevance of managerial accounting is crucial for success of a manager and for success of a company or organization (Mihăilă, 2014).

Decision making is not a separate function, but a combination of all three functions: planning, organizing implementation and evaluating. All of them require a decision. Most management accounting information serves the decision making function (Dam et al., 2017).

The art of decision making provides a variety of approaches, methods and techniques helpful and useful for making high quality of decision (Kidane, 2012).

After a managerial decision is taken, it is transformed into a decisional act and the management team formulates a solution to the problem in the shortest time possible, according to its own capacity (Țirău et al., 2018).

Users of decision making models strictly follow predefined stages (Pranjić, 2018). These models usually include the following steps: identify the problem, gather information, identify alternatives, weight evidence, choose among alternatives, take action, and review your decision (University of Massachusetts, 2018).

Since the managerial accounting provide the management team with the pieces of information needed to reveal the general idea of what goes on in the entity, the managers, using this information, can make permanent decision and anticipate their effects, also having a control on the effectiveness. This view helps clarifying the areas in which managerial accounting offers support for the managers in order to make the most efficient decision (Țirău et al., 2018).

On one hand, decision-making is considered a daily and required task for managers, since it is related to the performance of each of their managerial functions. On the other hand, this process may be discussed also as a tool for

increasing the organizational efficiency due to the fact that improving managers' decision making skills, leads to a more successful realization of the objectives and tasks of the organization (Ivanova-Stankova, 2015).

Making managerial decisions turns out to be a major and extremely responsible task for each manager since, on one hand, it integrates and becomes a basis for realization of each managerial function, and on the other hand, the result of the decision made affects all participants and aspects of the management activity, and hence it affects the competitive power of the organization in general (Ivanova-Stankova, 2015).

Making decisions is a matter of a huge responsibility for the managers not only against the organization itself, but against their employees and other stakeholders, as well. The goals identification, providing alternatives for solving the problems and the weighing and balancing the values and interest are crucial for the quality of decision making (Flueler and Blowers, 2007). The quality and speed of decision making (McGregor, 2010) is the key determinant of board success or failure (Negulescu and Doval, 2014).

Mullins (Mullins, 2000), Moorhead and Griffin (Moorhead and Griffin, 2000) posit that decision making is one of the first and a crucial step in management. Good and effective decisions can only be made when right information is made available at the right time to the right recipient (Kidane, 2012).

Johnson, Newell and Vergin (Johnson et al., 1972) stated that information for decision making is dynamic; therefore, it needs to be constantly up-dated. Managers need continuous flow of information in order to make appropriate decisions. Decision making efficiency of managers can therefore be greatly enhanced by the quality of information they are able to utilize in decision making (Kidane, 2012).

4 Methodology

In Cohen, Manion and Morrison (Cohen et al., 2007), we find the view expressed by Kaplan (Kaplan, 1973), that in essence the research methodology aims to help us understand its steps and course, and not the specific scientific field or case study for which we conduct research.

Our research focused mainly on data collection from secondary sources. These sources mainly concern articles in scientific journals, scientific books, online bibliographic databases, which create frameworks for reflection, controversy and reflection.

In the decision making area, when managers have to decide whether or not to start a particular project, they need help from managerial accounting information to estimate the economic benefits and the various business opportunities and decide what is good to choose. The information provided by managerial accounting is of vital importance in the management of a company, because they ensure a good management in decision making (Breuer et al., 2013).

A specific procedure is followed to make any decision within a company. Initially, all the available alternatives are identified and recorded, as well as the data that will help in judging the solution as efficient or not. Then the effects that each of the solutions will have on the business are identified and presented in detail. After studying all the above, the alternative that has been evaluated as the most efficient is selected, that is the one that meets all the necessary conditions. Finally, it is applied and then within a certain period of time the results that has brought to the company are collected and compared with those that were initially assumed, if the results coincide with the desired then the solution chosen was the most appropriate if not, then the process of finding the best alternative have to be repeated (University of Massachusetts, 2018).

5 Research Results

Managerial accounting for decision-making has been established in many organizations and businesses. However, since it was introduced in the early stages, it was not really focused. Managerial accounting models of many organizations and enterprises are not organized in a scientific way, the separation of content between financial accounting and managerial accounting is not clear (Dam et al., 2017).

The use of managerial accounting can help and drive a business to achieve its goals and operate effectively in all its sectors. Most managers make decisions based on their own experience, and they rely on the return that the company makes when making those decisions. Quite a few leaders know models and decision-making algorithms (Dam et al., 2017). Managers of businesses evaluate all the decision alternatives with the help of information given by managerial accounting.

Managerial accounting helps every business to improve its financial health. This is achieved by making the right short term and long-term decisions.

Decision making is one tool to achieve organizational goals. Incorrect decision making can have an impact on organizations that can be felt directly and influence future decision making (Meiryani et al, 2020).

According to Anderson (Anderson, 2015) many organizations want to be data-driven but few actually are. Organizations are never truly data-driven if the analyses are not acted upon (Anderson, 2015). Being truly data-driven is not only about having the right technology, but also about the mindset of all employees (Kiron, 2017; Mitzner, 2016).

According to Kiron (Kiron, 2017), many organizations struggle to incorporate data into their everyday decision-making. Organizations are becoming data-driven and instead of asking "what do we think" start asking "what do we know" (McAfee & Brynjolfsson, 2012).

6 Conclusions

Managerial accounting is a very important tool in decision making because it provides all the needed information to managers of the companies. That is the reason why managerial accounting considered as one of the most basic parts of decision making.

Thus, managerial accounting provides management with the primary and necessary information to understand how all business processes are developed and carried out within a given period of time, and this piece of information helps to make the most appropriate decision for improvement of the activity of each company.

The concept of managerial accounting has a significant impact on the decisions made in the enterprises, which clearly underline the sources from which managerial accounting receives its information.

Decision making is one important tool that helps companies achieve their organizational goals. The results of making the right or not decisions, most of the time, are visible to any company immediately. The results of these decisions influence and the future decision making.

Decision making helps any company to make safe steps that will lead it in its future success. So, it is critical for the future of any company. At the same time, decision making uses relevant information from all departments of the organizational structure. These informations are provided by the managerial accounting. It can be stated that all the information provided by managerial accounting helps in the process of decision making. So, the result is that this process can forecast and secure the good evolution of the economic activity of any company.

References

Al-Otaibi, M. (2004). Following the informal organization in managerial decision-making in the security organizations. Naif Arab University for Security Sciences, Riyadh, Saudi Arabia.

Alsayyed, S. (2015). The Impact of the use of Modern Management Accounting Techniques to Streamline Decision-Making in the Jordanian Industrial Companies Dr. Saleh Mohammad Al-Sayyed Accounting department. Isra university, P.O Box 22, code 11622, Amman – Jordan.

Anderson, C., 2015. *Creating a data-driven organization: Practical advice from the trenches*. O'Reilly Media Inc, Sebastopol.

Awawda, A. (2007). The factors affecting the decision-making among workers in Jordan Ministries. University of Jordan, Amman, Jordan.

Breuer, A., Frumusanu, M. and Manciu, A. (2013). The Role of Management Accounting in the Decision Making Process: Case Study Caras Severin County. *Annales Universitatis Apulensis, Series Oeconomica*, Vol. 15(2), 355-366.

Briciu, S. and Teiuşan, S. C. (2006). The Informational System of Managerial Accounting. *Journal of Annales Universitatis Apulensis Series Oeconomica*, Vol. 8(1).

Cohen, L., Manion, L., & Morrison, K. (2007). Research methods in education (6th ed.). Routledge/Taylor & Francis Group.

Collins, B. (1999). Collins Concise Dictionary 4th edition. United Kingdom: HarperCollins Publishers Ltd.

Crosson, S. and Needles, B. (2008). Managerial Accounting, 8th edition.

Dam, H., Dam, M. and Doan, A. (2017). The System of Management Accounting Information to Support Decision Making in Business. *Accounting and Finance Research*, 7, 99.

Diaconu, P. (2006). *Managerial accounting & Business Plans*. Economic Publishing House, Bucharest.

Flueler, T. and Blowers, A. (2007). Quality in decision making process, Insights, COVARN 2 WPs project, 13-15.

Fotache, G., Fotache, M., Bucsa, R. and Ocneanu, L. (2011). The Changing Role of Managerial Accounting in Decision Making Process Research on Managing Costs.

Hulle, J., Kaspar, R. and Moller, K. (2011). Multiple Criteria Decision-Making in Management Accounting and Control-State of the Art and Research Perspectives Based on a Bibliometric Study. *Journal of Multi-criteria Decision Analysis*, 18, 253–265.

Ivanova-Stankova, L. (2015). Management decisions - realization and assessment. *Trakia Journal of Science*, 13, 233-239.

Johnson, R. A., Newell, W. T. and Vergin, R. C. (1972). Operations management – a system concept. Boston: Houghton Miffin Co., 6-10, 208.

Kaplan, A. (1973) The Conduct of Inquiry. Aylesbury: Intertext Books.

Kidane, F. (2012). Decision Making and the Role of Management Accounting Function - *A Review of Empirical Literature*.

Kiron, D., 2017. Lessons from Becoming a Data-Driven Organization. *MIT Sloan Management Review*, 58 (2).

McAfee, A. & Brynjolfsson E., 2012. Big Data the Management Revolution. *Harvard Business Review*, 90(110), 60-68.

McGregor, L. (2010). Improving the quality and speed of decision making. *Journal of change management*, 344-356, published online.

Meiryani, Pariang Siagian, R.A. Aryanti Wardaya Puspokusumo, Lusianah (2020). Decision Making and Management Information Systems. *Journal of Critical Reviews*, 7 (7), 320-325.

Mihăilă, M. (2014). Managerial Accounting and Decision Making, in Energy Industry. *Procedia - Social and Behavioral Sciences*, 109, 1199-1202.

Mitzner, D., 2016. What is a data-driven company? Infoworld. Downloaded 2017-03-14: http://www.infoworld.com/article/3074322/big-data/what-is-a-data-drivencompany.html

Moorhead, G. and Griffin. W. R. (2000). Organizational Behavior: Managing people and organization. Delhi: AITB, 5th edition.

Mullins, J. L. (2000). Management and organizational Behavior. London: Pearson Education, 5th edition.

Negulescu, O. and Doval, E. (2014). The Quality of Decision Making Process Related to Organizations' Effectiveness. Procedia Economics and Finance, 15.

Pranjić, G. (2018). Decision Making Process in The Business Intelligence 3.0 Context. Ekonomska misao, 2, 603-619.

Saremi, H., and Nejad, B. M. (2013). Role of Management Accounting in Managerial the Decision Making of Enterprises. Elixir Finance Management, 65B, 19859-19866.

Talpeş, C. G. (2010). Managerial accounting: The Line between Traditional and Modern. Scientific Session "Excellence in business, present and perspectives", West University Timisoara.

Tichá, I., Hron, J. and Fiedler, J. (2010). Managerial decision making - importance of intuition in the rational process. *Agricultural Economics*. 56. 553-557.

Ţirău, A. I., Gînţa, A. I. and Marin Pantelescu, A. (2018). Influence of Managerial Accounting in the Decision Making Process, "Ovidius" University Annals, *Economic Sciences Series*, XVIII (2/2018).

Topor, D., Dorin, I. and Putan, A. (2011). The Role of Cost Information in Decision-Making. Case Study. *Annales Universitatis Apulensis Series Oeconomica*, 2, 5-15.

Üç, M. (2016). The Use of Managerial Accounting as a Tool for Decision Making by Manufacturing Companies in Albania. *Journal of Accounting, Auditing and Finance*.

University of Massachusetts (2018). https://www.umassd.edu/fycm/decisionmaking/process

Innovations and their impact on the performance of companies in the Czech Republic

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Abstract: Innovative business activities are an integral part of business management and building. The subject of the research is the evaluation of innovation activities of small and medium-sized enterprises in the Czech Republic with a focus on innovation strategies, innovation process and also the economic evaluation of implemented innovations. The aim of the paper is to analyze the innovation activities of small and medium-sized enterprises. The paper contains an evaluation of trends in innovation activities of small and medium-sized enterprises from various business areas. The results show that small and medium-sized enterprises have focused innovation strategies in a similar way, but the reasons for introducing innovations differ.

Keywords: Innovation, Innovation activities, small enterprises, medium-sized enterprises, Czech Republic
JEL classification: O00, O11, O30

1. Introduction

From the very beginning of private enterprise, innovation has been an integral part of building and managing businesses. Over the last decade, innovation, resp. Innovation strategies have become the only possible cross-sectoral strategy, especially with regard to unprecedented competition, market liberalization and globalization processes. The economic surplus in developed countries, automation and the associated development of information technologies are only a fraction of the list of factors influencing the unprecedented innovation activity of companies (Novák, 2017). Innovation is usually measured and captured through surveys, various analyzes, case studies and peer reviews, with the vast majority of available statistics focusing on the business sector. In order for innovation activity to be measurable, it must be defined. For more than twenty years, OSLO has provided a manual defining innovation, but only for use in statistical measurement in the business sector. Innovation surveys have been conducted in the public and household sectors, but there is no international standard providing definitions that would apply in these sectors. This is a significant gap that hinders analysis and understanding of innovation across the economy - how innovation in one sector is affected by activities in another (Fitjar & Rodriguez-Pose, 2015; Forsman, 2011). We would find countless definitions of innovation, the cores of these definitions usually focus on creating new and improved products, processes, marketing and organizational business models. Innovation is measured in terms of incidence, activities, outputs and results. Given the close link to economic growth, policy makers and researchers are interested in understanding and supporting activities that lead to innovation activities (Gault, 2018; Keller et al. 2018).

By investing, we increase the stock of capital, while the amount of investment depends on the part of the income that people do not use for immediate consumption, but save it. If we assume that all savings will be used for investment, then we can consider investment and savings as a constant share of income, we are talking about the so-called basic macroeconomic identity, ie savings equal investments (Colander & Gamber, 2006).

Innovation thus drives economic growth through investment, but also helps to address various social challenges. Innovation can mitigate climate change, promote the idea of sustainable development and promote social cohesion at all levels. The advantage of using a general definition of innovation is that innovation can be measured in a consistent way across all sectors and new indicators are being developed that describe the interactions between market players and sectors. These indicators can be used to inform about the expected development of innovation activities and to monitor and evaluate the current situation. This approach to a systemic understanding of innovation is a major benefit of the general definition. At this general level, we understand innovation as a new or improved product or business process, which then differs significantly from previous processes or products (Gault, 2018).

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Innovation and competitiveness

We understand competitiveness as the ownership of a certain ability, skill or know-how of a company, necessary for sustainable economic growth in a competitive environment. Ferreira et al. (2017) defines competitiveness as a set of policies, institutions and factors that determine the level of productivity of each economy and the resulting ability to generate wealth and return on investment and thus explain the potential for economic growth. For a definition of competitiveness to be meaningful, it needs to be understood as including a relative comparison of growth rates or performance comparisons, in order to assess how well each market participant has performed in developing its capacity for innovation and growth.

Ferreira et al. (2017) describes a set of factors that affect the economy and that also support innovation activities. The author mentions the human and financial resources allocated to scientific and technological progress, the level of technological sophistication, public policies focusing on innovation-related activities, including intellectual property protection, fiscal incentives for innovation, the implementation and promotion of antitrust laws to prevent market abuse. , promoting innovation based on market competition and the overall openness of the economy to trade and investment. Innovation has become a crucial challenge in global competitiveness. To succeed, businesses need to know how to meet this challenge and reap the benefits of innovation to create and commercialize new ideas. In advanced economies, the production of standard products using standard methods does not allow a competitive advantage to be achieved. Companies need to demonstrate their ability to innovate in global markets, create and market new products, push the boundaries of technology and evolve faster than their competitors. This global innovation is characterized by their ability to produce goods and services capable of meeting market needs within free and fair markets.

Open innovation

We understand open innovation as the use of targeted outflows and inflows of knowledge to accelerate internal innovations and expand the company's scope of operations. Chesbrough & Bogers (2014) then define Open Innovation as a distributed innovation process based on purpose-driven knowledge flows across organizational boundaries using monetary and non-monetary mechanisms in line with the organization's business model. Open innovations are based on different research streams, so it is appropriate to organize them into the following perspectives:

1. Structural perspective, division of labor increases in the case of open innovations. We find a strong trend towards outsourcing and value chain is becoming more and more fragmented. The main reason is the reduction of costs and the narrow specialization of companies with regard to the advent of constantly evolving technologies.
2. The user perspective, when the users of the output of the innovation process of integration are already at the very beginning of this process, it allows to understand the requirements of customers, in the sense of mass customization. This is one of the best explored perspectives on the concept of open innovation.
3. Supplier perspective, where timely integration of suppliers and subcontractors significantly increases the efficiency of innovation in most industries.
4. Institutional perspective, when we consider open innovation as a model of collective innovation. Temporary monopoly profits are thus replaced through regular compensation - eg licensing.
5. Cultural perspective. The starting point for an open innovation process is knowledge, resp. culture, competence and know-how. Creating a culture that values competence and know-how is essential for open innovation practice. This culture is then influenced by many other factors (Gassmann et al., 2010).

2 Methodology

The aim of the paper is to analyze the innovation activities of small and medium-sized enterprises in the period 2016-2020. The literature review defines the basic concepts and presents an introduction to the issues of innovation activities of companies. The research part presents a statistical survey on innovation, which evaluates the innovation activities of small and medium-sized enterprises in the Czech Republic. In the first part of the survey, it was only the innovation activities of companies in the field of product and process innovation. The research part is also supplemented by our own research. Data collection took place at the beginning of 2021 in the form of a questionnaire survey, which was preceded by verification of the questionnaire by representatives of selected companies. Data were obtained from 102 food industry companies in the Czech Republic, with the aim of the highest possible correlation of respondents with the actual representation of food companies in the Czech Republic according to the CZ-NACE methodology. The questionnaire was distributed electronically exclusively to company managers, through a third party providing data collection. Furthermore, other surveys were extended to include marketing and organizational innovations according to the change in the EU / OECD methodology. The last survey from which the data will be drawn is the TI 2018 survey, which took place in the

period 2016-2018. Eurostat harmonized model questionnaire was used for data on innovation activities of enterprises for the unified EU Innovation Survey CIS 2018 (Community Innovation Survey 2016) for the monitored period 2016 - 2018.

Furthermore, 2 hypotheses were established in the work:

Hypothesis H1: The amount of costs incurred for innovation and the total sales of goods are independent variables.

Hypothesis H2: The size of the company expressed in terms of number of employees depends on the number of innovation activities.

Descriptive statistics and Pearson correlation analysis are used to analyze the available data. The basis of testing is the above research proving the dependence of innovation activities, the size of the company and the amount of costs incurred for innovation activities and total sales of goods sold. The survey then asked companies that, according to their predominant economic activity, belong to one of the following branches of the classification of economic activities (CZ - NACE).

3 Results

3.1 Innovative activities of small and medium enterprises in the Czech Republic

The latest survey, from the period 2016 - 2018, shows that a total of 24,265 companies operated in the Czech Republic, of which 17,946 were small companies (10-49 employees) and 5,028 medium-sized companies (50-249 employees) and 1,291 large enterprises (250 and more employees).

Of the total number of companies in the Czech Republic, there were also 11,358 companies (47%) that introduced innovation and 12,907 (53%) that did not introduce innovation.

Thus, small companies have the largest share in innovation activities in the Czech Republic. Out of the total number of innovating enterprises, a total of 7,400 (65%) small enterprises introduced innovation, from the group of medium-sized enterprises 3,008 (27%) enterprises and the smallest share of innovation activities is held by large companies, where only 951 (8%) companies introduced innovation.

3.2 Business innovation strategies of small and medium enterprises

As part of their corporate strategies, companies most often focus on satisfying existing customer groups, with 52% for small companies and up to 58% for medium-sized companies. The next most common focus of corporate strategy in innovation activities is on high quality products, small businesses focus on this strategy in 51% and medium-sized enterprises in 55%. Both groups focus on their strategies of acquiring new customer groups, where in the case of small companies it is about more than a third of the company and in the case of medium-sized companies it is almost half of the companies.

On the other hand, small enterprises (11%) focus the least on the low price of products (market price leader) and the group of medium-sized enterprises (8%) on the area of one or a few key products.

Table 2 The most important corporate strategies for companies by size in the period 2016 - 2018

Focus of business strategy	small businesses		medium-sized enterprises	
	Number	%	Number	%
satisfaction of existing customer groups	3 868	*52,3%*	1 732	*57,6%*
high quality products (quality leader)	3 788	*51,2%*	1 665	*55,4%*
gaining new customer groups	2 853	*38,6%*	1 469	*48,9%*
improvement of existing products	2 833	*38,3%*	1 285	*42,7%*
specific customer solutions	2 348	*31,7%*	955	*31,8%*
launch of new products	1 771	*23,9%*	846	*28,1%*
wide range of products	1 001	*13,5%*	551	*18,3%*
standardized products	951	*12,9%*	440	*14,6%*
one or a few key products	873	*11,8%*	238	*7,9%*
low product price (market price leader)	789	*10,7%*	566	*18,8%*

Source: CZSO, Statistical Survey on Innovation Activities of TI 2018 Enterprises

3.3 Revenues from goods and services of innovative companies for the period 2016-2018 and the impact of the introduction of product innovations

For the purpose of evaluating the success of innovation costs, the indicator of the share of sales of innovated products in the total sales of companies with product innovation can be used. During the year, the revenues of small and medium-sized enterprises with product innovation reached almost CZK 1.2 trillion, but they earned only CZK 284 million (23.6%) for innovated products. Larger sales of small and medium-sized enterprises (CZK 896 million) thus came from the sale

of non-innovated products. In terms of sales of innovated products, more than half (CZK 165 million) were new innovated products "only" for the company and CZK 120 million fell on products that were launched on the market.

Table 4 Revenues of enterprises with 10 or more employees in the Czech Republic in 2018, which launched an innovated product on the market in the period from 2016 to 2018 according to the novelty of their products or services

Index	Total				By product type							
					for innovated products						for products unchanged or slightly modified	
					Total				according to the degree of their innovation			
									new to the market	new for business only		
	mld. Kč	% [1]	% [2]	% [3]	mld. Kč	% [1]	% [2]	% [3]	mld. Kč	mld. Kč	mld. Kč	% [3]
small businesses	341,0	*22,1%*	*45,4%*	*100,0%*	89,0	*5,8%*	*11,8%*	*26,1%*	39,6	49,4	252,1	*73,9%*
medium-sized enterprises	839,5	*35,7%*	*50,7%*	*100,0%*	195,1	*8,3%*	*11,8%*	*23,2%*	80,4	114,7	644,5	*76,8%*

[1] share of total sales of enterprises in the given group (row)
[2] share of total revenues of enterprises with innovation activities in the given group (row)
[3] share of total sales of product innovation enterprises in the given group (row)
Source: CZSO, Statistical Survey on Innovation Activities of TI 2018 Enterprises

While small businesses considered increasing the quality or quality of existing products to be the most significant impact of their product innovations, for medium-sized enterprises it was an expansion or change in the product offering in the existing sector.

3.4 Factors limiting the innovation activities of small and medium-sized enterprises in the period 2016 – 2018

In order for a company to be able to introduce or at least try to innovate, it must not only have good conditions and preconditions for its introduction, but also financial resources, incentives for innovation or suitable partners for innovation cooperation. However, many companies still face constraints that prevent them from launching innovation activities. Most small businesses (18.5%) state that they are limited by a lack of own funds. Medium-sized companies (17.9%) are the biggest reason for the lack of skilled workers in the company. This factor also lists small businesses as the second most common (15.1%). On the other hand, small (2.9%) and medium-sized (2.2%) companies do not perceive so many restrictive invoices as a lack of ideas for innovation or a lack of incentives to innovate from customers.

Table 6 Small and medium-sized enterprises in the Czech Republic, which identified the above factor limiting innovation activities as the most important for the enterprise in the period from 2016 to 2018

Factors limiting the implementation or initiation of innovation activities in the company	small businesses		medium-sized enterprises	
	Number	%	Number	%
lack of own funds	1372	*18,5%*	470	*15,6%*
lack of skilled workers in the company	1120	*15,1%*	538	*17,9%*
lack of financial resources outside the company (private, public)	1034	*14,0%*	299	*9,9%*
low or uncertain return on investment due to low purchasing power or market size	890	*12,0%*	390	*13,0%*
lack of suitable partners for innovation cooperation	492	*6,7%*	237	*7,9%*
insufficient decision-making powers of the company on the development of new products or investments	382	*5,2%*	257	*8,5%*
lack of incentives for innovation from customers	372	*5,0%*	124	*4,1%*
lack of ideas for innovation in the company	214	*2,9%*	67	*2,2%*

Source: CZSO, Statistical Survey on Innovation Activities of TI 2018 Enterprises

These data are also confirmed by research conducted in 2021 focused on companies in the food industry. From the research dealing with the introduction of Industry 4.0, which also belongs to the area of innovative activities of companies, 53 companies out of 102 respondents responded to the lack of financial resources. Of these, 30 companies (29%) answered that the introduction of innovations related to Industry 4.0 depended significantly on the lack of financial resources. Another 23 companies (23%) answered that the lack of financial resources was rather significant.

Another factor that limited the implementation of Industry 4.0 in companies was bureaucracy. This was mentioned as a significant barrier by 12 companies (12%). Another 49 companies (48%) stated the bureaucracy as rather important in the implementation of Industry 4.0.

3.5 Hypothesis results

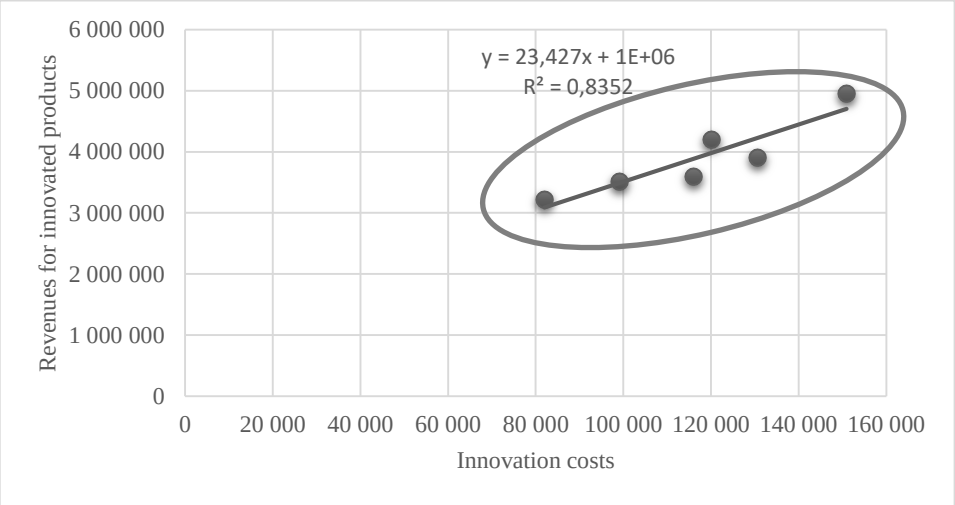
Verification of hypothesis H1

The above surveys and data form the basis for the following statistical testing: H0: r = 0 and H1: r ≠ 0 at the selected significance level p = 0.05. The results of testing are contained in Chart 4. Based on statistical testing, it was possible to confirm or refute hypothesis H1:

Hypothesis H1: The amount of costs incurred for innovation and the total sales of goods are independent variables.

Pearson's correlation coefficient was used for the calculation, with which we can determine what the dependence is. From Graph No. 4 it is clear that on the basis of available data and the chosen level of significance p = 0.05, the Pearson correlation coefficient for the interval variables (Pearson's R) is 0.835. Since the value is positive and close to 1, we speak of a so-called positive positive correlation. The dependence can therefore be described as direct and moderate.

Graph 4 Dependence of innovation costs on sales of innovated products in the period 2006 - 2018



Source: CZSO, Statistical Survey on Innovation Activities of TI 2018 Enterprises, processing: own

From the above statistical testing, it can be stated that there is a relationship between the costs incurred for innovations and the sales of innovated products.

Verification of hypothesis H2

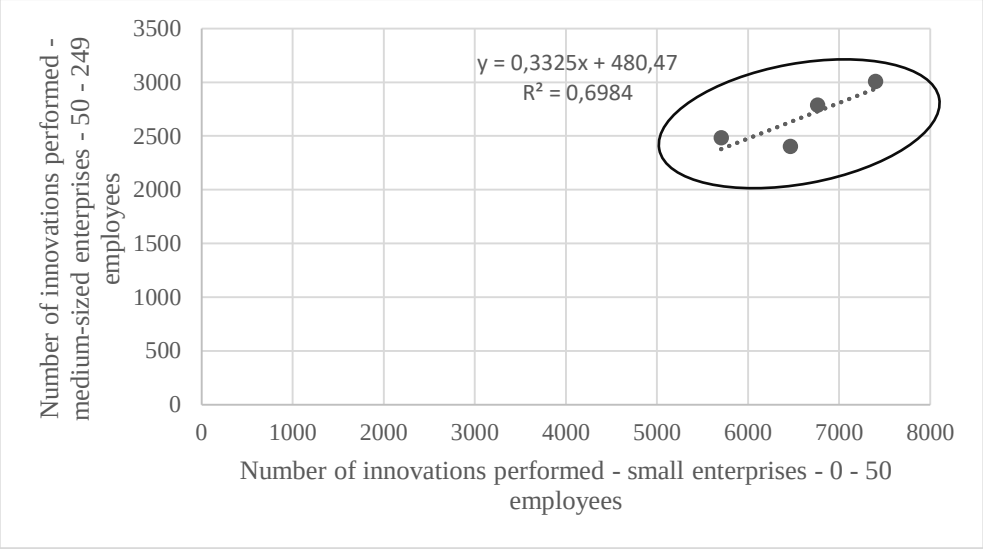
The second of the established hypotheses dealt with the demonstration of the mutual relationship between innovation activities and the size of the company expressed by the number of employees.

Hypothesis H2: The size of the company expressed in terms of number of employees depends on the number of innovation activities.

Revilla (2012) states that researchers should focus on what causes the various effects on SME growth and not just focus on finding correlations between business size and innovation (Revilla, Fernández, 2012, Stock et al, 2002). The issue of innovation and the size of companies can also be viewed from the perspective of the type of innovation. Oke et al (2007) argued that SMEs are more inclined to generate incremental innovations and large companies are more inclined to generate radical innovations, which may be due to sufficient funding. We must also consider that, thanks to sufficient funding, large companies can afford to employ a large number of R&D professionals who can accumulate a wealth of ideas and have a wealth of technical knowledge and skills. Conversely, small businesses do not have this option, but have the ability to be flexible, adapt quickly, and accept new challenges (Kanter, 1985). If we talk about innovation spending and the relationship of companies to innovation, then many studies have shown that R&D spending increases with the size of the company.

Based on the available data, the following statistical testing was performed: H0: r = 0 and H1: r ≠ 0. The test results are contained in Graph No. 5.

Graph 5 Dependence of the size of enterprises expressed by the number of employees on the number of innovations performed



Source: CZSO, Statistical Survey on Innovation Activities of TI 2018 Enterprises

In Graph No. 5 we can see that on the basis of statistical testing and the chosen level of significance p = 0.05, the Pearson correlation coefficient of 0.698 is acquired. As with the previous hypothesis, the value is positive and close to 1, where we speak of a positive positive correlation. The size of the company expressed by the number of employees depends on the number of implemented innovation activities.

4. Conclusion

The work shows that small and medium-sized enterprises in the Czech Republic are introducing innovations. Together, they make up a third of all companies that introduced innovation in the period 2016-2018. The most successful are the innovations in the field of Information and Communication Activities, where innovation was introduced by more than 65% of small and medium-sized enterprises. This fact is also due to the fact that the industry is closest to the technologies that manage to be implemented very quickly in the company as an innovation. This is also the result of other results concerning the type of innovation carried out. More than 68% of small businesses introduced innovation in the area of machinery, equipment, software and buildings, while medium-sized enterprises introduced this type in 72%. However, small and medium-sized enterprises are still failing to bring innovated products to market. This confirms the share of sales for innovated and non-innovated products, which are one of the key indicators of the company's innovation activities. More than 70% of SME sales still come from unchanged or slightly modified products.

Where the results of these size groups differ, it is for the reasons why companies introduce innovations at all. A total of 41% of small enterprises introduced innovation mainly to increase the quality of existing products, while the highest number of medium-sized enterprises (38%) stated that the reason was mainly the expansion / change of product offerings in the existing sector. The same was true for the factors that limit the implementation or start of innovation activities in the company. While small enterprises (18.5%) encountered a lack of their own financial resources, medium-sized enterprises (17.9%) were due to a lack of skilled workers. Small and medium-sized enterprises in the Czech Republic also have enough ideas and incentives to innovate, but what they lack, there are financial resources, especially for small enterprises (18.5%). Medium-sized enterprises (15.6%) most often identified the lack of qualified employees as a limiting factor.

These statistical tests also show that there is a relationship between the cost of innovation and the revenue from the innovative products. Businesses that spend more on innovation also achieve higher sales for innovated products. The number of employees in the company has the same effect on the number of implemented innovation activities, which was the subject of the research of the second hypothesis. It follows that the number of employees depends on the number of innovation activities.

Thus, small and medium-sized enterprises should focus more on various programs, thanks to which they can draw on various subsidies and programs of the Government of the Czech Republic for innovation activities. Thanks to these funds, they can also reward qualified employees who will help them implement innovations into the company. Furthermore, SMEs should focus more on marketing and sales promotion of innovative products, as research shows that sales of innovative products are far from being the same as non-innovative or slightly modified ones. By increasing sales of innovated products, companies can obtain additional funding for further innovations.

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Resources

Bureš, V. & Czech Society for Systems Integration. (2007). *Znalostní management a proces jeho zavádení: Průvodce pro praxi*. Grada.

Carneiro, A. (2000). How does knowledge management influence innovation and competitiveness? *Journal of Knowledge Management*, *4*(2), 87–98. https://doi.org/10.1108/13673270010372242

Colander, D. C., & Gamber, E. (2006). *Macroeconomics*. Pearson/Prentice Hall.

Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: Exploring the phenomenon. *R&D Management*, *39*(4), 311–316. https://doi.org/10.1111/j.1467-9310.2009.00570.x

Ferreira, J. J., Fernandes, C. I., & Ratten, V. (2017). Entrepreneurship, innovation and competitiveness: What is the connection? *International Journal of Business and Globalisation*, *18*(1), 73. https://doi.org/10.1504/IJBG.2017.081030

Fitjar, R., & Rodríguez-Pose, A. (2015). Interaction and Innovation across Different Sectors: Findings from Norwegian City-Regions. *Regional Studies: The Journal of the Regional Studies Association*, *49*. https://doi.org/10.1080/00343404.2015.1016415

Forsman, H. (2011). Innovation capacity and innovation development in small enterprises. A comparison between the manufacturing and service sectors. *Research Policy*, *40*(5), 739–750. https://doi.org/10.1016/j.respol.2011.02.003

Gassmann, O., Enkel, E., & Chesbrough, H. (2010). The future of open innovation: The future of open innovation. *R&D Management*, *40*(3), 213–221. https://doi.org/10.1111/j.1467-9310.2010.00605.x

Gault, F. (2018). Defining and measuring innovation in all sectors of the economy. *Research Policy*, *47*(3), 617–622. https://doi.org/10.1016/j.respol.2018.01.007

Chesbrough, H., & Bogers, M. (2014). *Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation* (SSRN Scholarly Paper ID 2427233). Social Science Research Network. https://papers.ssrn.com/abstract=2427233

Keller, S., Korkmaz, G., Robbins, C., & Shipp, S. (2018). Opportunities to observe and measure intangible inputs to innovation: Definitions, operationalization, and examples. *Proceedings of the National Academy of Sciences*, *115*(50), 12638–12645. https://doi.org/10.1073/pnas.1800467115

Manceau, D., Moatti, V., Fabbri, J., KALTENBACH, P.-F., & BAGGER-HANSEN, L. (2011). Open innovation—What behind the buzzword; Analysing what Open Innovation Changes in the Way Companies Innovate in terms of Partner Relationships, Internal Organization and Innovation Performance. In *FROM I7 INSTITUTE, ESCP EUROPE*.

Novák, A. (2017). *Inovace je rozhodnutí: Kompletní návod, jak dělat inovace nejen v byznysu : 12 praktických nástrojů, 40 příkladů z praxe*.

Powell, W. W., & Snellman, K. (2004). The Knowledge Economy. *Annual Review of Sociology*, *30*(1), 199–220. https://doi.org/10.1146/annurev.soc.29.010202.100037

Scholleová, H. (2017). *Ekonomické a finanční řízení pro neekonomy: 3., aktualizované vydání*. Grada Publishing a.s.

Synek, M. (2007). *Manažerská ekonomika*. Grada.

Tuganova, E. A., Ibragimova, G. M., & Gerkina, E. A. (2017). Innovation and competitiveness: Evidence from Republic of Tatarstan. *International Journal of Economic Perspectives*, *11*, 1656–1661.

Valach, J. (2010). *Investiční rozhodování a dlouhodobé financování*. Ekopress.

West, J., Salter, A., Vanhaverbeke, W., & Chesbrough, H. (2014). Open innovation: The next decade. *Research Policy*, *43*(5), 805–811. https://doi.org/10.1016/j.respol.2014.03.001

Yun, J. J., Zhao, X., Jung, K., & Yigitcanlar, T. (2020). The Culture for Open Innovation Dynamics. *Sustainability*, *12*(12), 5076. https://doi.org/10.3390/su12125076

Bakytová, H.; Hátle, J.; Novák, I.; Ugron M. (1986). *Statistická indukce pro ekonomy*. Praha: SNTL, 1986. ISBN 99-00-00135-X.

Stock, G.N., N.P. Greis a W.A. Fischer. Firm size and dynamic technological innovation. Technovation [online]. 2002, roč. 22, č. 9 [cit. 2021-08-10]. doi: http://dx.doi.org/10.1016/S0166-4972(01)00061-X. Dostupné z: http://www.sciencedirect.com/science/article/pii/S016649720100061X

Dobbs, M., & Hamilton, R. T. (2007). Small business growth: Recent evidence and new directions. *International Journal of Entrepreneurial Behavior & Research*, 13(5), 296–322. https://doi.org/10.1108/13552550710780885

César Camisón-Zornoza, R. L.-A. (n.d.). *A meta-analysis of innovation and organizational size* - César Camisón-Zornoza, Rafael LAPIEDRA-ALCAMÍ, MERCEDES Segarra-Ciprés, MONTSERRAT Boronat-Navarro, 2004. *SAGE Journals*. Retrieved September 26, 2021, from https://journals.sagepub.com/doi/10.1177/0170840604040039.

McDermott, C. M., & Prajogo, D. I. (2012, February 3). Service innovation and performance in smes. *International Journal of Operations & Production Management*. Retrieved September 26, 2021, from https://www.emerald.com/insight/content/doi/10.1108/01443571211208632/full/html.

Oke, A., Burke, G., & Myers, A. (2007, June 26). Innovation types and performance in growing UK SMEs. *International Journal of Operations & Production Management*. Retrieved September 26, 2021, from https://www.emerald.com/insight/content/doi/10.1108/01443570710756974/full/html.

Kanter, R. (2002, April 26). Supporting innovation and venture development in established companies. *Journal of Business Venturing*. Retrieved September 26, 2021, from https://www.sciencedirect.com/science/article/pii/0883902685900060.

Staff competences for the position of accountant

Michaela Šebístková[1], Jaroslav Vrchota[2]

Abstract: Nowadays, an operating company is presented mainly by its results, good reputation and customer satisfaction. These aspects can be improved through competencies that are distributed among individual employees within the company. With competencies, employees know which issues within their job function they are supposed to address, and therefore there is no confusion in the company that would cause losses and poor quality outputs. The aim of this paper is to analyze and evaluate the key activities of accountants and to propose an optimal competency model that will help to make better use of accountants' activities. Based on the National Occupational Competency Framework, those competencies that are important to the functions of accountants will be evaluated.

Keywords: competence, accountants, competence model, employees, competencies
JEL Classification: G32, G33, C35

1 Introduction

In recent years, competencies have been an important focus in order to harmonize the functioning of not only production but also administrative, technical and other departments in organizations (Kohtamäki, Tornikoski, & Varamäki, 2013).

The segment of the workforce that has been selected for the competency assessment is the accounting staff. Accountants are one of the least expendable positions in the administrative field. These workers are responsible for the proper maintenance of the accounting records of each accounting unit. However, there are many functions of accountants, and each is assigned different or very similar competencies that accountants must follow for the purpose of their work. The hard and soft competencies result in a systematic treatment of the accounting units' accounts, which leads to a lower error rate.

The concept of competence is often ambiguous due to the English terms "competence" or "competency", and many authors of literature define the concept of competence differently (Kovács, 2007). Competence can be defined as an authorization or power that is granted from or belongs to a certain authority (Grzybowska & Łupicka, 2017; Kubeš, 2004). At the same time, competence is taken for granted as a certain commonplace nowadays, which can cause difficulties. From an analytical point of view, competencies can be divided through disciplines differently; from a political point of view, they can be divided normatively. Due to their uniqueness and uniqueness, they guarantee that all dealings with employees, partners, competitors or customers will be successful (Isik, Arditi, Dikmen, & Birgonul, 2009).

Only when a given task is defined can it be best determined which competencies are needed, and once the task is achieved, the level of competencies used can be identified. If the result is almost or completely identical to the expectation, it can be said that the person is fully utilizing the competencies needed for the specific job (Mirhosseini, Kiani Mavi, Abbasnejad, & Rayani, 2020). That is why HR professionals, when selecting employees, focus most on their competencies that can take the company to a better level (Kubeš, 2004). These competencies are divided into three levels of Competencies: Key, Soft and Hard. Core competencies identify the individual behaviours that are attributed to a given employee within the work process. Through the core competencies, the individual criteria that are needed when selecting employees for jobs are established (Gudanowska, Alonso, & Törmänen, 2018). At the same time, they serve to categorize firms in terms of the behavioural elements that are needed for the work pro-environment. Soft competencies are otherwise also referred to as "soft skills"(Vrchota & Řehoř, 2019). These are competencies that primarily affect the behavioural plane and affect the social and emotional situation of a person. Soft competencies are essential for the development of hard competencies, which will be described in more detail in the next chapter. The soft competencies are always in a specific area and differ according to the subject matter of the area. They are especially important for innovation and include creativity and critical thinking that helps to solve pro-problems (Bellanca & Brandt, 2010). Based on the National Occupational Competency Framework (2017), seven soft competencies have been identified to perform the functions of an accountant. These competencies are autonomy, problem-solving, planning and organization, lifelong learning, effective communication, leadership and information orientation. Hard competencies can be considered as skills and knowledge that the employee is able to apply in practice. The level of hard competencies can be increased through training

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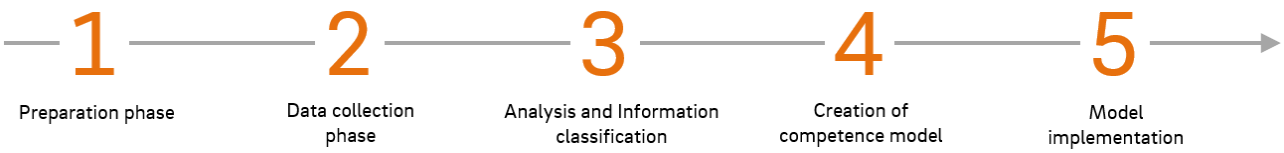
and are easily quantifiable (Cerezo-Narváez, Otero-Mateo, & Pastor, 2017; Enke et al., 2018). Hard competencies are much more valued within the job function than soft competencies. Therefore, more attention is paid to their development. The achievement of a specific hard competence is often confirmed by a certificate or certification (Bellanca & Brandt, 2010). The most frequently used hard competencies of the four functions of employees in the accounting position (Double Entry Bookkeeping, Financial Accounting, Accounting Documents and their Records, and Internal Accounting) were included in the questionnaire compilation.

Identifying competencies is one of the most important steps in using the competency approach. The first procedure for identifying competencies was developed by McBer in the 1970s. This analysis led to the creation of a development programme for managers. Nowadays, companies identifying competencies tend to focus more on identifying critical statements that distinguish above average managers from average managers. Gael (1988) identified over 40 types of techniques that helped to formulate competencies, and through these techniques, a process that on-helps to identify each competency was developed, which is illustrated in the figure below.

Figure 1 Diagram of competency identification



Source: Gael (1989)

In order for competencies to be distributed correctly and fairly, it is important to develop an optimal competency model that serves as a comprehensive overview of competencies while optimally managing human resources. However, a competency model cannot only be used to allocate competencies. It also serves as a tool for selecting new employees or for evaluating existing employees.

2 Methodology

The aim of the paper is to define and analyze the individual competencies of accountants. Another objective is to propose an optimal competence model for employees in the position of accountant.

The questionnaire regarding the competencies of employees in the accounting position was created in Google forms and contained a total of 17 questions. The individual hard skills belonging to the accounting profession were mapped to the National Occupational Classification System (NOCS) in the questionnaire. The NSP catalogue is regularly updated on the basis of the Employment Act No. 435/2004 Coll. All information is updated to be in line with the current labour market supply. On the basis of the NSP catalogue, the questionnaire divided the individual hard competencies between the four functions of accountants. The questions covering the hard competencies were in the form of scaling questions, which took values from 1 (fully use) to 5 (not fully use). The survey was conducted in the form of an electronic questionnaire. The reason for using an electronic questionnaire was to reach the respondents in the fastest way and to evaluate the data as easily as possible. The electronic questionnaire was preceded by a paper questionnaire which was used for the pilot study. The pilot research was conducted in the accounting firm Jifos, s.r.o., where 15 respondents with many years of accounting experience were contacted. Based on the accountants' comments, some questions were modified, e.g. three closed questions were corrected to open questions, some questions were even removed and replaced with questions related to soft competencies.

A total of 958 respondents were contacted by e-mail containing a link to the electronic questionnaire. At the beginning of the survey, there was a big problem with the return rate of the questionnaires. Firms that were not directly involved in accounting were also contacted. The solution was that the e-mail addresses of the respondents were searched on the internal website www.firmy.pohoda.cz, where a list of all accounting firms using the Pohoda software is located. Thus, those firms that are fully engaged in accounting were contacted and were more likely to respond to my questionnaires. In addition, some accounting firms were contacted in person or by telephone. The questionnaires were collected from June 2019 to August 2019. A total of 156 respondents out of 958 responded to the questionnaires. Thus the return rate was approximately 16.3%.

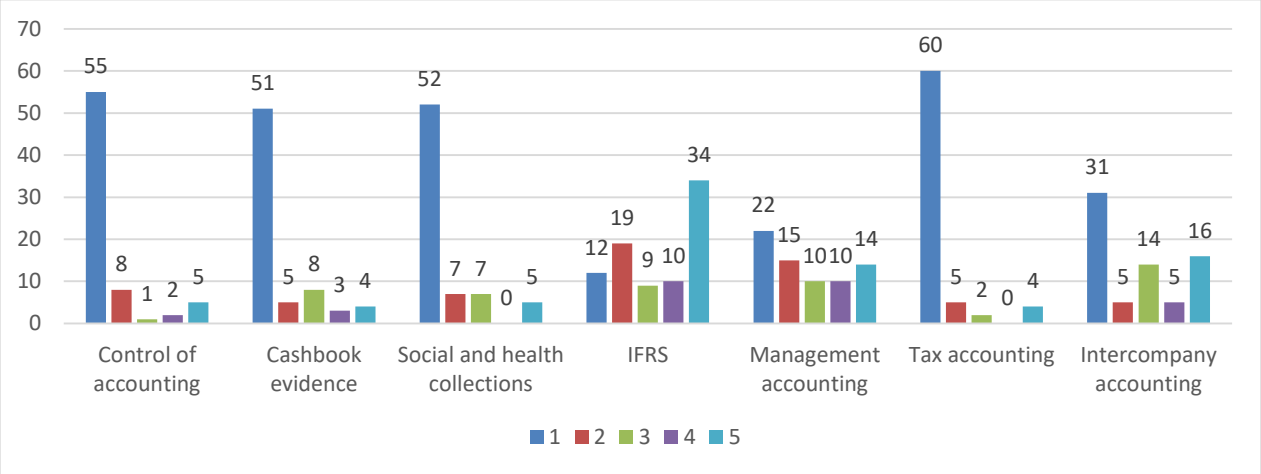
The statistical methods used in the data analysis include the Mann-Whitney U test, which observes the dependence between two variables, namely between two nominal variables X and Y (Freund, Wilson, & Mohr, 2010; Svarova & Vrchota, 2014). Another type of statistical method used is Pearson chi-square and Cramer's V, which measure the strength of the dependence between two variables. The coefficient takes on values between 0 and 1. The closer the coefficient is to 1, the tighter the dependence between X and Y is; conversely, the closer the coefficient is to 0, the looser the dependence between X and Y is. If the p-value is less than α (in this case $\alpha = 0.05$), H0 is rejected in favour of HA (Budíková, Králová,

& Maroš, 2010). The questionnaire survey was also evaluated through the statistical method of Fisher's exact test. As in the previous tests, the value of α for Fisher's exact test is set at 0.05. If the p-value ≤ α, then the hypothesis is rejected at the α level of significance (Spellman & Whiting, 2014).

3 Research results

The accounting position is mainly held by women in the sample of respondents, with 117 women out of 156 respondents, which is 75%. The highest level of education attained by the respondents in the position of accountant is a university degree (76 respondents reported this, which is 48.72%). Approximately 10% less respondents answered that their highest level of education was secondary school with a high school diploma. Only one respondent's highest educational qualification was vocational with an apprenticeship certificate. The seven competencies that are least used by the Chief Accountants are controlling accounting, cash book and ledger management, health and social insurance contributions, International Financial Reporting Standards (IFRS), management accounting, tax accounting and internal accounting.

Figure 2 Hard competencies of the chief accountant



Source: Own processing

The competencies of double-entry bookkeeping were the most highly rated, with 67 out of 71 chief accountants responding that they use this competence, followed by the preparation of financial statements, filling in forms and reports for state authorities, cooperation with financial authorities, tax and financial accounting, accounting documents and their records, etc.

Through hypothesis H0 it was tested that men and women have the same level of individual competences. Based on the table below, it can be observed that there is a statistically significant difference for the question "Do you use payroll accounting in your practice" as the p-value came out to be less than 0.05. Based on the Z parameter, which came out positive in this case, it can be determined that the higher values are taken by group X, i.e. women. Further, it was evaluated that there is a difference between gender and the question: "Do you use business economics in general in your practice" is statistically significant because the p-value came out to be 0.04 and is, therefore, less than the established significance level of $\alpha = 0.05$. Again, the Z parameter is positive, and this means that higher values are taken by group X, i.e. women. The same results were evaluated for questions 3 and 4. For the other questions, where gender and competencies used in practice were compared, the p-value came out > α, there is no statistically significant difference between these questions, and the Z-parameter does not need to be monitored further.

The interesting result is for the competence of performing accounting system control, where one would expect a statistically significant difference between gender and this competence. The accounting system control competency is mainly related to IT issues, and this is a competency that men are mainly interested in the practice. In the research, the p-value was greater than 0.05, and therefore there is no statistically significant difference between gender and the above competency.

Table 1 Mann-Whitney U test - comparison of competencies and gender

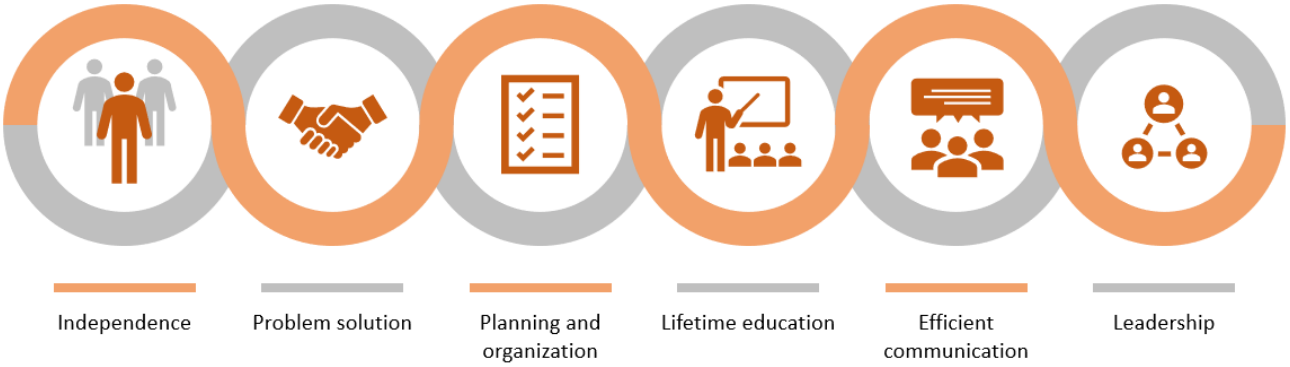
	Name of competence	U	Z	p-value
1	Payroll accounting	1734.50	2.24	0.03
2	Business economics in general	1766.00	2.11	0.04
3	Principles of business entity management, economic result	1759.50	2.13	0.03
4	Calculations of depreciation and certain taxes	1760.50	2.13	0.03

Source: Own processing

Based on the results of the individual statistical tests that evaluated the answers to the questions, competency models of soft competencies and competency models of hard competencies were proposed for individual accounting functions.

The soft competency models were designed to include all the soft competencies suggested to be relevant for the accounting functions. These are the seven soft competencies: autonomy, problem-solving, planning and organization, lifelong learning, effective communication, leadership, and information orientation. Based on the results, respondents use problem-solving competencies the most and leadership the least.

Figure 3 Competency model of soft competencies

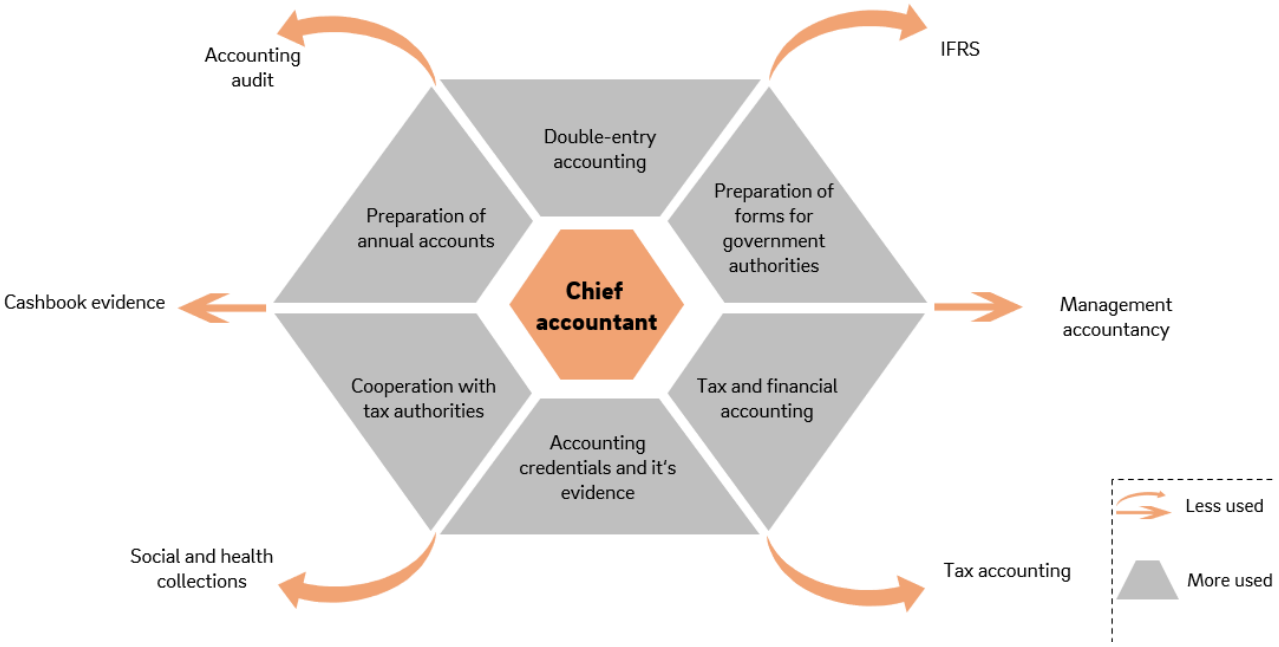


Source: Own processing

The hard competency models were designed according to accountants' functions and the responses recorded in the questionnaires during the survey. The hard competencies were divided in the diagrams into more used and less used in practice. Relevant training was designed based on the competencies that were most frequently identified as less used for all accounting functions.

Through the questionnaire survey results, it was determined that the most used competency by the chief accountant is double-entry bookkeeping, and the least used competency is knowledge of International Financial Reporting Standards (IFRS). Other more and less used competencies can be found in the competence model of the chief accountant.

Figure 4 The competency model of the hard competencies of the chief accountant



Source: Own processing

4 Conclusions

The competency models have been designed for soft and hard competencies and are shown graphically so that accountants can best navigate them at a glance. In general, it can be assessed from the research that women are the most likely to work as accountants, with 75% of the total respondents being women. This result is not surprising, given that the companies surveyed were primarily women-owned or women-dominated.

In the questionnaire, we focused on four functions of accountants, namely accountants, accountants themselves, accounting methodologists and chief accountants. Chief accountants were the most numerous among the respondents while accounting methodologists were the least numerous. There are many other functions of accountants, but they were not included in the questionnaire due to the results of the pilot research. For example, in the firm where the pilot research was conducted, payroll accountants were the fewest in number and therefore were not included in the questionnaire.

Focusing more on the hard competencies themselves, it can be said that most of the competencies that were suggested for the different functions of accountants are actually used by most employees in their practice. This may also be some indication that they are doing their work in a way that is as efficient and error-free as possible.

As far as soft competencies are concerned, leadership, or managing people, was the least used competency. This is not surprising for an accounting position, but for the position of chief accountant, the use of the soft competency of leadership might be expected by many primarily because chief accountants delegate many tasks between individual accountants, the accountants themselves, accounting methodologies, and others. Therefore, leadership competency is very necessary for this function.

Although accounting is considered to be a pretty unglamorous job, the opposite is true. Employees in accounting positions must keep abreast of current developments in the field, which they must incorporate into their practice. This is why accounting is a very varied and interesting field, which can be of interest to many potential job applicants. However, it carries with it a lot of legislation that has to be followed and adhered to within this job position (Rolinek et al., 2015).

Also interesting are the forecasts of accountants for future years, which mainly entail the automation of this field and the disappearance of functions that are more dedicated to transcribing data from documents into systems or invoicing (Ba-hrin, Othman, Azli, & Talib, 2016). This is very convenient for our research as we do not focus on these accounting functions in our research. In the forecasts, irreplaceable tasks are also mentioned, which confirms the fact that employees in the accounting position are still necessary and irreplaceable by any software. These are mainly activities related to digital literacy, setting up an accounting system, knowledge of individual companies, and others. It is in this direction that we could extend our research further and focus on developing these skills.

Acknowledgement

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References

Bahrin, M. A. K., Othman, M. F., Azli, N. H. N., & Talib, M. F. (2016). Industry 4.0: A Review On Industrial Automation And Robotic. *Jurnal Teknologi*, 78(6–13). doi: 10.11113/jt.v78.9285

Bellanca, J. A., & Brandt, R. S. (Ed.). (2010). 21st century skills: Rethinking how students learn. Bloomington, IN: Solution Tree Press.

Budíková, M., Králová, M., & Maroš, B. (2010). Průvodce základními statistickými metodami (První vydání). Praha: Grada Publishing.

Cerezo-Narváez, A., Otero-Mateo, M., & Pastor, A. (2017). Development of professional competences for industry 4.0 project management. 7th IESM Conference. Prezentováno v 7th IESM Conference, Saarbrücken.

Enke, J., Glass, R., Kreß, A., Hambach, J., Tisch, M., & Metternich, J. (2018). Industrie 4.0 – Competencies for a modern production system. Procedia Manufacturing, 23, 267–272. doi: 10.1016/j.promfg.2018.04.028

Freund, R. J., Wilson, W. J., & Mohr, D. L. (2010). Statistical methods (3rd ed). Amsterdam: Elsevier.

Gael, S. (Ed.). (1988). The Job analysis handbook for business, industry, and government. New York: Wiley.

Grzybowska, K., & Łupicka, A. (2017, říjen 11). Key competencies for Industry 4.0. 250–253. doi: 10.26480/icemi.01.2017.250.253

Gudanowska, A. E., Alonso, J. P., & Törmänen, A. (2018). What competencies are needed in the production industry? The case of the Podlaskie Region. *Engineering Management in Production and Services*, 10(1), 65–74. doi: 10.1515/emj-2018-0006

Isik, Z., Arditi, D., Dikmen, I., & Birgonul, M. T. (2009). Impact of corporate strengths/weaknesses on project management competencies. *International Journal of Project Management*, 27(6), 629–637. doi: 10.1016/j.ijproman.2008.10.002

Kohtamäki, M., Tornikoski, E. T., & Varamäki, E. (2013). The Strategic Management Competence of Small and Medium-Sized Growth Firms (SSRN Scholarly Paper Č. ID 2284845). Rochester, NY: Social Science Research Network. Získáno z Social Science Research Network website: https://papers.ssrn.com/abstract=2284845

Kovács, J. (2007). Manažerské dovednosti. Ostrava: VŠB - Technická univerzita Ostrava, Ekonomická fakulta.

Kubeš, M. (2004). Manažerské kompetence (1. vyd). Praha: Grada Publ.

Mirhosseini, S. A., Kiani Mavi, R., Kiani Mavi, N., Abbasnejad, B., & Rayani, F. (2020). Interrelations among Leadership Competencies of BIM Leaders: A Fuzzy DEMATEL-ANP Approach. *Sustainability*, 12(18), 7830. doi: 10.3390/su12187830

National Occupational Framework. (2017). Catalogue of occupations. Retrieved: 2020-2-15. Available from: https://nsp.cz/jednotka-prace/ucetni

Rolinek, L., Kopta, D., Plevny, M., Rost, M., Kubecova, J., Vrchota, J., & Marikova, M. (2015). Level of process management implementation in SMEs and some related implications. Transformations in Business and Economics, 14(2A), 360–377. Scopus. Získáno z Scopus.

Spellman, F. R., & Whiting, N. E. (2014). Handbook of mathematics and statistics for the environment. Boca Raton: CRC Press, Taylor & Francis Group.

Svarova, M., & Vrchota, J. (2014). Influence of competitive advantage on formulation business strategy. 17th International Conference Enterprise and Competitive Environment 2014, 12, 687–694. doi: 10.1016/S2212-5671(14)00394-3

Vrchota, J., & Řehoř, P. (2019). Project management and innovation in the manufacturing industry in Czech Republic. 164, 457–462. Scopus. doi: 10.1016/j.procs.2019.12.206

Prerequisites for the Effective Functioning of Controlling in Small and Medium-sized Agricultural Enterprises

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Abstract: The pragmatic level of information fundamentally affects the prosperity of business. Controlling obtains information, transforms it into an adequate form so that the company's management can responsibly make appropriate decisions. This creates an information base that serves the management of the company in the supervision of the organizational unit. Small and medium-sized agricultural holdings are linked to national and transnational markets and are therefore exposed to competitive pressure. In order to maintain their market position, they are forced to introduce innovative elements into management as well. One of the effective tools, but little used in the conditions of Slovak companies, is controlling. For effective implementation and realization of controlling in the company, it is necessary to create suitable conditions. The aim of this paper is to identify the prerequisites for the effective functioning of controlling as a management tool in small and medium-sized agricultural enterprises to increase competitiveness. The study is based on a detailed theoretical examination of previously published experiences based on the implementation and application of controlling abroad, which is supplemented by empirical research in the practice of agricultural enterprises. The results of the research study show that the standardization of business processes and their automation, flexibility and, last but not least, the approach of managers are decisive factors in the effective operation of controlling in small and medium-sized agricultural enterprises. The presented results show the possibilities of ensuring the stability of the company and increasing its corporate performance based on controlling.

Key words: Controlling, Small and Medium-sized Enterprises, Agriculture
JEL Classification: M19, M20, Q19

1 Introduction

The current hyper-competitive environment offers many great opportunities for small and medium-sized businesses (SMEs), but on the other hand, this business environment is also hazardous (Pavlak and Písař, 2020). Business environment is not stable due to globalisation processes in economics, cyclical changes and other disturbing factors. Hence, it is necessary to search such reserves that would improve efficiency of the business entity. The main objective of these reserves is to buffer negative impacts of external disturbances on financial and economic sustainability of enterprises (Khudyakova, Shmidt and Shmidt, 2019). The tool for treating the economic systems is controlling, which allows not only detecting the action of economic and non-economic factors, but also their future development, analysis of deviations from the desired state and prepare corrective actions (Sedliačiková, Vacek and Sopková, 2015). Controlling is one of the new approaches which helps management to adapt better to new circumstances, to build vital and vivid organisations, capable of facing new challenges (Bedenik et al., 2019). Controlling is a set of qualitative and quantitative tools introduced to control the coordination of information in order to support decision processes. The term

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of controlling should not be confused with the concept of control (Tulvinschi, 2010). Managing business successfully in dynamic environment requires effective controlling system. Controlling is proven to be an efficient method, which is to provide key information for the management at the right moment, concerning the status of environment and inside processes (Francsovics, Kemendi and Piukovics, 2019). Controlling function as a separate department contributes business efficiency trough ensuring transparency of business result and business processes (Vuko and Ojvan, 2013). A place, role, and process of controlling in the corporate management should be focused on the improvement of the efficiency of the management of current economic activities by application of adequate approaches and methods (Koval, Kvach and Makarov, 2010). One should bear in mind that when it comes to controlling, according to the theory of situational conditions, there is no single, all-purpose model solution. The implementation of the model controlling solutions should on the one hand assure the proper controlling implementation into the organization, and on the other its effective functioning (Bieńkowska, 2014).

Small and medium enterprises today create an organic part of the market economy. Their importance for the national economy, but also from microeconomic perspective is unquestionable. The internationalization of business creates new market opportunities, the possibility of organic growth and strengthening the market position (Mura and Buleca, 2014). Small and medium enterprises are forced to make innovations, because they are under permanent pressure of competitors at the market. From this point of view the ability to compete in innovations plays very important role as a factor of their competitiveness. Small and medium enterprises that encourages innovativeness creates preconditions for new procedures and solutions (Lesáková, 2014). The modern globalized world, new technologies, and advanced connectivity bring SMEs a wide range of opportunities, but also threats (Pisar and Bilkova, 2019). Fáziková and Melichová (2014) also confirm that agriculture is becoming more and more integrated into the global market and that if farmers want to survive, they must innovate continuously. Controlling as a management tool supported by corporate culture and communication should offer opportunities for SMEs growth, stability and future development (Pisar, 2020). In the ever harsher competition, agricultural managers are aware of the value of information (Látečková, Bolek and Szabo, 2018). Controlling brings efficient work with information, which includes its collection, classification, editing and subsequent distribution. Its task is to prepare the information in such a form that it serves to solve planning, decision-making, implementation and control tasks (Foltínová et al., 2011).

2 Methods

The aim of this paper is to identify the prerequisites for the effective functioning of controlling as a management tool in small and medium-sized agricultural enterprises to increase competitiveness. If controlling in the company is to be effective, it is necessary to meet certain prerequisites. There are many conditions that ensure the effectiveness of this management tool, in our paper we focus on the four, from our point of view, the most important conditions. The study is based on a detailed theoretical examination of previously published experience based on the implementation and application of controlling abroad, which is supplemented by empirical research in the practice of agricultural enterprises.

The object of the research were small and medium-sized agricultural enterprises operating in the Slovak Republic. The paper presents relevant data obtained through a questionnaire survey supplemented by interviews with selected farms. The questionnaire survey was conducted in the online version. As it was part of a large research study, all companies were asked to fill it in by phone to ensure a higher return. The results presented in the paper come from a total of 112 small and medium-sized farms, achieving a return of 32%. The research sample represented 39% of medium-sized and 61% of small enterprises from the entire territory of Slovakia, which also ensured the territorial criterion. The introductory part of the questionnaire contained classification questions. The main part of the questionnaire was questions focused on business management and controlling as a management tool. Among all the questions in the questionnaire, we evaluated those that we considered relevant to the research topic of paper. In order to evaluate the management's approach to controlling and innovation in management, we found out which type of leadership prefer managers. Another question we identified reasons for the low level of automation in small and medium-sized agricultural enterprises. Since standardization of business processes is a necessary prerequisite for automation, we subsequently identified the extent of standardization of specific business processes in agricultural businesses.

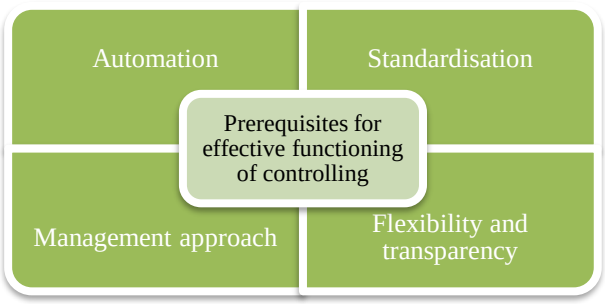
The above-mentioned complementary technique of data collection - an interview - served to supplement and better understand the information obtained from the questionnaire forms. We used a semi-standardized interview we conducted with business managers from three farms. Outputs based on the conclusions of the paper have a wide range of uses in any agricultural, respectively not just a farm.

3 Research results

In order for controlling to be successfully implemented in any company and to bring increased efficiency in the implementation of business processes, certain prerequisites must be met.

As can be seen in Figure 1, based on the study of professional literature, scientific and professional articles, empirical research in Slovak agricultural enterprises, we have formulated the 4 most important assumptions, without which controlling in the enterprise cannot be effective.

Figure 1 Prerequisites for effective functioning of controlling



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3.1 Automation

The ever-increasing amount of data that the development of information technology brings with the need to streamline existing business processes and deepen automation. Controlling automation can bring enormous savings by minimizing manual labor. Automation can eliminate a number of errors caused by manual work, further thanks to the introduction of routine tasks, such as. operational planning, reporting, or the creation of financial statements creates the potential to increase the efficiency of controlling processes, which leads to a higher quality level and transparency of data. Last but not least, automation contributes to shorter data processing time zones, which in turn leads to faster responses to business management.

Despite the many benefits that business process automation brings, there is a low level of automation in small and medium-sized Slovak agricultural enterprises. We came to this statement after interviews with representatives (business managers) of three selected farms. We asked the respondents of the questionnaire survey about the reasons for the situation. Based on the answers of the respondents, we formulated several generalized reasons for the low level of automation in companies, namely:

- insufficient support from the company's management,
- insufficient technical support and technical support,
- lack of digitization strategy,
- high costs and low financial resources,
- lack of identification of processes to be automated.

Most respondents identified the lack of a digitization strategy as the reason for the low degree of automation. The developed digitization strategy is a basic prerequisite for automation. It should include requirements for relevant data, systems, necessary resources, people, etc. In this context, the respondents also stated as a reason that the processes that should be automated and what the outputs from process automation should be are not precisely identified. Insufficient technical support was also a very frequent answer, which was followed by high costs and low financial resources, which could be used to finance a comprehensive integrated automation solution. The reason for the low level of automation is also the approach of the company's management, resp. insufficient change management. If the need to automate processes does not come directly from the management of the company, respectively. if the company's management does not see the potential in automation and does not lead employees to do so, this can be another obstacle. In connection with the above, we therefore defined the factor "management approach" as one of the important prerequisites for the effective functioning of controlling.

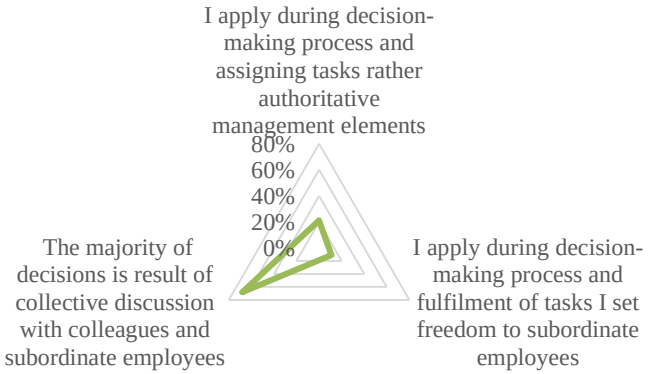
3.2 Management approach

Awareness of controlling and a positive approach by management to it is one of the most important prerequisites for controlling to be successfully implemented in the company. Today, managers need to be flexible, able to adapt to the constant changes taking place in the external environment, and to be able to react appropriately. Managers should not be afraid of change, but on the other hand should realize that there is an opportunity in every change. Managers should be not only managers, but real leaders who know how to get people and point out that the introduction of controlling will make the whole system of planning and evaluating the results of work transparent and functional. Barriers to the effective implementation and functioning of controlling arise from ignorance and insufficient information. Managers should be constantly educated in this area and not close the door to new opportunities and approaches. One of the prerequisites is a successfully implemented change management in the organization.

In addition to the beliefs of managers about its positive effect, the style in which they lead their subordinates is also essential for the successful implementation and functioning of controlling in the company. In the next question, we asked respondents which leadership style they preferred. As can be seen in Figure 2, according to our findings, 68% of respondents discuss decisions with their subordinates, respectively applies a democratic style of leadership. Share of 21% respondents tend to be more autocratic when assigning tasks and making decisions. The remaining 11% of respondents stated that they leave their subordinates free in the decision-making process and in the performance of their tasks.

From the point of view of controlling, it is desirable that managers apply cooperative, resp. democratic style of people management, where the superior decides after consultation with his co-workers and subordinates. Only in this case do co-workers feel that their opinion matters, which is a significant motivating factor. This style of leadership is manifested on the one hand by strict, on the other hand by free behaviour, depending on the situation, but in such a way as to achieve a balance.

Figure 2 Preferred leadership styles in companies



Source: own processing

3.3 Standardization

Standardization is a necessary prerequisite for ensuring the already mentioned effective automation of processes and subsequently also the effective functioning of controlling. Standardized formats facilitate work with information, enable fast summarization and subsequent data processing. Standardized formats are desirable not only for processes but also for data with a high frequency of repeatability.

In the questionnaire, we found out from the respondents to what extent they have standardized business processes, which are most often classified under the area of controlling. Answers of respondents are presented in Table 1. Most respondents included reporting and operational planning among the highly standardized processes. The answers of the respondents result from the fact that reporting, resp. reporting is usually done on a regular basis at different times, depending on what the reports are intended for and what they relate to. Due to regular reporting, it is therefore logical that most respondents, 41%, stated that reporting is carried out in their company as highly standardized. Reporting should be clear and up-to-date, because it is a means of communication from the controller to the manager. On the other hand, most respondents, 78%, said that strategic planning is not very standardized in their company. This is mainly due to the fact that strategic plans are drawn up for a longer period of time (in the case of agricultural holdings it is 5 years or more). In the case of other named business processes (costing, budgeting, providing financial statements), respondents were inclined to the fact that they are implemented in their company as average standardized. Costing and budgeting are one of the basic activities of every business entity. The calculation system takes over standardized information from the financial

accounting. Although the cost structure is different in each company and different calculation formulas are used, there is a standardized calculation formula for each industry, which the company can adapt to its own needs. Váryová et al. (2015) also confirms that none of agricultural entity can exist without the calculation of own costs because for the measurement of own production.

A high degree of standardization is desirable from the point of view of the effective functioning of controlling, but this does not mean that standardized processes should remain unchanged in the long run. Standardization and subsequent automation open up possibilities for optimizing business processes.

Table 1 Standardization of business processes

	Highly standardized	Average standard-ized	Less standardized
Reporting	41%	39%	20%
Operational planning	31%	48%	21%
Strategic planning	8%	14%	78%
Costing	23%	42%	35%
Budgeting	22%	53%	25%
Providing financial reports	19%	57%	24%

Source: own processing

Notes: 0-25% 26-50% 51-75% 76-100%

3.4 Flexibility and transparency

The management of a company that meets the conditions of controlling must be flexible. Business flexibility is a competitive advantage. An important step in increasing flexibility is identifying unnecessary time-consuming activities. On the other hand, it is necessary to keep flexibility within certain limits so that employees, as well as managers, lose the main purpose at work. Since controlling works with information over time, it is necessary for all those who are part of the business environment of the company to be flexible and able to respond quickly to situations or changes. Flexibility is achieved by a combination of different types of rules, planning, obligations, prohibitions, recommendations, etc., and therefore the level of flexibility depends on the people who work in the company.

Transparency in business is as important a prerequisite as flexibility in business. Transparency requirements apply not only to data but also to business processes. Controlling can provide effective information and advisory support to management only if it works with transparent information.

4 Conclusion

Controlling leads to business flexibility. It is a management tool that aims to support business management. In order for controlling in the company to be a real benefit and lead to an increase in the efficiency of business processes, it is necessary to create suitable conditions for it, resp. preconditions for its effective functioning. Based on the study of professional literature, scientific articles containing knowledge and experience from the application of controlling and subsequent empirical research in agricultural enterprises, we formulated scorpions, from our point of view the most important assumptions, namely: automation, standardization, management approach, flexibility and transparency. Empirical research - an interview, we found that farms are dominated by a relatively low level of automation, mainly due to the lack of digitization strategy, insufficient technological security, lack of financial resources or insufficient support from business management. It is these factors that limit the effectiveness of the implementation and application of controlling in business management. The approach of management and managers has a significant impact on how ordinary employees react to any changes. When the company's management is not convinced of the importance of implementing controlling, is not sufficiently informed and cannot adequately translate the benefits of implementing this management tool in the company to its subordinates, controlling cannot be successfully implemented and will not bring the desired effect. Equally important prerequisite for the effective functioning of controlling is the standardization of business processes. Through a questionnaire survey, we found that the most standardized business processes in agricultural enterprises are reporting and operational planning. On the contrary, most respondents stated that strategic planning is the least standardized business process. Equally important prerequisites for the effective functioning of controlling are corporate flexibility and transparency, as controlling works with real data over time.

The implementation and functioning of controlling in each company is governed by its own preferences and rules. However, there are certain common assumptions that need to be ensured and adhered to in order for controlling to be of

real benefit to the business. Our opinion is also shared by Bieńkowska, (2014), who claims that it turns out that it is theoretically possible to specify, and empirically prove that there are some determinants that determine the effectiveness of the controlling implementation in the organization. Further research should focus on a deeper examination of these assumptions, in particular the automation and standardization of processes, as at present, which is aimed to minimize manual labour and, conversely, increasing process automation, every company should have a digitization strategy in place.

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References

Bedenik N.O., Prebežac D., Strugar I. & Barišić P. (2019). The Challenges of Controlling and IT Support in Non-financial Reporting. *International Journal of Industrial Engineering and Management (IJIEM)*, 10(1), 21-29. http://doi.org/10.24867/IJIEM-2019-1-021

Bieńkowska, A. (2014). Determinants of controlling effectiveness. *Management: Science and Education*, *3*(1), 9-13.

Fáziková, M., & Melichová, K. (2014). The problems of knowledge economy and innovation processes in agriculture case study of the Nitra region. *Acta regionalia et environmentalica*, *11*(1), 24-29.

Foltínová, A. et al. 2011. *Nákladový controlling*. 1. ed. Bratislava : Iura Edition. 304 p. ISBN 978-80-8078-45-6.

Francsovics, A., Kemendi, A., & Piukovics, A. (2019). Controlling as a management function. *Management, Enterprise and Benchmarking in the 21st Century*, 35-42.

Khudyakova, T., Shmidt, A., & Shmidt, S. (2019). Implementation of controlling technologies as a method to increase sustainability of the enterprise activities. *Entrepreneurship and Sustainability Issues*, *7*(2), 1185. doi:10.9770/jesi.2019.7.2(27)

Koval, V., Kvach, Y., & Makarov, S. (2010). Efficiency of the Controlling Application in the Corporate Management. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, (145 Quantitative Methods in Accounting and Finance), 54-58.

Látečková, A., Bolek, V., & Szabo, Ľ. (2018). Information systems in agricultural enterprises: An empirical study in Slovak republic. *AGRIS on-line Papers in Economics and Informatics*, *10*(665-2018-3625), 49-60. 10.22004/ag.econ.276120

Lesáková, Ľ. (2014). Evaluating innovations in small and medium enterprises in Slovakia. *Procedia-Social and behavioral sciences*, *110*, 74-81. https://doi.org/10.1016/j.sbspro.2013.12.849

Mura, L., & Buleca, J. (2014). Trends in international business of the Slovak small and medium food enterprises. *Procedia-Social and Behavioral Sciences*, *110*, 905-912. https://doi.org/10.1016/j.sbspro.2013.12.936

Pavlak, M., & Písař, P. (2020). Strategic management controlling system and its importance for SMEs in the EU. *Problems and Perspectives in Management*.

Pisar, P. (2020). Controlling, communication and corporate culture–the opportunities for Smes. *Economics & Sociology*, *13*(3), 113-132.

Pisar, P., & Bilkova, D. (2019). Controlling as a tool for SME management with an emphasis on innovations in the context of Industry 4.0. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *14*(4), 763-785.

Sedliacikova, M., Vacek, V., & Sopkova, E. (2015). How Slovak small and medium enterprises perceive financial controlling. *Procedia Economics and Finance*, *26*, 82-85.

Tulvinschi, M. (2010). Relevant Costs for Decision in an Effective Controlling System. *Theoretical & Applied Economics*, *17*(5).

Váryová, I., Vaňová, A. F., Košovská, I., & Krajčírová, R. (2015). Information Tools of Cost Controlling in Entities of Agricultural Primary Produce in Slovakia. *AGRARIAN PERSPECTIVES XXIV.*, 502.

Vuko, T., & Ojvan, I. (2013). Controlling and business efficiency. *Croatian operational research review*, *4*(1), 44-52.

Coordination of medical and social care about AD patients in CZ/SK in the context of bed capacities

Adéla Mikuličová [1]

Abstract: Alzheimer's disease (here referred to as AD) is in present times very actual topic because with increasing life expectancy it occurs more frequently. Persons with AD need both medical and social care. Two separated authorities – the Ministry of Health and the Ministry of Labour and Social Affairs, provide such care. Their representatives are trying to connect effectively for many years and thus create integrated care consisting both of medical and of social services. Purpose of this study is to map care for AD patients in bed facilities and coordination between medical and social system when AD patient stay is ending. A questionnaire survey among representatives of hospital and long-term care (here referred to as LTC) facilities both in the Czech Republic (here referred to as CZ) and in the Slovak Republic (here referred to as SK) served for this purpose. Questionnaires also mapped incidence rate of AD patients in hospitals and LTC facilities. Additionally a few semi-structured interviews with chosen hospital / LTC facility employees both in CZ and in SK were carried out. Interviews were focused on gathering information related to AD patient acceptance, hospitalization, discharge and an offer of services available to them.

Keywords: Alzheimer's disease, dementia, prevalence, Case management, coordination
JEL Classification: I10, I11, I19

1 Introduction

AD is in present times very actual topic. With increasing life expectancy it occurs more often and iaw Mátl et al. (2016) there will be approximately 183 000 people with AD or other form of dementia in 2020 and this figure will almost double till 2050. Exact figures in SK are unknown but present figures are estimated to 50 000 people suffering from the AD and in 2040 this figure could climb up to 180 000 (Dynatech, 1998-2020).

AD is neurodegenerative brain illness that gradually leads to irreversible damage of nerve cells. Because of nerve cells loss, dementia syndrome develops with AD causing between 50 to 75% of all dementia syndromes. Cognitive functions, perception, memory and logic thinking and understanding then gradually decline. With illness advancing patient is more and more troubled by daily life activities such as operating washing machine, mobile phone or a TV (Zvěřová, 2017). In this phase, a patient needs help and uninterrupted surveillance (Fertaľová a Ondriová, 2020). In the last phase of illness the patient is tied to the bed, not being able to communicate and is fully dependent of daylong care (Zvěřová, 2017).

Not only persons suffering by the AD need medical and social care. Two separated bodies are providing this care, that their respective representatives are trying to interconnect effectively for many years and thus create integrated care consisting both of medical and of social services provide this care. Departments of medical and social care in both states are only minimally interconnected in legislative area and in the area of mutual coordination (Čevela, 2015). Coordination of these departments is nevertheless important and there is a need to set it in the way that the care provided meet needs of individual patients. In practice, problems are encountered especially during discharge of patients from hospitals because coordination of services is missing and families are subsequently facing serious situations (living, ensuring of services). Capacities of social service facilities are insufficient and thus there is a need to support care, which is ensured in the patient's home environment (Kuzníková, 2017).

Main goal of this paper is to map care for AD patients in bed facilities and coordination between medical and social system when AD patient stay is ending. Research has been conducted in hospitals and LTC facilities both in CZ and in SK. Three research questions have been defined: What is the prevalence of AD patients in hospitals / LTC facilities? Where AD patients go once discharged from the hospital / LTC facility? How cooperation between medical and social system works?

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2 Methods

For research part of this paper strategy of quantitative and qualitative research has been used. Quantitative research has been carried out through emailed questionnaire survey across whole CZ and SK.

At least 5 hospitals and LTC facilities have been addressed from each region for having a representative sample. The questionnaire consisted of six questions and it only took a few minutes to each respondent to answer them. The questionnaire has been focused on mapping AD patients incidence rate in hospitals and LTC facilities and on coordination between medical and social system when AD patient hospitalisation ends. It inquired data for 2019, it was focused only on G30 and F00 diagnoses per MKN-10. In total 42 hospitals and 44 LTC facilities in CZ, and 23 hospitals and 17 LTC facilities in SK participated in the quantitative research (Tables 1-4).

Qualitative research has been carried out with the help of semi-structured interviews with chosen hospital / LTC facility employees. Interviews were focused on the process of AD patient admission, from where patients are coming to medical system facilities, how long do patients stay, to where they subsequently go once discharged, what is the offer of services and whether a cooperation between medical and social system exists. In total 3 hospitals and 2 LTC facilities in CZ, 2 hospitals and 2 LTC facilities in SK participated in the qualitative research.

Table 1 Research cover in hospitals based on regions in CZ

Region	Total count of hospitals in the region	Hospitals addressed in the region	Hospitals involved in the research	Research cover
Central Bohemian	22	5	3	14 %
South Bohemian	7	7	3	43 %
South Moravian	21	5	4	19 %
Karlovy Vary	4	4	2	50 %
Hradec Králové	8	5	3	38 %
Liberec	9	5	3	33 %
Moravian-Silesian	18	6	3	17 %
Olomouc	8	5	2	25 %
Pardubice	5	5	3	60 %
Plzeň	9	5	1	11 %
Prague	21	7	3	14 %
Ústí nad Labem	11	5	4	36 %
Vysočina	6	5	5	83 %
Zlín	7	5	3	43 %
TOTAL	**156**	**74**	**42**	**27 %**

Source: Own processing

Table 2 Research cover in hospitals based on regions in SK

Region	Total count of hospitals in the region	Hospitals addressed in the region	Hospitals involved in the research	Research cover
Bratislava	20	5	3	15 %
Trnava	7	5	4	57 %
Trenčín	10	5	3	30 %
Nitra	11	5	3	27 %
Žilina	11	5	3	27 %
Banská Bystrica	20	5	3	15 %
Prešov	16	5	3	19 %
Košice	17	5	1	6 %
TOTAL	**112**	**40**	**23**	**21 %**

Source: Own processing

Table 3 Research cover in LTC facilities based on regions in CZ

Region	Total count of LTC facilities in the region	LTC facilities addressed in the region	LTC facilities involved in the research	Research cover
Central Bohemian	14	5	2	14 %
South Bohemian	10	5	3	30 %
South Moravian	11	5	4	36 %
Karlovy Vary	6	5	2	33 %
Hradec Králové	5	5	4	80 %
Liberec	7	6	3	43 %
Moravian-Silesian	16	5	2	13 %
Olomouc	5	5	3	60 %
Pardubice	10	5	4	40 %
Plzeň	8	5	3	38 %
Prague	15	6	4	27 %
Ústí nad Labem	14	5	4	29 %
Vysočina	8	5	4	50 %
Zlín	8	5	2	25 %
TOTAL	**142**	**72**	**44**	**31 %**

Source: Own processing

Table 4 Research cover in LTC facilities based on regions in SK

Region	Total count of LTC facilities in the region	LTC facilities addressed in the region	LTC facilities involved in the research	Research cover
Bratislava	6	5	4	67 %
Trnava	2	2	0	0 %
Trenčín	7	5	2	29 %
Nitra	5	5	1	20 %
Žilina	6	5	4	67 %
Banská Bystrica	9	5	4	44 %
Prešov	6	5	2	33 %
Košice	8	5	1	13 %
TOTAL	**49**	**37**	**18**	**37 %**

Source: Own processing

2.1 Research limitations

People many times consider words „dementia“ and „Alzheimer disease“ for being synonyms thus it is not possible to conclusively separate „Alzheimer disease“ from „dementia“. Another factor, which can distort obtained data, is the fact that doctors often do not state AD diagnosis into the medical records system because for some patients who are being admitted it is only their secondary diagnosis. Also in some facilities, they have not enough time to fill in the questionnaire due to the epidemiologic situation with COVID-19.

3 Research results

Prevalence of AD patients in hospitals / LTC facilities

The research showed that the prevalence rate of AD in CZ hospitals is 11 %, in CZ LTC facilities is 16 %, in SK hospitals is 12 % and in SK LTC facilities is 13 %. Estimated number of AD patients is thus 5 502 in CZ hospitals, 1 765 in CZ LTC facilities, 3 377 in SK hospitals and 275 in SK LTC facilities (Table 5). Hanzalová (2020) states the prevalence of 16 % in homes for the elderly and 78 % in special regime homes (summarily called residential social services). Estimated number of AD patients is nearly identical both in hospitals and in homes for the elderly in CZ. According to the results of the research, 1 949 patients with AD went to residential social services from hospitals / LTC facilities in CZ. This means that 9 % of patients with AD enter residential social services from hospitals / LTC facilities and remaining 91 % enter them mainly from the home environment.

Table 5 Estimation of AD patient numbers in hospitals / LTC facilities in CZ and SK and comparison of results in homes for the elderly and special regime homes iaw Hanzalová (2020)

	CZ hospitals	CZ LTC facilities	SK hospitals	SK LTC facilities	Homes for the elderly iaw Hanzalová (2020)	Special regime homes iaw Hanzalová (2020)
AD prevalence	11 %	16 %	12 %	13 %	16 %	78 %
Total bed capacity	50 020	11 030	28 143	2 118	32 121	20 351
Estimation of AD patient numbers	5 502	1 765	3 377	275	5 139	15 874

Source: Own processing

At estimated number of 167 000 people with AD in CZ according to the Health insurance company of the CZ Ministry of Interior (2019), inpatient care was provided approx. to 4,4 %. Mátl et al. (2016) states that inpatient care is provided to incomplete 6 % of persons with dementia. AD represents 60 – 75 % of all dementias (Zvěřová, 2017) and therefore my result of 4,4 % can be considered optimal. With estimated number of 50 000 people with AD in SK iaw Dynatech (1998-2021), inpatient care was provided approx. to 7 %. In reality, this result can be lower as an exact figure of people with AD in SK is not known up until now.

Forms of AD patients discharge from hospitals / LTC facilities

I obtained results from the questionnaire survey and I verified them against results of semi-structured interview. The research showed that AD patients in CZ were most often discharged into the home environment once their hospitalisation finished (34 %), followed by the patient transfer into some other medical or LTC facility (32 %), discharging the patient in residential social services (21 %) and that 13 % of AD patients died during the hospitalisation. Results from SK are similar. 36% of AD patients in SK were discharged into the home environment, then 30 % of AD patients were discharged in residential social services, 28 % of AD patients were transferred into some other medical or LTC facility and only 6 % of AD patients died during the hospitalisation. Qualitative research confirmed that after the hospitalisation AD patients most often go into the home environment or LTC facility.

After finishing hospitalisation in LTC facility in CZ 45 % of AD patients went in residential social services. Only a quarter of patients returned back to the home environment, 16 % of patients died in the course of hospitalisation in the LTC facility and 14 % of patients were transferred into some other medical facility. Results from SK are again similar. After finishing hospitalisation in LTC facility in SK 49 % of patients were discharged in residential social services. 37 % of patients returned back to the home environment, only 8 % were transferred into some other medical facility and 6 % died in the course of LTC facility hospitalisation. Qualitative research confirmed that after being hospitalised in the LTC facility most AD patients go into the home environment or in residential social services. With regard to already mentioned problematics of insufficient capacities in residential social services, which I came across not only while studying professional literature but in semi-structured interviews as well, nearly half of patients was discharged in residential social services. Results were clearly processed into the Table 6.

Table 6 Termination of hospitalization of AD patients in hospitals / LTC facilities in CZ and SK

	Home care	Other medical facility, LTC facility	Social care facility	Deaths
CZ hospitals	34 %	32 %	21 %	13 %
SK hospitals	36 %	28 %	30 %	6 %
CZ LTC facilities	25 %	14 %	45 %	16 %
SK LTC facilities	37 %	8 %	49 %	6 %

Source: Own processing

Cooperation between medical and social system

The coordination between medical and social system in CZ hospitals and LTC facilities takes place through social or health and social workers and in SK through nurses. These workers help AD patients and their families to ensure residential social services. If a patient with AD is discharged to a home environment after hospitalization, they also help families to ensure social services such as assistance services, relief services or care services. In CZ workers can also turn to the municipal authority when ensuring patient care and in SK to the mayors of towns and municipalities.

The mentioned hospital staff tries to help AD patients and their families in providing follow-up care. Nevertheless, that is where their work ends, and families usually still have to rely on each other to deal with other situations. According to Holmerová (2018), informal carers most often need to obtain necessary information, help in coordinating care and services, or help with orientation in a confusing system of medical and social services. In these respects, the Case Management approach could help families, which would not only improve the quality of life of AD patient carers, but could also bring economic savings.

Kuzníková (2017) states that in practice there are problems in discharging patients from the hospital, where there is a lack of coordination of services and families are facing serious situations. There is a lack of a coordinated and smooth transition of the user between the medical and social system (Pospíšil, 2015). Also Mátl et al. (2016) state that the systemic interconnection of the medical and social system is missing and a substantial part of the services must be provided by informal carers themselves. In SK, medical and social care also consists of two separate ministries with minimal legislative interconnection in the area of direct coordination (Ministry of Health of the Slovak Republic, 2019). However, qualitative research proves that since at least 2019, hospitals and LTC facilities have been trying to help AD patients and their families to provide follow-up care and to provide information about the care options they can use.

4 Conclusions

For this study, whose subject is the coordination of medical and social care about AD patients in CZ/SK in the context of bed capacities, the strategy of quantitative and qualitative research was used. The goal of the study was to map the care about AD patients in bed facilities and the coordination of medical and social system when AD patient hospitalisation ends. The research was done in hospitals and LTC facilities in CZ and SK. Data collection took place through the questionnaire survey and semi-structured interviews.

Quantitative research has shown that in CZ AD patients are most frequently discharged into home environment or into the LTC once their hospitalisation is ended. In SK AD patients are most frequently discharged into home environment or into residential social services once their hospitalisation is ended. Both in CZ and SK are AD patients discharged from LTC into residential social services or into home environment.

Qualitative research has shown that cooperation between the medical and social care system in hospitals and in LTC facilities is going well. They try to coordinate this cooperation in hospitals and LTC facilities in CZ through social or health and social workers and in SK through nurses. They help AD patients and their families to provide residential or field social services and, if necessary, to provide essential information. In CZ, hospitals can also turn to the municipal authority and in SK to the mayors of towns and municipalities, who will help them provide follow-up care for an AD patient.

Despite the efforts of medical care facilities to coordinate services between the medical and social care system, it would be appropriate to deal with this issue in more depth, to define exactly who should be the coordinator, which tasks he should solve and in what way. In addition, as the number of people with AD is growing and this topic is now becoming an increasingly discussed, it would be appropriate to focus more on the outputs of statistics that would show how many such patients are treated in neurological departments, for example.

References

Čevela, R., (2015). *Sociální a posudkové lékařství*. Praha: Univerzita Karlova v Praze, nakladatelství Karolinum. ISBN 978-80-246-2938-4.

Dynatech. 1998-2021. Štatistické údaje. *Alzheimer.sk* [online]. ©1998-2021 [cit. 3. 1. 2021]. Dostupné z: http://www.alzheimer.sk/informacie/alzheimerova-choroba/statistiky.aspx.

Fertaľová, T., Ondriová I. (2020). *Demence: nefarmakologické aktivizační postupy*. Praha: Grada. ISBN 978-80-271-2479-4. ISBN 978-80-247-5439-0.

Hanzalová, M. *Prevalence Alzheimerovy choroby v domovech pro seniory a domovech se zvláštním režimem v ČR.* Jindřichův Hradec, 2020. Diplomová práce. Vysoká škola ekonomická v Praze. Fakulta managementu.

Holmerová, I., (2018). *Case management v péči o lidi žijící s demencí: koordinace péče zaměřená na člověka*. Praha: Fakulta humanitních studií Univerzity Karlovy. ISBN 978-80-7571-031-4.

Kuzníková, I., (2017). *Dlouhodobá zdravotně-sociální péče*. Ostrava: Ostravská univerzita. ISBN 978-80-7464-968-4.

Mátl, O., Mátlová M., Holmerová I., (2016). Z*práva o stavu demence 2016*. Velké Pořičí: Mare CZ s.r.o. ISBN 978-80-86541-50-1.

Ministerstvo zdravotníctva slovenskej republiky, (2019). Stratégia dlhodobej sociálno-zdravotnej starostlivosti v Slovenskej republike [online]. [cit. 4.12.2020]. Dostupné z: https://www.health.gov.sk/Clanok?strategia-dlhodobej-socialno-zdravotnej-starostlivosti-v-sr.

PospíšiL, D., (2015). *Národní strategie rozvoje sociálních služeb na období 2016-2025.* Praha: MPSV. ISBN 978-80-7421-126-3.

Zdravotní pojišťovna ministerstva vnitra ČR, (2019). Počet nemocných Alzheimerovou chorobou každoročně stoupá. *Zpmvcr.cz* [online]. 19. 9. 2019 [cit. 10. 11. 2020]. Dostupné z: https://www.zpmvcr.cz/o-nas/aktuality/pocet-nemocnych-alzheimerovou-chorobou-kazdorocne-stoupa.

ZvěřovÁ, M., (2017). *Alzheimerova demence.* Praha: Grada. ISBN 978-80-271-0561-8.

Mathematical-statistical Modelling and Optimization in Practice

Analysis of the determinants of the formation of flat prices in Czech Republic

Jakub Kalenský[1], Martin Hrabík[2]

Abstract: This conference paper describes the determinants of bid prices for apartments in 17 regions towns of the Czech Republic based on 1222 observations from February and March 2018. To achieve the resulting coefficients, multiple regression based on a method of hedonic price was used. A total of 18 determinants have been included in the final model, which appear to be variable in the model. The most influential determinants were: the size of the apartment, the city in which the apartment is located, the distance from the center, the type of property and the condition of the apartment. The resulting model can be widely used in the field of real estate valuation in the studied areas and similar locations, as an alternative to other real estate valuation methods.

Keywords: regression analysis, hedonic price, flats, price indexes.
JEL Classification: C43, E30, R31

1 Introduction

Each of us makes certain decisions in our lives. Some of these decisions are unimportant and we make them rather intuitively. For the more complex ones, it is necessary to think for a while and consider all possible consequences. The imaginary third group, i.e. the group of the most important life decisions, undoubtedly includes the decision to buy an apartment or sell it. In such moments, it is necessary to find an expert or carefully analyze the problem. This paper examines the price of an apartment and its dependence on various factors, the contribution answers the questions asked by everyone who plans to buy an apartment or sell it. To the questions of what the price of an apartment should be and why. This contribution presents a number of determinants that can affect the price of an apartment.

The researched branch is the subject of many studies, articles and professional works. Of the vast number, there are several studies dealing with real estate abroad. Štefan Rehák focuses mainly on the influence of the location of the apartment on its price. The model uses a total of 10 other independent variables, which were the area of the apartment, the number of rooms, the existence of a balcony, the existence of a cellar, the state of reconstruction of the apartment, apartment floor, age of the apartment, existence of an elevator, number of floors. Rehák proved the location of the apartment as an important determinant. In all his models, it has been proven that the offered price of real estate decreases with a greater distance from the center (Rehák, 2016).

Anne Laferrére's study is very interesting. Laferrére examines the apartments in Paris using the hedonic price method. One part of her work examines the effect of individual variables in the Paris region No. 13, which is near the city center. Here, research is conducted on 5,520 observations. The second part of her work then examines the effect of individual variables in the Paris suburb of Haut de Siene, where a total of 2476 properties are entering the research. The work is interesting mainly because it showed different behavior of variables depending on the location. For example, the impact of the existence of a garage near the center of Paris is higher, up to 4% of the total price. An interesting variable, the influence of which Laferrére tested, is a special variable for apartments that are on the 4th and higher floors and at the same time do not have an elevator. According to Laferrére, these flats are about 11% cheaper (Laferrére, 2005).

2 Methods

The dataset represents a summary of data from the observation of a total of 1222 dwellings in 17 regions cities of the Czech Republic. The towns are located in the South Bohemian, Karlovarský region and Ústecký region. The data were obtained from the websites of Sreality.cz and Bezrealitky.cz. Data collection was carried out during February and March 2018. The relatively short period of data collection minimizes the impact of the macroeconomic context and thus the change in the price level. The basic motivation for using regression analysis is an easier and more accurate estimate of the value of the explained variable. However, in order to accomplish this task, it is necessary that there is a mathematically descriptive relationship between the explanatory variable and the explanatory variables. The representation of this

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mathematical dependence is just the regression model (Hebák, 2013), the finding of which is the key task of this contribution. The linear regression model has the form:

$$Y= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \ldots. + \beta_n x_n + \varepsilon \quad (1)$$

where:

Y	dependent variable
x_1–x_n	independent variable
β_0–β_n	coefficients of variables
ε	random error

The linear model in which the explained variables underwent a logarithmic transformation must be modified for a more appropriate interpretation. During this modification, the model changes from additive to multiplicative model and the resulting model has the form:

$$Y=10^{\beta 0} \cdot (10^{\beta 1})^{x1} \cdot (10^{\beta 2})^{x2} \cdot (10^{\beta 3})^{x3} \ldots.. \cdot (10^{\beta n})^{xn} + \varepsilon \quad (2)$$

where:

10	the base of the logarithm

The following is an estimate of the individual coefficients using the least squares method, for this estimation the mathematical software R was used. The adjusted coefficient of determination will be used to evaluate the significance of the model.

2.1 Prerequisites of the model

For the application of the regression model is necessary to meet some assumptions. One of the assumptions is homoskedasticity, i.e. equality of variances. Any heteroskedasticity will be tested by the Breusch-Pagan test. Another assumption is the normality of residues, which will be assessed graphically using a Q-Q graph and will also be tested by the Shapiro-Wilk test. Multicollinearity, i.e. the dependence of individual predictors, will be indicated using the Variance Inflation Factors (VIF) method, i.e. a method based on the comparison of multiple coefficients of determination. Possible variables causing multicollinearity will be excluded from the model. All testing is at the 95% level of significance, with the exception of the Breusch-Pagan test, which is at the 99% level of significance.

3 Research results

A total of 41 independent variables entered the original model, and their common logarithms were also inserted into the model for all quantitative variables. By gradual exclusion, due to their insignificance and subsequent comparison of individual models, a total of 23 variables were excluded. All coefficients are in Table 1 and resulting model has the form:

Log. price = $\beta_0 + \beta_1 \cdot$ balcony + $\beta_2 \cdot$ garage + $\beta_3 \cdot$ log. distance from the store + $\beta_4 \cdot$ log. floor area + $\beta_{5\text{-}20} \cdot$ city + $\beta_{21} \cdot$ maisonette + $\beta_{22\text{-}24} \cdot$ condition of the apartment + $\beta_{25\text{-}26} \cdot$ condition of the house+ $\beta_{27} \cdot$ terrace + $\beta_{28} \cdot$ ownership + $\beta_{29\text{-}31} \cdot$ apartment equipment+ $\beta_{32} \cdot$ distance from the center+ $\beta_{33} \cdot$ kitchenette + $\beta_{34} \cdot$ MM + $\beta_{35\text{-}37} \cdot$ house height + $\beta_{38} \cdot$ storeroom + $\beta_{39} \cdot$ cellar + $\beta_{40} \cdot$ first floor + ε.

For a more suitable interpretation, due to the logarithm of the price, the model is converted to the following form:

price $=10^{\beta 0} \cdot (10^{\beta 1})^{\text{balcony}} \cdot (10^{\beta 2})^{\text{garage}} \cdot (10^{\beta 3})^{\text{log. distance from the store}} \cdot (10^{\beta 4})^{\text{log. floor area}} \cdot (10^{\beta 5\text{-}20})^{\text{city}} \cdot (10^{\beta 21})^{\text{maisonette}} \cdot (10^{\beta 22\text{-}24})^{\text{condition of the apartment}} \cdot (10^{\beta 25\text{-}26})^{\text{condition of the house}} \cdot (10^{\beta 27})^{\text{terrace}} \cdot (10^{\beta 28})^{\text{ownership}} \cdot (10^{\beta 29\text{-}31})^{\text{apartment equipment}} \cdot (10^{\beta 32})^{\text{distance from the center}} \cdot (10^{\beta 33})^{\text{kitchenette}} \cdot (10^{\beta 34})^{\text{MM}} \cdot (10^{\beta 35\text{-}37})^{\text{house height}} \cdot (10^{\beta 38})^{\text{storeroom}} \cdot (10^{\beta 39})^{\text{cellar}} \cdot (10^{\beta 40})^{\text{first floor}}$

This model reaches a significance of 87.9 %, so 87.9 % of the data variability is explained. The standard deviation of the residues is 0.1158 at 1181 degrees of freedom. The value of R^2 is 88.29 %. P-value is $<2.2 \cdot 10^{-16}$ the coefficients for each variable will be interpreted separately. The P-value of the homoskedasticity test, i.e. the Breusch-Pagani test, is 0.021. At the 99% level of significance, we do not reject H_0, i.e. the existence of homoskedasticity. VIF, for individual variables they take values lower than 5, the absence of multicollinearity is confirmed at the 95% confidence level. Since the vast majority of residues are located in the confidence interval, it can be said that this is a normal distribution. Therefore, all assumptions of the model were met. The normality of residues was not rejected by the Shapiro-Wilk test, whose p-value was 0.41.

Table 1 Results

Variable	Label	coefficient	recalculated coefficient	Standard deviation	p-value	
Konstant	β0	4,84800	70469,83000	0,07035	< 2e-16	***
balcony [no]	β1	-0,03404	0,92461	0,00876	0.00011	***
garage [no]	β2	-0,08099	0,82987	0,01825	9.94e-06	***
log. distance from the store	β3	0,05651	1,13897	0,00989	1.42e-08	***
log. floor area	β4	0,87883	7,56550	0,02526	< 2e-16	***
City [CV]	β5	-0,52592	0,29791	0,01709	< 2e-16	***
City [ČK]	β6	-0,19744	0,63469	0,04600	1.92e-05	***
City [DC]	β7	-0,34518	0,45166	0,02391	< 2e-16	***
City [CH]	β8	-0,30640	0,49385	0,02287	< 2e-16	***
City [JH]	β9	-0,22056	0,60178	0,03704	3.44e-09	***
City [K]	β10	-0,12693	0,74657	0,01430	< 2e-16	***
City [LN]	β11	-0,28380	0,52023	0,02530	< 2e-16	***
City [LT]	β12	-0,19411	0,63957	0,02467	8.19e-15	***
City [MO]	β13	-0,61303	0,24377	0,01443	< 2e-16	***
City [PÍ]	β14	-0,16819	0,67891	0,02183	2.81e-14	***
City [PR]	β15	-0,20744	0,62025	0,05391	0.00013	***
City [SO]	β16	-0,39938	0,39868	0,02174	< 2e-16	***
City [STR]	β17	-0,18203	0,65761	0,03877	2.98e-06	***
City [TP]	β18	-0,45191	0,35326	0,01558	< 2e-16	***
City [TA]	β19	-0,14693	0,71296	0,02520	7.18e-09	***
City [UL]	β20	-0,31126	0,48836	0,01472	< 2e-16	***
Maisonette [no]	β21	0,08858	1,22625	0,01904	3.69e-06	***
Condition of the apartment [new]	β22	0,17009	1,47941	0,01815	< 2e-16	***
Condition of the apartment [repaired]	β23	0,09226	1,23670	0,00906	< 2e-16	***
Condition of the apartment [old]	β24	-0,05965	0,87167	0.00924	1.63e-10	***
Condition of the house [good]	β25	0,02614	1,06204	0,00944	0.00575	**
Condition of the house [old]	β26	-0,04519	0,90119	0,01712	0.00843	**
Terrace [no]	β27	-0,06425	0,86247	0,02050	0.00177	**
Ownership [personal]	β28	0,08027	1,20300	0,00934	< 2e-16	***
Apartment equipment [partly]	β29	-0,04320	0,90531	0,00931	3.91e-06	***
Apartment equipment [empty]	β30	-0,05046	0,89030	0,01146	1.17e-05	***
Apartment equipment [unknown]	β31	-0,06097	0,86903	0,01124	7.11e-08	***
Distance from the center	β32	-4,9E-05	0,99989	0,00001	< 2e-16	***
Kitchenette [no]	β33	-0,02732	0,93903	0,00951	0.00418	**
MM [no]	β34	-0,02757	0,93850	0,00918	0.00276	**
House height [middle]	β35	-0,03314	0,92653	0,01166	0.00458	**
House height [the tallest]	β36	-0,05534	0,88035	0,01767	0.00179	**
House height [tall]	β37	-0,05816	0,87466	0,01269	5.09e-06	***
Storeroom [no]	β38	-0,02000	0,95499	0,01014	0.04897	*
Cellar [no]	β39	-0,03636	0,91970	0,00937	0.00011	***
First floor [no]	β40	0,02018	1,04755	0,00931	0.03056	*

Source: Own processing

Table 1 shows the total output for the resulting model. Table 1 has seven columns. The first column shows the input variables, the second column identifies the individual variables. The coefficient is the value for each variable. For easier interpretation of the values, Table 1 shows the "recalculated coefficient", which is the most important indicator for the interpretation of the resulting model. The variable "balcony" is a statistically significant variable. Dwellings with a balcony are taken as the reference category, so the coefficient given in Table 1 is the coefficient for dwellings without a balcony. After recalculating the coefficient, it can be said that it is proven that if the apartment does not have a balcony, it has only 92.46 % of the offer price of the same apartment that would have a balcony. Apartments with a balcony are therefore approximately 8.15 % more expensive than apartments without a balcony. The standard deviation indicates how differently the individual cases in the set of examined values typically differ from each other. The P-value or significance expresses a numerical value and determines the significance of the variable. The lower the p-value, the more significant the variable. The seventh column graphically expresses the p-value.

4 Conclusion

Due to the lack of proof of the influence of variables, such as the adjustment of the apartment for a suitable presentation and the color of the walls, the possibility opens up for the algorithmization of data collection. Thanks to this, it would be possible to make up to several times more observations. A higher number of observations could increase the aptness but also the usability of the model and at the same time could help to demonstrate the significance of some variables with a lower frequency. The knowledge gained can also be applied to observations made in other cities. When collecting data from other cities in the Czech Republic, very complex work could arise.

It would also be possible to include some other variables or new categories in the model. For example, separate from the category of brick houses a separate category for historic houses. A new variable could be, for example, a variable referring to whether a given apartment is sold with a tenant. Some socio-economic data from a specific area could also be included in the model.

A group of variables that could be better worked with is a group of variables referring to the position of the apartment and its surroundings. For the distance from the store, it would be appropriate to consider, for example, only hypermarkets, or to create a separate variable for hypermarkets. It would also be possible to work further with the variable distance from the school and create variables for different types of schools. A variable determining the distance from the park or urban greenery could also be added to the model.

The resulting model includes a total of 18 variables, of which 3 are quantitative and 15 are qualitative. Qualitative variables have a total of 52 categories. One of the most important variables and at the same time the variable with the highest number of categories is the variable "city". The most expensive apartments were found in České Budějovice, followed by Karlovy Vary, Tábor and Písek. On the contrary, the lowest apartment prices are in Most, Chomutov and Teplice. The most influential determinants were: the size of the apartment, the city in which the apartment is located, the distance from the center, the type of property and the condition of the apartment.

This work can serve the sellers, who thanks to this work can set the offer price for the apartment they sell. However, this work can also serve buyers who can compare the offer price of the apartment with the price determined on the base of our model. They thus avoid buying a property which, due to its properties and location, will not correspond to the offer price.

There is still a lot of work and that needs to be done on the field of real estate market price analysis and specifically the determinants of the offer price of apartments. I believe that this work appropriately supplemented some missing pieces of information and thus contributed to a better understanding of this topic.

References

Hebák, P. (2013). *Statistické myšlení a nástroje analýzy dat*. Praha: Informatorium, 2013. ISBN 978-80-7333-105-4.
Rehák, Š. (2016). Poloha bytu a jeho cena, priestorový hedonický model. *Geographical Journal* [online]. Bratislava: Národohospodárska fakulta Ekonomickej univerzity v Bratislave.
Lafferrere, A (2005). *Hedonic housing price indexes: the French experience*. In: Real Estate Indicators and Financial Stability [online]. Washington DC, ISBN 92-9197-678-4. ISSN 1682-7651.

Appendix

Table 2 City abbreviations

CB	**České Budějo-vice**	**K**	**Karlovy Vary**
CK	Český Krumlov	SO	Sokolov
JH	Jindřichův Hradec	DC	Děčín
PI	Písek	CV	Chomutov
PR	Prachatice	LT	Litoměřice
ST	Strakonice	LN	Louny
TA	Tábor	MO	Most
CH	Cheb	TP	Teplice
UL	Ústí nad Labem		

Analysis of the effect of historical data on the portfolio composition: Empirical study with open unit trust using the mean-semivariance model

Adam Borovička[1], Miroslav Virius[2]

Abstract: Decision making on the capital market through the quantitative approaches of operations research are often based on historical data that the investor naturally observes because history can have a significant impact on a future development. It is therefore natural that this article studies the strength of the effect of the selected historical periods on investment decision, or the composition of the investment portfolio. The basis of this empirical study is a mean-semivariance model that shows certain benefits over the notorious mean-variance model standardly used to a portfolio selection. Return and risk are calculated from several historical time periods with different lengths in the spirit of determined investment strategies. The time analysis also covers the study of the effect of the outbreak of the COVID-19 pandemic on the portfolio shape. The effect of historical period, or data, on the portfolio composition is empirically studied on the capital market with open unit trusts. The composition of the portfolios is analyzed and compared, as well as the efficient frontiers, through various historical periods. This reveals the considerable and different influence of the observed history on the composition of portfolios, and thus on their characteristics. In addition, the performed time analysis offers interesting overview of the participation of funds in portfolios. Thus, 'promising' funds as well as funds with negligible potential can be identified.

Keywords: composition, effect, fund, mean-semivariance, portfolio, unit trust.
JEL Classification: C44, C61, G11

1 Introduction

Decision making on the capital market can undoubtedly be challenging. Therefore, various support tools are used, which should facilitate a decision-making process. These often quantitative tools are based on historical observations of the prices of investment instruments, from which the characteristics of investment are calculated (estimated). Thus, a fundamental question arises as to how sensitive the methods are to the incoming data, or mainly what is the effect of the selected historical period on the composition of the investment portfolio and its characteristics.

To make a portfolio, the mean-semivariance model is applied (Markowitz, 1959). Compared to the more well-known mean-variance model (Markowitz, 1952), this concept is more sensible to the distribution asymmetry. Normality of returns may not be assumed which is appropriate in the context of frequent distribution asymmetry and skewness in investment practice, see from Jansen and Vries (1991) to Borovička (2020). Further, the semivariance concept does not penalize upside return volatility through a semi-deviation risk measure which is satisfactorily used in investment decision making, see more Butler and Joaquin (2002), or Stevenson (2001). The computational complexity is not significantly greater than with the mean-variance model. The concept therefore naturally seems to be suitable for making an investment portfolio, where the characteristics of return and risk play a crucial role.

To perform a complex analysis of the effect of the historical period on a portfolio composition, the model is applied to several data sets. This first couple of the periods reflects the short-term and long-term investment strategy. Then the length of the period is proposed on last one and ten years. Shorter time period actually reflects a recent development on the capital market. It is therefore more likely to suggest developments in the near future. On the contrary, a longer period of time including various trends on the capital market follows a longer-time development. The second part of the empirical study focuses on the analysis of the impact of the COVID-19 pandemic. Investment characteristics are calculated (estimated) from the prices of annual pre-pandemic period. This shorter time period, for rather short-term investment

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decision, is then extended by the time of the outbreak of the epidemiological crisis to this day (July 2021) to capture the impact of a significant fall in prices with a subsequent positive turnaround.

The main aim of the article is to empirically analyze the effect of the historical data on the composition of the investment portfolio, and thus decision-making on the capital market. To fulfill this aim, the following analytical procedure using the mean-semivariance model is proposed. To make the analysis complex, several specific time periods, representing different investment strategies, by extension, some interesting events on the capital market, are included (short, long, with huge fluctuations). The observed effect is indicated by comparing the structure of portfolios, and their characteristics over these historical periods. The 'risk-return' profile of investments are analyzed by plotting efficient frontiers. The secondary aim of the analysis is to identify 'promising', often participating assets in portfolios, as well as 'hopeless' funds, with (almost) zero participation. Such an information can also be very beneficial for investor decisions.

The usefulness of the proposed analytical procedure is enhanced by the selection of the investment instruments – open unit trusts – recently very popular, which further emphasizes the uniqueness and practical benefits of the study. After collecting the prices of open unit trust offered by Česká spořitelna, their characteristics of return and risk are calculated from each selected historical period, for which efficient portfolios are subsequently selected via the mean-semivariance model. The considerable influence of the historical periods (data) is confirmed by comparing the composition of efficient fund portfolios and their characteristics. Finally, the 'promising' and 'hopeless' funds are identified. The study performed in this market segment on (among other) current pandemic data is unique.

The rest of the article is structured as follows. Section 2 deals with the mean-semivariance model. The empirical analysis is performed in Section 3. Section 4 summarizes the contribution of the paper and outlines the path for further research.

Mean-semivariance model

The mean-variance model was proposed by Markowitz (1952). To eliminate the often unsatisfactory requirement for a normality of assets' returns and penalization of upside return volatility, a modification in the form of a mean-semivariance model was developed (Markowitz, 1959). The list of benefits is slightly hampered by the implementation of a semi-deviation risk measure, but with a today's computer technology this is not a significant computational complication.

The quadratic programming model, using semivariance above the mean reducing the (co)variance, is specified in the following form by Ballestero (2005)

$$\begin{aligned} &\min \quad \mathbf{x}^{\mathbf{T}}\mathbf{V}_{\mathbf{S}}\mathbf{x} \\ &\mathbf{x}^{\mathbf{T}}\mathbf{r} \geq r^{*} \\ &\mathbf{e}^{\mathbf{T}}\mathbf{x} = 1 \\ &\mathbf{x} \geq \mathbf{0} \end{aligned} \tag{1}$$

where:

$\mathbf{x}^{\mathbf{T}} = (x_1, x_2, ..., x_m)$	vector of variables $x_i, i = 1, 2, ..., m$, representing the share of the *i*-th asset in the portfolio
$\mathbf{V}_{\mathbf{s}} = (\sigma_{ij}^{s})$	$m \times m$ matrix including the semicovariances $\sigma_{ij}^{s}, i, j = 1, 2, ..., m$, between the return of the *i*-th and *j*-th asset
$\mathbf{e}^{\mathbf{T}} = (1, 1, ..., 1)$	vector of *m* ones
$\mathbf{r} = (r_1, r_2, ..., r_m)^{T}$	vector of returns $r_i, i = 1, 2, ..., m$, denoting a return of the *i*-th asset
r^{*}	minimum required level of return

The model (1) minimizes a portfolio risk (measured as semivariance of portfolio return) at a specified minimum level of required return. The condition $\mathbf{e}^{\mathbf{T}}\mathbf{x} = 1$ standardly ensures making a portfolio as a whole. The non-negativity conditions $\mathbf{x} \geq \mathbf{0}$ exclude short selling. This model can be quite easily solved by the quadratic programming optimization techniques. The minimum required return r^{*} can be subjectively determined according to its minimum and maximum possible value. The maximum corresponds to the highest return over all assets, or the maximum return function on the set $X = \left\{\mathbf{e}^{\mathbf{T}}\mathbf{x} = 1, \mathbf{x} \geq \mathbf{0}\right\}$. The minimum level of return is determined in the context of the minimum risk level on the set *X*. Then the smallest achievable return is given by $\mathbf{r}^{\mathbf{T}}\mathbf{x}^{*}$, where $\mathbf{x}^{*} = \arg\min \mathbf{x}^{\mathbf{T}}\mathbf{V}_{\mathbf{S}}\mathbf{x}, \mathbf{x} \in X$.

How to determine the semicovariance matrix $\mathbf{V_S}$? Let $v(\mathbf{r_M} > \bar{r}_M)$ be a semivariance above the mean return for the market portfolio whose *q* historical returns are situated to the vector denoted as $\mathbf{r_M} = (r_{M_1}, r_{M_2}, ..., r_{M_q})^T$. Then the expected return of the market portfolio is calculated as a simple mean $\bar{r}_M = \frac{1}{q}\sum_{k=1}^{q} r_{M_k}$. The easiest way to make a market portfolio is through a naïve strategy. Then the market portfolio contains all *m* assets with the same share. Then the *k*-th return of the market portfolio is specified as follows

$$r_{M_k} = \frac{1}{m}\sum_{i=1}^{m} r_{ik} \quad k = 1, 2, ..., q \tag{2}$$

where:

$r_{ik}, i = 1, 2, ..., m, k = 1, 2, ..., q$ the *k*-th return of the *i*-th asset

Now, the semivariance can be calculated as follows

$$v(\mathbf{r_M} > \bar{r}_M) = \frac{1}{q}\sum_{k=1}^{q}\left[\max(r_{M_k} - \bar{r}_M, 0)\right]^2. \tag{3}$$

Let **B** be the $m \times m$ matrix with the generic elements $b_{ij} = \beta_i \beta_j v(\mathbf{r_M} > E_M)$, $i, j = 1, 2, ..., m$, where Sharpe's β_i for the *i*-th asset, or β_j for the *j*-th asset is calculated as

$$\beta_i = \frac{\sigma_{iM}}{\sigma_M^2} \quad i = 1, 2, ..., m, \text{ or } \quad \beta_j = \frac{\sigma_{jM}}{\sigma_M^2} \quad j = 1, 2, ..., m \tag{4}$$

where:

σ_{iM} covariance of return of the *i*-th asset and the market portfolio

σ_{jM} covariance of return of the *j*-th asset and the market portfolio

σ_M^2 variance of return of the market portfolio

Now the $m \times m$ matrix semivariances and semicovariances can be determined as $\mathbf{V_S} = \mathbf{V} - \mathbf{B}$, where **V** is the matrix of variances and covariances of the assets' returns.

3 Empirical research of the historical data effect

The empirical research is started by specifying the historical periods where asset prices are monitored. The effect of historical data is analyzed on open unit trusts offered by Česká spořitelna. The investment portfolios for specified time periods are selected through the mean-semivariance model. The efficient frontiers are drawn. The compositions of the efficient portfolios are compared. The conclusions on the effect of historical prices are made.

3.1 Historical periods and data on open unit trusts

In order to comprehensively study the power of effect of the historical observations of assets' prices, or returns, on the composition of the investment portfolio, or investment decision, several historical periods will be defined. These periods should reflect a concrete investment strategy or any special or specific situations on the capital market.

The first two periods are designed for two basic investment strategies – short-term and long-term investment. The short period covers one year (July 2020-July 2021), the long period ten years (July 2011-July 2021). Short-term investment is favourably affected by the current developments on the capital market. When deciding on a longer-time investment, the characteristics of the investment should be estimated on the basis of data from a longer historical period reflecting various developments (ups and downs, 'calm' period).

The second pair of periods reflects the impact of the exceptional event of the COVID-19 pandemic. The period from January 2019 to January 2020 reflects the short-term, current development immediately before the outbreak of the pandemic. This period is extended from February 2020 to the present (July 2020) to include a significant fall in prices with the outbreak of the pandemic, followed by an appreciable rise.

The time analysis is focused on the collective investment market. The open unit trusts are a very popular investment instrument. They mediate investments in various assets. The funds are managed professionally. For a fee, they are very easily available to the investor. Based on the rich active experiences, the open unit trusts offered and managed by Česká spořitelna are selected. There are seven bond funds – Sporoinvest, Sporobond, Trendbond, High Yield bond, Fund of

corporate bonds, Erste Portfolio Bond Europe, Erste Bond Europe High Yield; ten equity funds – Sporotrend, Global Stocks, Top Stocks, Erste Stock Russia, Erste Stock Japan, Erste Stock Istanbul, Erste Stock Global, Erste Stock Europe Property, Erste Stock Europe Emerging, Erste Stock Europe; six balanced funds – Fund of controlled yields, Fund of life cycle 2030, Equity Mix, Dynamic Mix, Balanced Mix, Conservative Mix. These funds have a sufficient history to perform all analyses. Their prices are downloaded from Investiční centrum (2021). The return of the fund is computed as monthly mean. The risk is therefore measured on a monthly basis through semi(co)variances[3]. The market portfolio is made using a naïve strategy. Each fund then has a share of $\frac{1}{23}$ (4.35%) on the market portfolio.

3.2 Making investment portfolios

For each period, the model (1) is formulated and solved using LINGO optimization software. The optimal portfolio is made for a particular required return specified from the interval of its accessible levels (obtained using the procedure described in Section 2). For the entire interval, the efficient portfolios are selected.

At first, the composition of the efficient portfolios and their characteristics for one-year period (July 2020-July 2021) and 10-year period (July 2011-July 2021) are analyzed. Table 1 provides a brief overview from the portfolio with the lowest return and risk to the portfolio with the highest return and risk.

Table 1 Portfolios and their characteristics for the period July 2020-July 2021 and July 2011-July 2021 [in %]

Period	*July 2020-July 2021*			*July 2011-July 2021*		
Open unit trust	**Portfolio I**	**Portfolio II**	**Portfolio III**	**Portfolio I**	**Portfolio II**	**Portfolio III**
Sporoinvest	62.65	x	x	99.09	x	x
Sporobond	x	x	x	x	36.52	x
Fund of corporate bonds	x	x	x	x	x	x
Erste Portfolio Bond Europe	x	x	x	0.91	32.11	x
Erste Bond Europe High Yield	1.23	x	x	x	x	x
Sporotrend	x	13.15	x	x	x	x
Top Stocks	x	8.11	100	x	12.32	100
Erste Stock Russia	1.35	x	x	x	x	x
Erste Stock Istanbul	0.31	x	x	x	x	x
Erste Stock Global	x	41.13	x	x	19.05	x
Erste Stock Europe Property	x	2.37	x	x	x	x
Fund of controlled yields	34.46	x	x	x	x	x
Fund of life cycle 2030	x	17.81	x	x	x	x
Equity Mix	x	17.43	x	x	x	x
Return (mean)	-0.041	2	3.963	0.014	0.5	1.083
Risk (semivariance)	0.003	1.232	30.87	0.018	1.547	28.283

Source: Own processing

As you can see, the portfolios are quite diverse. For shorter period, more than half of the funds participate in portfolios. Their combined diversification power pushes down the risk of investing. As return increases, the number of funds naturally decreases. There is a gradual transition from less profitable and risky bond funds (Sporoinvest, etc.) to higher performing equity funds (Tops Stocks, Erste Stock Global, etc.). At the end of the process of increasing the return requirement, the only fund with the highest return (Top Socks) remains. As can be also seen in the table, the increase in risk with the pressure for higher return is gradual. Significant acceleration occurs with higher returns, when the sovereignly highest semivariance of Top Stock return begins to show.

And what do portfolios look like for a longer-term investment strategy? It is obvious that the composition of the portfolios is much more modest than in the case of a short-term period. Efficient portfolios consist of a maximum of five funds. The portfolio with the lowest risk (return) practically includes one fund. However, a sufficiently small positive share of the Erste Portfolio Bond Europe fund helps to reduce the portfolio risk. With the demand for a higher return, the low-return bond funds Sporoinvest and Sporobond are disappearing, while the equity funds named Top Stocks and Erste Portfolio Bond Europe are entering the portfolio. The demand for a lower return allows the Erste Portfolio Bond Europe fund to be included which reduces the risk of the investment thanks to its diversification capability with Top Stocks (through negative semicovariance of their returns). However, it is no longer enough for higher return levels. The portfolio with the highest possible return is then made by only one, the most 'return-efficient' fund (Top Stocks). The nature of the development of risk versus return is similar to the previous case.

[3] The vector of mean return, matrix of semi(co)variances and other calculated data (market portfolio characteristics or beta factors) in each historical period cannot be included due to the limited permissible range of the article. They are available from the author on request.

Similar analysis of the portfolios' compositions is performed for the second couple of time periods. Table 2 summarizes the results for both the pre-pandemic period (January 2019-January 2020) and its extended version with a period of pandemic outbreak followed by annual development (January 2019-July 2021).

Table 2 Portfolios and their characteristics for the period January 2019-January 2020 and January 2019-July 2021 [in %]

Period	*January 2019-January 2020*			*January 2019-July 2021*		
Open unit trust	**Portfolio I**	**Portfolio II**	**Portfolio III**	**Portfolio I**	**Portfolio II**	**Portfolio III**
Sporoinvest	x	13.68	x	26.85	x	x
Sporobond	x	x	x	x	16.91	x
Fund of corporate bonds	x	57.24	x	x	x	x
Erste Portfolio Bond Europe	x	7.23	x	x	38.21	x
Sporotrend	0.34	x	x	0.15	x	x
Tops Stocks	0.12	x	x	x	10.36	100
Erste Stock Russia	0.24	7.31	100	x	x	x
Erste Stock Global	x	11.77	x	x	28.76	x
Erste Stock Europe Property	0.10	2.77	x	x	x	x
Erste Stock Europe	x	x	x	x	5.76	x
Fund of controlled yields	99.20	x	x	73	x	x
Return (mean)	0.032	1	2.955	-0.016	1	1.986
Risk (semivariance)	0.002	0.302	9.258	0.011	2.185	49.204

Source: Own processing

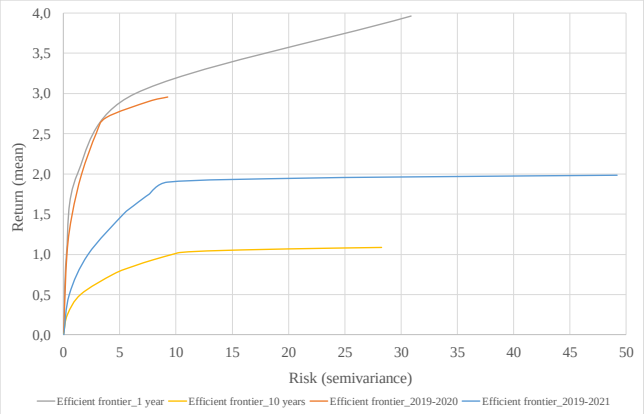
Again, we can see the portfolios with the lowest and highest risk (return) for both defined periods. For shorter period, the Erste Stock Russia fund participates in the portfolios due to its high return and diversification capabilities (negative semivariance with Erste Stock Europe or Erste Stock Global). Fund of corporate bonds with the second lowest risk has a significant representation in the portfolios with lower return. For extended period, the Top Stocks fund plays a crucial role in demanding higher return. A fund with excellent risk profile named Erste Portfolio Bond Europe is proving to be efficient, with the potential for higher returns naturally declining.

3.3 Comparative analysis, results discussion

Firstly, we can clearly identify inefficient funds, or funds that do not participate in any of the portfolios. There are bond funds Trendbond and High Yield bond, equity funds Global Stocks, Erste Stock Japan and Erste Stock Europe Emerging, and balanced funds Dynamic Mix, Balanced Mix and Conservative Mix. These funds do not have a suitable 'risk-return' profile. On the other hand, some funds are frequent participants in the portfolios – bond fund Erste Portfolio Bond Europe, equity fund Top Stocks and Erste Stock Global. Based on this partial analysis, we can identify funds that are potentially suitable or absolutely unsuitable for investing.

The short series of often recurring funds in the portfolio shows their diverse composition. While for a period of ten years all portfolios contain three to five open unit trusts, for a one-year period there are funds containing more than ten funds. For (pre)pandemic periods, the diversity in the composition of portfolios is not so marked, however, in a weak form it is evident. This is due to the fact that in the period covering the time of the COVID-19 pandemic, the significant monthly decline in market prices was offset by a significant increase. The trend of the development in the considered periods 2019-2020 and 2019-2021 is thus similar. This cannot be said about the annual period 2020-2021 and the ten-year period 2011-2021. The development in the shorter period is positively much more dynamic, which results in such a difference in portfolios. Different dynamics of development in selected historical periods can be demonstrated by drawing efficient frontiers as can be seen in Figure 1.

Figure 1 Efficient frontiers for all historical periods



Note: Efficient frontier_1 year ~ July 2020-July 2021; Efficient frontier_10 years ~ July 2011-July 2021; Efficient frontier_2019-2020 ~ January 2019-January 2020; Efficient frontier_2019-2021 ~ January 2019-July 2021
Source: Own processing

The empirical analysis confirms the hypothesis that the chosen historical period for a calculation (estimation) of the investment characteristics (significantly) effect a composition of the portfolios, as well as naturally their characteristics (return and risk). On the other hand, sometimes even shorter-term fundamental changes in the portfolio may not occur during dramatic events on the capital market. The proof is, for instance, the portfolios with a minimum level of risk in the period before and year and quarter after the outbreak of the pandemic, which are largely identical.

Whether the effect of the history can be greater or lesser, the investor should judiciously choose the historical period for calculating (estimating) the observed characteristics. This period should correspond to the chosen investment policy. Furthermore, the investor should keep in mind that the choice of historical period shapes the nature and properties of the data (distribution asymmetry, …) that condition the use of a particular method. The mean-semivariance model proves to be a good choice in the environment of asymmetric (not normally distributed) data for making a robust investment decision. And if the investor has doubts about the determination of the historical period, the analysis performed for time-complex periods proves to be a very handy supporting tool. The investor thus gets a basic idea of which investment instruments he should focus on and which instruments are not too 'promising'.

4 Conclusions

The article empirically analyses the impact of the choice of historical period for estimating investment characteristics on the composition of the portfolio. The basic building blocks of the proposed analytical procedure, i.e. the method for a portfolio making and the mechanics of shaping historical periods, are described. This procedure is uniquely applied to the capital market with very popular open unit trust offered by Česká spořitelna. Several historical periods related to the specific investment strategies (short-term, long-term investment) or situation on the capital market (outbreak of the COVID-19 pandemic) are specified. Portfolios, or efficient frontiers, made by a mean-semivariance model, are compared. The influence of the historical period has been confirmed. Portfolios are significantly different for short-term and long-term investment strategies. Annual pre-pandemic data enriched with pandemic data also brings changes in the investment portfolios, but not so considerable.

The investor should thus really sensitively choose the historical period from which the key characteristics of the investment are calculated. The historical period should be chosen in accordance with the conscientiously set investment strategy. The comprehensive analysis performed for several time periods can be very beneficial for the investor who gets an idea of the 'promising' and 'hopeless' open unit trusts according to their participation in the efficient portfolios.

In future research, the empirical analysis could be extended to other investment instruments (stocks, bonds, etc) which would make the analysis more robust and representative. Of course, another optimization model (multi-objective programming) can be used to make a portfolio, especially if you need to include other investment characteristics (costs, currency, etc.). The range of historical periods can also be expanded according to the current real needs.

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References

Ballestero, E. (2005). Mean-semivariance efficient frontier: a downside risk model for portfolio selection. *Applied Mathematical Finance*, 12(1), 1-15.

Borovička, A. (2020). Stock portfolio selection via mean-semivariance model. In: Quantitative Methods in Economics – Multiple Criteria Decision Making XX [online]. Púchov, 27.05.2020–29.05.2020. Bratislava: University of Economics, Bratislava.

Butler, K. C. & Joaquin, D. C. (2002) Are the gains from international portfolio diversification exaggerated? The influence of downside risk in bear markets. *Journal of International Money and Finance*, 21(7), 981-1011

Markowitz, H. M. (1952). Portfolio selection. *Journal of Science*, 7(1), 77-91.

Markowitz, H. M. (1959). *Portfolio Selection: Efficient Diversification of Investments*. New York: John Wiley & Sons, Inc.

Prices of open unit trusts. (2021). Retrieved from *https://cz.products.erstegroup.com/Retail/*.

Stevenson, S. (2001). Emerging markets, downside risk and the asset allocation decision. *Emerging Markets Review*, 2(1), 50-66.

Swisher, P. & Kasten, G. W. (2005). Post-modern portfolio theory. *Journal of Financial Planning*, 18(9), 11-74.

Market Research and Sustainable Marketing in Trade and Tourism

Do consumers recognise CSR activities?

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Abstract: Corporate Social Responsibility (CSR) has recently gained importance as a possible instrument for increasing the company's competitiveness. This paper aims to find which specific activities are perceived as socially responsible and which activities are perceived as merely meeting legal requirements. An online questionnaire was used for data collection, where respondents were consumers from the Czech Republic, aged 18-44. The results show that consumers have insufficient knowledge about CSR – they are not able to reveal whether some activities are real evidence of CSR or only meeting legal requirements. An idea for future researchers into the cause of the insufficient CSR knowledge among consumers is another added value of this paper.

Keywords: Consumers, Corporate Social Responsibility, Legal Requirements, Online questionnaire
JEL Classification: M14, M31

1 Introduction

The basic idea of "Corporate Social Responsibility" (hereinafter referred to as CSR) is to contribute to the well-being of broad society in the economic, social, and environmental field, also known as the Triple Bottom Line Framework (Pan et al., 2020). There is not the aim only for business goals, i.e. profit maximization (Hayes & Carr, 2021). Nevertheless, CSR should be included in the first line of a marketing strategy. This implementation can lead to many positive effects, e.g. increasing customers' and investors' satisfaction, increasing the reputation and competitiveness of a company (Chkir et al., 2021; Islam et al., 2021). The research paper by Kong et al. (2021) fills another gap in CSR: according to these authors, the CSR implementation has a positive impact of relationship between employees and environmental, and furthermore, the increased potential for creating a sustainable environment has been noted. In addition, the research by Benitez et al. (2020) mentions a higher credibility and involvement of employees to the company, when CSR is implemented in the corporate strategy.

Recently, CSR has come to the forefront of research, especially in marketing and social studies. One of the reasons is a constant increase in competition of companies on the (world) market (Lu & Ren et al., 2020; Sánchez-Torné et al., 2020). Currently, the second reason is COVID - 19 pandemic. On the one hand, this coronavirus disease has caused a change in consumer's behaviour (García-Sánchez & García-Sáchez, 2020; Mahmud et al., 2020). On the other hand, it caused less CSR implementation due to a lack of corporate's free financial resources. However, Hongwei & Lloyd (2020) have confirmed, that the maintenance of ethical behaviour during business practices and still fulfilling CSR activities to stakeholders is important in this crisis. Even, Broubaker et al. (2020) report that companies with high level of CSR practices have higher financial performance.

Even though there are many research studies on CSR, the absence of consensus persists: especially on CSR's voluntariness and also it is not crystal clear which activities are included in CSR and which are not (Barauskaite & Streimikiene, 2020; Tamvada, 2020). In general, CSR is used on a voluntary basis in companies. This makes companies to implement only those points that are suitable for their individual goals (Tamvada, 2020). From this point of view, there is no verification and monitoring mechanism that would determine the rate of completed CSR activities (Hira, 2020). The problem of voluntariness would occur if there were negative effects of business activity. In these cases, legal regulation of CSR would be necessary. The question remains whether the company can afford to wait for potential adverse effects (Tibiletti et al., 2021).

As for the CSR activities, the variety of them point out obscurities meaning which activity can be included in the economic, social, and environmental fields and which one cannot (Lu & Liang et al., 2020). Therefore, it is no wonder that the knowledge of the lay public about CSR is insufficient. Also, a paper by Pham et al. (2021) refers to this problem

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and emphasizes necessary knowledge and government support of CSR issue. At the same time, however, the world's expert sources accept that the strict division could be somewhat unclear and ambiguous (Gatti et al., 2019).

In the Czech Republic, CSR is understood as a set of activities that companies voluntarily perform beyond legal obligations (Rada kvality ČR, 2021). These optional/additional activities are related to economic, social, and environmental business aspects that have the potential to improve the business environment in the broadest term. That is why our conducted research was carried out in order to find out which specific activities are perceived as a sign of social responsibility and which activities are understood as a sign of legal requirements by Czech consumers.

2 Methods

The research was based on an online questionnaire survey (in Google Forms), which was realised during February and March 2021. The survey was focused on respondents aged 18-44 years who were from the Czech Republic (n = 406; the sample was balanced in terms of gender and also in terms of sub-age groups formed as intervals of three years). As the online questionnaire was intended to use, respondents who shopped online more frequently were examined – i.e. people aged 18-44 (Redakce, 2019. In terms of content of the online questionnaire, the battery of questions according to Kozel (2011) was used there. Then an examined activities were connected into two parts – activities with positive connotations and negative connotations. At the end, the identification questions finding out an age, a gender and the highest education attainment was included in the questionnaire. From the view of the highest educational attainment, 6% of respondents have a primary education, 14% a secondary education without a graduation, 48% a secondary education with a graduation, 5% upper vocational education and 27% a university education. A control mechanism, inspired by Martiskova (2020), was included in the questionnaire to avoid careless questionnaire completion.

The obtained data were then statistically processed; the Chi-square test of independence was used when 95% rate of reliability was determined for interpretation purposes.

3 Research results

3.1 Facts with positive connotations

Based on our own experience, specific activities have been chosen that could be assumed to be positively accepted by the public. For each item, respondents had to decide whether they perceived it as a sign of social responsibility (consisting in the performance of optional activities), or it is a compliance with legal requirements from their point of view. The obtained results are presented in Figure 1.

Although ecology and environmental protection are the most typical signs of social responsibility (Ipsos, 2019), according to results from the conducted questionnaire survey, respondents did not consider “reduction of waste production” to be the absolute most visible example of CSR. Quite surprisingly, the most visible example of CSR for respondents was “support non-profit and charitable organisations” (71% + 22% = 93% of respondents). A possible explanation is offered by the hypothesis that ecology and environmental protection are becoming almost a matter of course for consumers (Gabrielová & Kovandová, 2019) in contrast with supporting non-profit and charitable institutions. Hence, this support is considered as an extra activity.

The following statistical contexts, found out using the Chi-square test of independence, are worth mentioning:

- “Fight against discrimination” is considered a sign of CSR more by people aged 27-32 years. On the other hand, older people aged 33-41 have an opinion that it is only performance of legal requirements.
- As for “respect for ethical principles”, respondents with primary education most often perceived it as a performance of legal requirements. While people with the upper vocational education are most often convinced that it is a sign of CSR. (However, these results can be distorted due to the small representation of respondents with primary and upper vocational education.)
- According to respondents with a secondary education without a graduation, the “top quality of offered products” is most often a sign of CSR, while people with primary education or upper vocational education are most often convinced that it is a performance of legal requirements. (Again, however, these results can be distorted due to the small representation of respondents with primary and upper vocational education.)

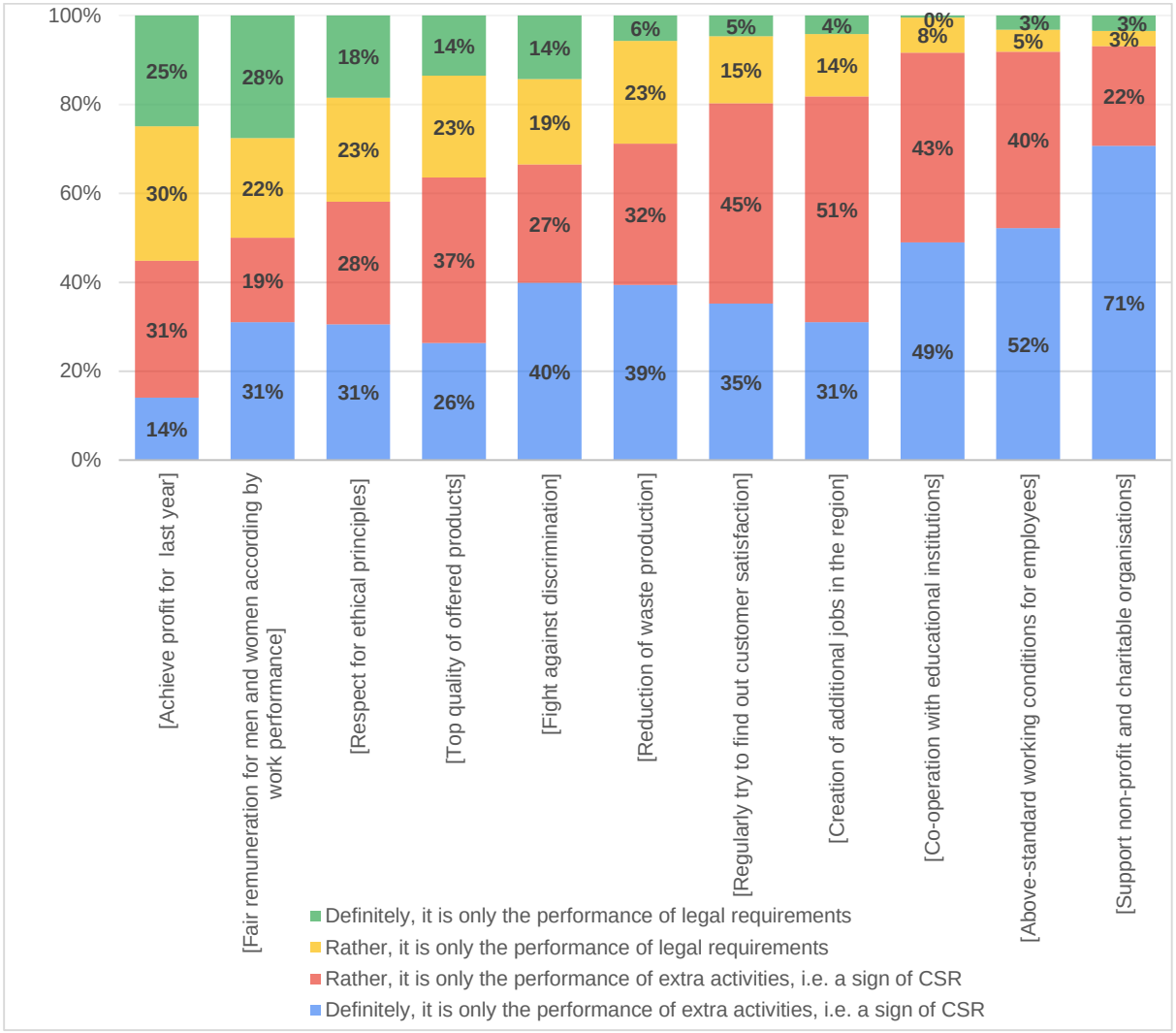

Figure 1 Facts with positive connotations; source: own processing.

3.2 Facts with negative connotations

The second part of the questionnaire was focused on chosen facts that have negative connotations. For each item, respondents had to decide whether it is a failure of voluntary provisions in terms of CSR or it is a violation of legal requirements. The obtained results are presented in Figure 2.

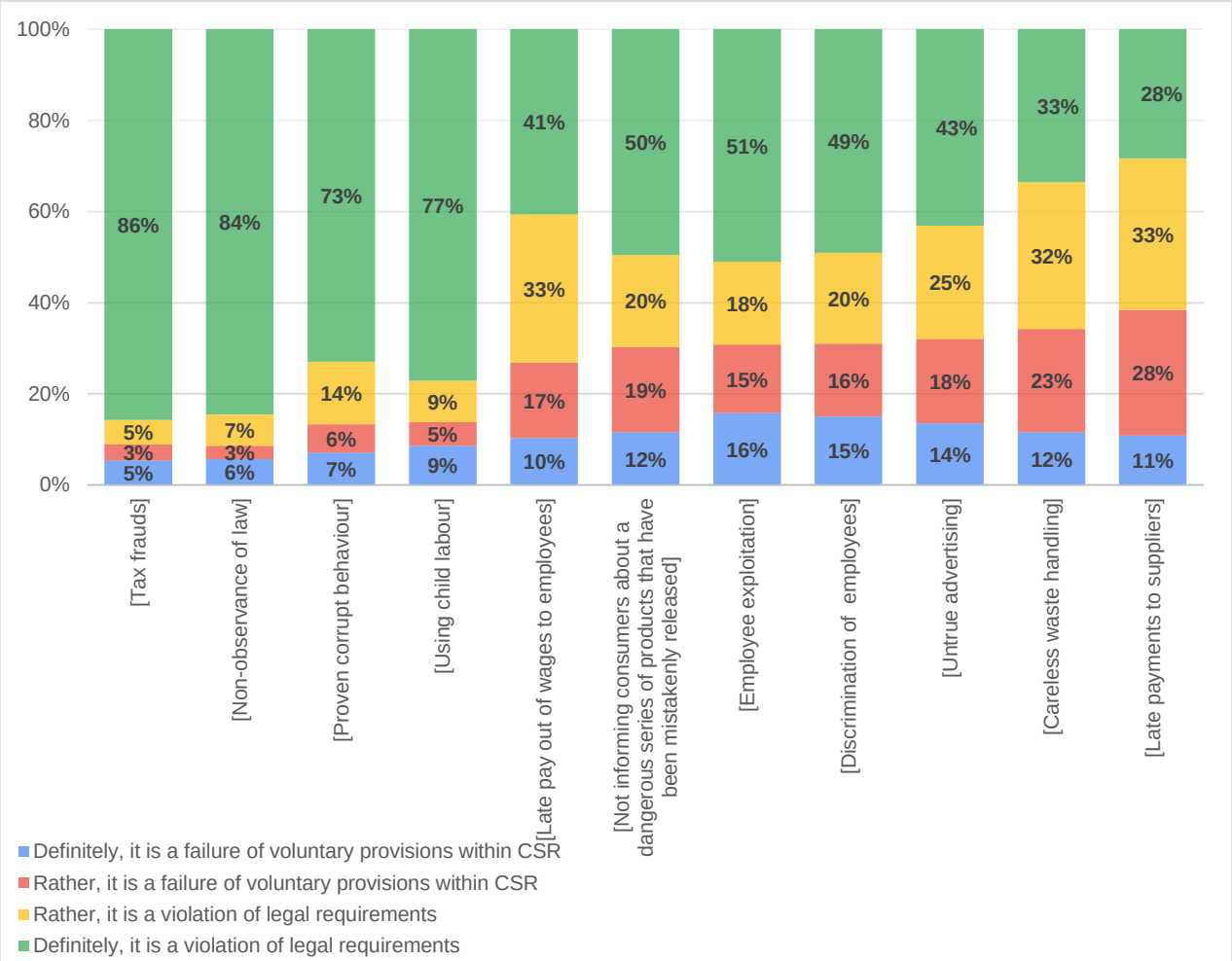

Figure 2 Facts with negative connotations, source: own processing.

Surprisingly, 8% (5%+3%) of respondents included the item "tax frauds" in a failure of CSR. The result regarding the item "non-observance of law" is also surprising. However, based on CSR definitions, it can not be said that compliance should be seen as an optional activity.

When the Chi-square test of independence was applied, the following contexts were found out from statistic testing:

- According to people aged 18-23 with secondary education without graduation, the item "late payments to suppliers" is perceived as a violation of legal requirements. In contrast, people aged 18-20 with upper vocational education are significantly convinced that it is a failure of voluntary provisions within CSR.
- According to people aged 18-32 with primary education, "careless waste handling" is most often perceived as a failure of voluntary provisions within CSR, while people aged 33-41 with secondary education most often consider this activity as a violation of legal requirements.
- According to people aged 36-38, "untrue advertising" is most often perceived as a violation of legal requirements. While people aged 24-26 most often suppose that it is a failure of voluntary provisions within CSR.

4 Discussion

Hommerova et al. (2020) examined the understanding of the essence of CSR of a selected fast-food chain in the Czech Republic. Above half of the respondents have understood the significance of CSR. In terms of this, a correlation between knowledge about CSR and age and between knowledge about CSR and education was pointed out there. Also, the importance of CSR was found out. It was placed in the fourth place (after price, quality, and recommendations from friends) by respondents' point of view. These respondents indicated which CSR activities have been more important for them: accountability and the fair treatment of staff (90,15%), the provision of truthful information by a company and its transparency (87,5%), a statement rejecting corruption and respecting the rules of fair competition (85.61%). Following this research study by Hommerova et al. (2020), our attention was drawn to examining the knowledge of consumers about specific CSR activities in this research paper. We have found that if a particular activity is presented to the consumer without indicating whether it is CSR or legal requirement, a consumer is not sure. As a result, our survey showed that our selected sample of respondents did not know the general nature of CSR.

Ulke & Schons (2016) investigated a connection between corporate reputation and credibility as an outcome of CSR initiatives. The results show that if a company's reputation is bad, it is not an obstacle to the positive results of CSR initiatives. Potepkin & Firsanova (2017) examined the impact of CSR on customer loyalty in international comparison (in Russia and Finland). The conclusions point to a similar international response to CSR. It is also mentioned in this study that implementation of CSR improves the company's image in the minds of consumers, thereby positively affecting the monitored factor – customer loyalty to the company or brand. Their loyalty also increases in direct proportion, the more the company tries to publicly show the implemented CSR activities.

Regarding these studies in comparison with our research paper, implementation of CSR activities increases the company's credibility (image) towards consumers, however, some consumers are not educated enough to recognize whether it is CSR activity or just compliance with legal requirements. It can so easily happen that a company tries to increase its credibility / image of the "extra" activities, however, these "extra" activities may be only law requirements.

5 Conclusions

Research findings indicate that consumers have insufficient ability to recognise what is a CSR activity and what is not. It can happen that a company presents itself as socially responsible, although in reality it meets only legal requirements. Therefore, it can be recommended consumers could be critical when receiving information and may try to find whether a company does not present meeting legal requirements as an extra voluntary activity. It is also worth considering, whether it would not be better to establish a supervisor organisation that could control and draw attention to unfair practices of companies boasting activities that they must carry out anyway. One of the ways how to this organization could draw attention to the unfair practices of companies is an opportunity to publicize these cases. The threat of media coverage may be a sufficient sanction in the context of CSR (e.g. Zarantonello et al., 2018). When companies consider how much time, money, and energy they have put into building CSR and how quickly they could lose it, there is a chance they change their minds and would not risk because they want to maintain the credibility and favour of their consumers.

Future studies could develop here presented research results and find the cause of the lack of CSR knowledge among consumers. Also, it would be useful to find out whether consumers' knowledge in the field of CSR could be increased, for instance, through education on social networks.

References

Baraukaite, G., & Streimikiene, D. (2020). Corporate social responsibility and financial performance of companies: The puzzle of concepts, definitions and assessment methods. *Corporate Social Responsibility and Environmental Management*, 28, 278-287.

Benitez, J., Ruiz, L., Castillo, A., & Llorens, J. (2020). How corporate social responsibility activities influence employer reputation: The role of social media capability. *Decission Support System*, 129.

Boubaker, S., Cellier, A., Manita, R., & Saeed, A. (2020). Does corporate social responsibility reduce financial distress risk? *Economic Modelling*, 91, 835-851.

Chkir, I., Hassan, B. E. H., , H., & Saadi, S. (2021). Does corporate social responsibility influence corporate innovation? International evidence. *Emerging Markets Review*, 46.

Gabrielová, R., & Kovandová, L. (2019, 30 July). *Průzkum: Čechům ekologie není lhostejná, řeší ji doma i při nákupu*. https://www.globus.cz/brno/o-globusu/pro-novinare/archiv-tiskovych-zprav/tiskova-zprava.html/139_14150-pruzkum:-cechum-ekologie-neni-lhostejna-resi-ji-doma-i-pri-nakupu/3.

García-Sánchez, I. M., & García-Sánchez, A. (2020). Corporate Social Responsibility during COVID-19 Pandemic**.** *J. Open Innov. Technol. Mark. Complex*, 6(4), 126.

Gatti, L., Vishwanath, B., Seele, P., & Cottier, B. (2019). Are We Moving Beyond Voluntary CSR? Exploring Theoretical and Managerial Implications of Mandatory CSR Resulting from the New Indian Companies Act. *Journal of Business Ethics*, 160(4), 961-972.

Hayes, R. A., & Carr, T. C. (2021). Getting called out: Effects of feedback to social media corporate social responsibility statements. *Public Relation Review*, 47(1).

Hira, A. (2020). The hollow core: breakdowns in global governance of CSR. *Global Affairs*, 6(4-5), 461-479.

Hommerova, D., Sredl, K., Vrbkova, L., & Svoboda, R. (2020). The Perception of CSR Activities in a Selected Segment of McDonald's Customers in the Czech Republic and Its Effect on Their Purchasing Behavior-A Case Study. *Sustainability*, 12(20), 17. doi:10.3390/su12208627

Hongwei, H., & Lloyd, H. (2020). The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy. *Journal of Business Research*, 116, 176-182.

Ipsos (2020, April). *CSR & Reputation Research 2019*: Public part of the research. Obtained by e-mail communication with M. Kneblíkovou (2021, 21 April)

Islam, T., Islam, R., Pitafi, A. H., & Xiaobei, L. (Eds.). (2021). The impact of corporate social responsibility on customer loyalty: The mediating role of corporate reputation, customer satisfaction, and trust. *Sustainable Production and Consumption*, 25, 123-135.

Kong, L. Sial, M. S., Ahmad, N., & Sehleanu, M. (Eds.). (2021). CSR as a Potential Motivator to Shape Employees' View toward Nature for a Sustainable Workplace Environment. *Psychology of Sustainability and Sustainable Development*, 13(3), 1499.

Kozel, R. Kapitola 6: Dotazování. In Kozel, R., Mynářová, L. & Svobodová, H. (2011). *Moderní metody a techniky marketingového výzkumu.* Praha: Grada, 2011. Expert (Grada). ISBN 978-80-247-3527-6

Lu, J., Liang, M., Zhang, C., & Rong, D. (Eds.). (2020). Assessment of corporate social responsibility by addressing sustainable development goals. *Corporate Social Responsibility and Environmental Management*, 28, 686-703.

Lu, J., Ren, L., Yao, S., Qiao, J., Mikalauskiene, A., & Streimikis, J. (2020). Exploring the relationship between corporate social responsibility and firm competitiveness. *Economic Research-Ekonomska Istraživanja*, 33(1), pp.1621-1646. Mahmud, A., Ding, D., & Hasan, M. M. (2021). Corporate Social Responsibility: Business Responses to Coronavirus (COVID-19) Pandemic. *Sage Journals*, 11.

Martiskova, P. (2020). Kontrolní mechanismy v dotaznících – tipy, jak je aplikovat v praxi. *Marketing & komunikace*, roč. XXV, č. 1/2020, s. 20-21. ISSN 1211-5622.

Pan, X., Sinha, P., & Chen, X. (2020). Corporate social responsibility and eco-innovation: The triple bottom line perspective. *Corporate Social Responsibility and Environmental Management*, 28, 214-228.

Pham, H., Pham, T., & Dang, C. N. (2021). Barriers to corporate social responsibility practices in construction and roles of education and government support. *Engineering, Construction and Architectural Management*. ISSN: 0969-9988

Potepkin, M., & Firsanova, O. (2017). Customer Perception of CSR Activities: A Comparative Study of Finnish and Russian Consumers. *Baltic Journal of European Studies, 7*(2), 59-83. doi:10.1515/bjes-2017-0010

Rada kvality ČR (2021). *Společenská odpovědnost organizací: CSR v ČR*. https://www.narodniportal.cz/spolecenska-odpovednost-organizaci/csr-v-cr/.

Redakce (2019, 25 March). *Infografika: Jak Češi nakupují na internetu? Dominují ženy, nejsilnější měsíc je listopad.* https://tyinternety.cz/e-commerce/infografika-jak-cesi-nakupuji-na-internetu-dominuji-zeny-nejsilnejsi-mesic-je-listopad/.

Sánchez-Torné, I., Morán-Álvarez, J. C., & Pérez-López J. A. (2020). The importance of corporate social responsibility in achieving high corporate reputation. *Corporate Social Responsibility and Environmental Management*, 27(6), 2692-2700.

Tamvada, M. (2020). Corporate social responsibility and accountability: a new theoretical foundation for regulating CSR. *Int J Corporate Soc Responsibility*, 5(2).

Tibiletti, V., Marchini, P. L., Furlotti, K., & Medioli, A. (2020). Does corporate governance matter in corporate social responsibility disclosure? Evidence from Italy in the "era of sustainability." *Corporate Social Responsibility and Environmental Management*, 28, 896-907.

Ulke, A. K., & Schons, L. M. (2016). CSR as a Selling of Indulgences: An Experimental Investigation of Customers' Perceptions of CSR Activities Depending on Corporate Reputation. *Corporate Reputation Review, 19*(3), 263-280. doi:10.1057/s41299-016-0005-0

Zarantonello, L., Romani, S., Grappi, S., & Fetscherin, M. (2018). Trajectories of brand hate. *Journal of Brand Management, 25*(6), 549-560. doi:10.1057/s41262-018-0105-5

The Importance of Social Media in the Food Market

Belisa Korriku[1]

Abstract: The usage of Social Media is leading the world of business. Through them all the business units and areas of interest are aimed at promoting and marketing. The impact that create the use of social networks from business is very important to get a feedback about all the activities and the environment where this companies operate. In this study it will be presented how the use of Social Media is affecting consumer behavior in the food market. Social Media has once again proven that it is a fundamental business objective for companies who want to increase their brand exposure. In the food industry this is no different. The world over, social media is being utilised by the business world as an effective marketing tool for connecting with their customers. Social networking websites such as Facebook and YouTube have rapidly grown in popularity creating online communities made up of people with shared interests. The trend has been supported by development in smart phones and mobile enabled websites. From a commercial stand point companies are embracing social media, with many operating online marketing strategies. Although most agree that businesses should utilise social media for marketing purposes, there is little agreement on what this should involve and how it can be made to work successfully, illustrated by a selection of industry quotes. Many of the strategies undertaken to date have placed a strong emphasis on connecting with customers, such as through posting updates regarding corporate activities, sharing information and resources and product marketing via competitions. Advertising via social media (e.g. via apps or photos) is also increasing. The expected results of this research not only will contribute in order to expand the literature review focuses on the relationship between social media platforms and business performance but these results will give some guidelines to marketers of these companies in order to better change their marketing functions directed oriented to companies.

Keywords: social media, food products, marketing
JEL Classification: M3, M31, M 37

1 Introduction

Social media is an online media, where the users can easily participate, share, and create any content such as banner, posters, videos and advertisement. Many companies use these social media as a tool to promote their products and make customers aware with their brand. On the other hand, not all companies succeed to market their products and make their products are at their customers' awareness. Marketing communication in a company has an impact to company's brand awareness (Tritama & Tarigan, 2016).

In recent years, social media has become ubiquitous and most important for social networking, content sharing and online accessing. Due to its reliability, consistency and instantaneous features, social media opens a wide place for businesses such as online marketing. Marketing which occurs via social media is known as social media marketing. Social media marketing has made possible for companies to reach targeted consumers easily, effectively and instantly. Besides that, social media marketing also faces several challenges in the field. (Nadaraja & Yazdanifard, 2014) The increasing popularity of social media has prompted the need to examine the effects of social media comments on consumers' responses to food safety information**.**(Seo, Almanza, Miao, & Behnke, 2015)

It's no secret that Instagram has changed the marketing game. One of the biggest ways is with the rise of "influencers," or people with accounts that have a sizeable number of followers who leverage their online clout by partnering with brands, then posting sponsored content or ads featuring those companies or their products.

Billions are spent yearly on food marketing that influences unhealthy eating preferences and habits, and contributes to the development of obesogenic environments worldwide. Recent social media advancements have provided food

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marketers with platforms to readily reach out to many especially younger consumers.(Qutteina, Hallez, Mennes, De Backer, & Smits, 2020)

U.S. companies spent $5.1 billion on social media advertising in 2013, but a recent Gallup survey revealed that these advertisements had no influence on the majority of U.S. consumers' buying decisions. For social media marketing to be effective, we argue that social media marketing efforts need to be congruent and aligned with the different needs of social media users. (Zhu & Chen, 2015)

Healthy food sales have increased in recent decades. Retailers are widening their marketing management approach, including the use of social media to communicate with consumers and to promote healthy food**.**(Samoggia, Bertazzoli, & Ruggeri, 2019) Researchers and brand managers have limited understanding of the effects social media communication has on how consumers perceive brands**.**(Schivinski & Dabrowski, 2016) The rise of social media has provoked both optimism about potential societal benefits and concern about harms such as addiction, depression, and political polarization.(Allcott, Braghieri, Eichmeyer, & Gentzkow, 2019) Many studies have been conducted in the last years that have demonstrated on how marketing has influenced sales and promotions of food products. It is said that one of the best ways to get to someone's heart is through his stomach. But which is the best way for a brand to make customers fall in love with their products? Answer, as you all were thinking is **Social Media.** Social media influence over food shopping habits has been small compared to other industries, but nowadays every brand has their **Community Managers** working hard to increase the engagement and number of followers. Keep an eye on risks, although the benefits of using Social Media are obvious you might have some considerations with your Community Manager.

Social media nowadays is among the 'best possibilities available' to an item to get in touch with potential customers (DURGAM, 2018)

Recently, it has become a part of marketing medium for organizations. Accompany with the advanced technology, many organizations rely on social media to reach out directly to existing consumers or to attract new ones. In marketing, social media has become a better marketing medium than traditional marketing which has shifted the ways in which consumers evaluate, choose and also share information

The purpose of the study is to investigate the use of social media as a new investigative tool in marketing research (Patino et al., 2012)

Social media such as Facebook, Instagram and YouTube are often used by many organizations. Consequently, it is no wonder that consumers will be able to get information at a very fast pace and only at their fingertips since technology always has had a huge impact on marketing (Hajli, 2014). Researcher identified that the industry's top performing companies have an integrated and active social media presence (Snyder, 2013). Nowadays, this has resulted in an interesting choice of food within the society. Thus, F&B industry are finding new ways to engage their customers through social media. Researcher stated that, the use social media in this advanced-era whereby mostly generation Y is dominating consumer in F&B industry (Hajli, 2014). Accordingly, researcher identified that influences of social media allowing many F&B companies to leverage on multiple media touch points in aiming to build up their brands (Poon, 2014). Advanced technology is providing the F&B companies opportunities to explore new ways to have better understanding in customer acquisition and retention (Dolan, 2013). F0&B companies on using social media as an information platform where Malaysian consumers will have access to variety of sources for information (Saaid, 2013). Besides that, researchers identified that F&B companies using social media to gathered consumers' feedback to improving their business (Saaid, 2013; Snyder, 2013). F&B companies will be able to gain competitive advantages by using social media as marketing medium. In recent years, it is a trend of using social media as the result of advanced technology by the current generations. The current generations spend most of their time using the social media to "connect with the world**" (**Schiffman, Kanuk, &Wisenblit, 2010).

Social Media has once again proven that it is a fundamental business objective for companies who want to increase their brand exposure. In the food industry this is no different. A recent survey from Forrester Research discovered that over ninety percent of food industry executives agree that social media has completely changed the way consumers interact with their brand.

Once thought of as an "extra" in marketing departments, social media is now a must-have, and one of the best ways to get results. It is estimated that over twenty thousand companies have a Facebook page for their business. With close to a billion people on Facebook, there is the ability for companies to target nearly any consumer group. And that's just Facebook, LinkedIn, YouTube, and others, continue to grow in importance for companies wanting to create dynamic and interactive online brands.

This is precisely the reason many food companies have started to look at their social strategies more carefully.

For example, the lead digital marketer from Sainsbury's, a British grocery chain, claims that social media has been a great way for the company to reach out to their consumers via a more "holistic approach." The ability for the company to have an "open dialogue" with customers gives Sainsbury's a way to improve their business, thanks to direct feedback from customers via social media.

In all cases, and regardless of industry, it's evident that social media plays a dynamic role in the consumer and brand relationship. It helps spread company news and brand awareness, while still keeping the company approachable in the eyes of the consumer. Moreover, companies who keep their social media accounts interactive, either via contests or other campaigns, usually have the best online rapport with their customers and the ability to build their online reputation faster than companies that are inactive in the social media space.

Cadbury, for example, held a special campaign called "Spots v Stripes" during the 2012 Olympics that was promoted via social media. The campaign reached over 120,000 people who participated in their specially sponsored events. This may be just one example of how a food industry based business has created a viral marketing campaign with social media, but it certainly is not the only one.

As social media continues to grow in importance, it will invariably become more and more important for brands in all industries to be engaged with consumers online. If a social media strategy is not already a necessity in the food industry (which I would argue it is), it will be soon enough for any business that wants to stay relevant in today's marketing world**.** (Aaron Kesteloot)

Platforms Available for the Food Industry Business:

- Facebook;
- Pinterest;
- Instagram.

Everyone keeps telling you “You need to post more to social media”, which is great, except are you posting with a goal in mind? Coming up with a clear social media strategy helps you to understand why your company wants to market on social media, what platforms you want to use and what you hope to achieve through using social media. (Surjet, Social Media Expert)

Before we get into creating the content for your business, we work with you to come up with a thorough strategy, so we both know what we want to accomplish on your social media platforms and how we’re going to accomplish that goal.

5 Ways Food Entrepreneurs Can Use Social Media To Grow Business (MithunAppaiah, CEO of Innovative Foods Ltd, Brand Sumeru);

- Creating your value proposition ;
- Be visual;
- Be consistent;
- Collaborate with Influencers ;
- Tell a story.

The failure rate for new products launched in the grocery sector is 70 to 80 per cent. A Nielsen study shows more than 85 per cent of new consumer packaged goods (CPG) products fail. So, what separates a successful launch from failure? It all boils down to how aware your consumer is about your brand and products which, in turn, means how connected you are with them through social media.

In this connected world where consumers spend far more time on their phones and laptops checking online reviews than in store, all food brands need to get their social media game right. Attention today is now of the most valuable commodities. The key to grabbing your customer’s attention in an increasingly noisy world is to give them something worth their time. For that, you need to treat each touchpoint more like as a transaction, not unlike the ones made in store. Your social media strategies should focus on giving your audience value above all else. So here are five social media strategies that every food brand needs to incorporate as part of product marketing strategy.

Sustainable food production is crucial to achieve food security, and the demand for sustainable food is rapidly growing. Sustainability-related brands are a marketing instrument to convey to consumers the credence attributes of a food product, i.e. organic production, ethical features and so on. Effects of sustainability branding may include an increase of consumers’ attitude to purchase the product and a higher willingness to pay for it, the raise of consumers’ satisfaction

upon purchase and the loyalty of consumers towards sustainability labelled products. To achieve these effects, promoting sustainability brands' awareness and image is crucial, together with the spread of consumers' knowledge about the impact of food production of sustainability issues, and the creation of a social environment where the culture of food sustainability is valued, thus pushing consumers to make sustainable food choices (Franco and Cicatiello 2018).

2 Methods

The research method in this paper is Qualitative, for developing a basic research model through analysing and interpreting of information collected from books, websites.

The world over, social media is being utilised by the business world as an effective marketing tool for connecting with their customers. Social networking websites such as Facebook and YouTube have rapidly grown in popularity creating online communities made up of people with shared interests. The trend has been supported by development in smart phones and mobile enabled websites.

Basing on the literature naturally arises the following hypothesis:

H1: *"social media platforms" have the most important influence on company's economic and financial performance"*

H2: *"social media platforms"have a positive influence on company's organization perormance"*

H3: *"social media platforms" have a positive influence on company's technical and innovative performance"*

H4*: "social media platforms" have a positive influence on company's market performance"*

H5: *"social media platforms" have a positive influence on company's human performance"*

3 Research results

There are six social media strategies all food brands should be using.

1- The first strategy is post consistently, using the help of a social media calendar. This Ensures that you retain the interest of your audience

2- Next, be sure to invest in visuals. Visuals are an important part of capturing attention, as well as ensuring information retention. Use iamges wherever possible to help increase brand recognition and effevtiveness of your ads.

3- Look for oppurtunities to partner with micro- and – medium – sized influencers to increase brand engagement and humanize your product. Influencers aldo provide you easy access to a new audience.

4- The fourth strategy involves making your product share- worthly through images that stimulate emotions. This is particulary important, as it is essentially the art of getting your audience to work for you.

5- Ensure that your social media strategy tells a story. You can do this using the acronym CDC: Create, Document and Curate.

6- Finally, make sure that you are takin advantage of Facebook and Instagram ads. They allow you to target your ads to a high degree and they are the best way to make your brand seen in an increasingly difficult environment.

4 Conclusions

Social media marketing plays an important role for the food and beverages industry either new or existing companies(Perumal et al., 2017)

Social Media has once again proven that it is a fundamental business objective for companies who want to increase their brand exposure. In the food industry this is no different.

Health campaigns have struggled to gain traction with young adults using social media, even though more than 80% of young adults are using social media at least once per day (Klassen et al., 2018).

Internet development has significantly changed consumers' behavior towards products, purchase and information. In particular, virtual environment plays a strong influence during the purchase process by introducing new elements, first of all, a wide range of information at sensibly reduced costs, to let consumers compare products and get to know others

‘opinions. In Italy social commerce is growing but it is still such a small market that it cannot be measured. However, Italy is also developing tools to integrate Facebook with e-commerce.

The direct evaluation of social media showed them to be useful for quality agrifood products, too, specifically for AranciaRossa di Sicilia, in order to design a good communication strategy in both environments, virtual and traditional, evaluating the impact of social media by adopting “word of mouth” among consumers concerning others’ purchase decisions; as well as the experiences relative to the messages towards both environments, which affect purchase decisions differently.

References

Allcott, H., Braghieri, L., Eichmeyer, S., & Gentzkow, M. (2019). The Welfare Effects of Social Media. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3308640

Alqadi, R., Al-Nojaidi, H., Alabdulkareem, L., Alrazgan, M., Alghamdi, N., & Kamruzzaman, M. M. (2020). How social media influencers affect consumers’ restaurant selection: Statistical and sentiment analysis. *2020 2nd International Conference on Computer and Information Sciences, ICCIS 2020*. https://doi.org/10.1109/ICCIS49240.2020.9257636

Dossena, C., & Mochi, F. (2020). Managing Online Communities and E-WOM: Prosumers’ Characteristics and Behaviors in the Food Service Sector. *Lecture Notes in Information Systems and Organisation*. https://doi.org/10.1007/978-3-030-47355-6_14

Gunden, N. (2017). How Online Reviews Influence Consumer Restaurant Selection. *University of South Florida Scholar Commons*.

Hubbard, L. J. (2018). Small Business Restaurant Marketing Strategies for Sustainability. *ProQuest Dissertations and Theses*.

Kim, B., Yoo, M., & Yang, W. (2020). Online Engagement Among Restaurant Customers: The Importance of Enhancing Flow for Social Media Users. *Journal of Hospitality and Tourism Research*. https://doi.org/10.1177/1096348019887202

Kuzubov, A. A., Maksimenko, A. N., Eremenko, I. A., & Bezuglova, M. N. (2021). Conceptual foundations for social media in the restaurant business in the aftermath of the pandemic. *Revista Amazonia Investiga*. https://doi.org/10.34069/ai/2021.38.02.17

Nadaraja, R., & Yazdanifard, R. (2014). Social Media Marketing SOCIAL MEDIA MARKETING : ADVANTAGES AND SOCIAL MEDIA MARKETING. In *Center of Southern New Hampshire University (SNHU)*.

Qutteina, Y., Hallez, L., Mennes, N., De Backer, C., & Smits, T. (2020). Food Messages Adolescents See Daily on Social Media: A Diary Study. *Proceedings of the Nutrition Society*. https://doi.org/10.1017/s0029665120005182

Samoggia, A., Bertazzoli, A., & Ruggeri, A. (2019). Food retailing marketing management: social media communication for healthy food. *International Journal of Retail and Distribution Management*. https://doi.org/10.1108/IJRDM-08-2018-0178

Schivinski, B., & Dabrowski, D. (2016). The effect of social media communication on consumer perceptions of brands. *Journal of Marketing Communications*. https://doi.org/10.1080/13527266.2013.871323

Seo, S., Almanza, B., Miao, L., & Behnke, C. (2015). The Effect of Social Media Comments on Consumers’ Responses to Food Safety Information. *Journal of Foodservice Business Research*. https://doi.org/10.1080/15378020.2015.1029384

Tritama, H. B., & Tarigan, R. E. (2016). The Effect of Social Media to the Brand Awareness of a Product of a Company. *CommIT (Communication and Information Technology) Journal*. https://doi.org/10.21512/commit.v10i1.1667

Yoo, M. (Myongjee), Yang, W., & Kim, B. (2018). Online Customer Engagement Among Restaurant Customers: The Importance Of Enhancing Flow For Social Media Users. *Global Fashion Management Conference*. https://doi.org/10.15444/gmc2018.05.10.03

Zhu, Y. Q., & Chen, H. G. (2015). Social media and human need satisfaction: Implications for social media marketing. *Business Horizons*. https://doi.org/10.1016/j.bushor.2015.01.006

Durgam, V. (2018). Social Media And Its Role In Marketing. *International Journal Of Advanced Research In Management*, *9*(2). https://doi.org/10.34218/ijarm.9.2.2018.001

Klassen, K. M., Borleis, E. S., Brennan, L., Reid, M., McCaffrey, T. A., & Lim, M. S. C. (2018). What people “like”: Analysis of social media strategies used by food industry brands, lifestyle brands, and health promotion organizations on Facebook and Instagram. *Journal of Medical Internet Research*, *20*(6). https://doi.org/10.2196/10227

Patino, A., Pitta, D. A., & Quinones, R. (2012). Social media’s emerging importance in market research. In *Journal of Consumer Marketing*, 29(3). https://doi.org/10.1108/07363761211221800

Perumal, I., Krisnan D., U&A Halim, N. S. B. (2017). Social Media in Food and Beverages Industry: Case of Klang Valley, Malaysia. *International Journal of Business and Management*, *12*(6). https://doi.org/10.5539/ijbm.v12n6p121

Poon, S. (2014). Designers Role in Marketing Lifestyle Brands to the Shopping Culture Generation. *Conference: Lets Help All Fields Grow Together to Serve the Society in a Better Way on 2nd International Conference on Innovation Challenges In Multidisciplinary Research & Practice*, https://www.researchgate.net/publication/305032660_Designers'_Role_In_Marketing_Lifestyle_Brands_To_The_Shopping_Culture_Generation

Mithun A. (2019). 5 Ways Food Entrepreneurs Can Use Social Media To Grow Business, Ceo of Innovative Foods Ltd, Brand Sumeru, https://www.entrepreneur.com/article/329958

Sturialea, L., Scuderib A. (2013) Evaluation of Social Media Actions for the Agrifood Systém. *6th International Conference on Information and Communication Technologies in Agriculture, Food and Environment* (HAICTA 2013)

Challenges and Opportunities for the Economy

The impact of ownership concentration on firms' productivity in V4 countries

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Abstract: A basic factor of competitiveness is the efficient use of factors of production. Ownership concentration influences decisions on the intensity of the use of factors of production. The aim of this paper is to assess the impact of ownership concentration on firms' productivity in V4 countries in manufacturing. Another factor analysed is profitability. The analysis showed a different impact of ownership concentration on productivity and on profitability of firms. Using ANOVA analysis, it was found that significant difference between enterprises divided by low ownership concentration and high ownership concentration. On the contrary, there was no proven statistically significant difference in profitability (ROA) between the two groups of enterprises.

Keywords: ownership, labour productivity, manufacturing.
JEL Classification: D24, G32, D22

1 Introduction

The performance and productivity of enterprise can be affected by the ownership structure of the enterprise and the relationships between the individual owners. At the same time, ownership structure is considered a key component of corporate governance. Previous studies have predominantly focused on the area of profitability (Horobet et al. 2019), but the area of labour productivity is missing. This paper aims to fill this gap by using the example of the V4 countries. The aim of this paper is to assess the impact of ownership concentration on firm productivity in manufacturing in the V4 countries (Czech Republic, Slovakia, Poland and Hungary).

The effect of ownership structure on the financial performance of firms is important, this conclusion has been confirmed by several studies showing the effect of majority shareholders on financial performance (Avmen, 2014). Regarding measures of firm performance, profitability ratios can be used however some researchers have shifted their focus to firm productivity and used total factor productivity (TFP) as a measure of firm efficiency, which is a more accurate measure of efficiency.

A firm-level study of the relationship between firm ownership and profitability by Aguiar-Diaze et al. (2020) found that firms with a single or dominant shareholder are more profitable. This finding is complemented by a study by (Palaniappan, G. (2017) which found a statistically significant negative relationship between board size and the magnitude of ROA and ROE. Board independence and frequency of board meetings also have an impact on this relationship by reinforcing these indicators among corporate governance mechanisms. Aluchna and Kaminski (2017) report that the negative correlation between concentration of ownership by the majority shareholder and ROA contributes to higher investment returns but there are clear negative effects due to concentration of ownership.

Productivity is an economic variable that is an indicator of the efficiency of the factors of production (inputs) used in the production of the final product (output) The most important and most used partial productivity is labour productivity. Labour productivity measures the amount of output per unit of labour (time or labour cost). A study (Chiang and Lin, 2007) analyses the relationship between ownership structures its effects on total factor productivity (TFP) of Taiwanese firms. The empirical results show that ownership structure in a firm does indeed affect TFP differences in favour of firms with clear ownership structure. In terms of productivity, Boddin et al. (2017) point out that ownership structure from the perspective of foreign ownership has a positive significant effect.

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2 Methods

The empirical analysis in this paper focuses on the area of labour productivity and profitability with respect to the ownership structure of enterprises in the V4 countries. The period of observation was 5 years, between 2015 -2019. The analysis focused on enterprises in the manufacturing industry sector, Machinery and Equipment Manufacturing section. In terms of regions, the analysis focused on the V4 countries (Czech Republic, Hungary, Poland and Slovakia). The empirical analysis included 920 enterprises from the V4 countries. The economic data of the surveyed enterprises were drawn from the AMADEUS database. The labour productivity (LP) indicator was used to assess productivity. To assess profitability, the return on assets (ROA) indicator was used. The dummy variable here was labour capital endowment. Table 1 below shows the definition of the indicators and their magnitude for the total set of enterprises under study. The companies have been divided into two distinct categories, depending on their degree of ownership concentration, as indicated by the specific methodology BvD independence indicators (Horobet et al. 2019).

- The first category of low ownership concentration (LOC) includes categories A (each shareholders having less than 25% of direct) and B (shareholders with ownerships below 50%).
- The second category of high ownership concentration (HOC) includes categories C (shareholders having ownership above 50%) and D (shareholders having direct ownership above 50%.

The hypothesis that that companies with HOD achieve higher labour productivity and profitability compared to companies with LOC was verified based on the ANOVA test.

ANOVA (Analysis of Variance) is a set of statistical models used to analyse differences between group means and to identify associated measures of variation (such as between-group and within-group variation). Analysis of variance is useful in situations where we are interested in the effect of one or more nominal variables (also called factors) on a quantitative variable. The null hypothesis states that all variances (factor-level means) are the same, while the alternative hypothesis states that at least one of the means differs from the others ((Montgomery and Runger 2007). A 95% confidence interval (linear model) was considered for the analyses.

Table 1 . Used indicators and description statistics (undefined data)

Shortcut	Indicator name	Definition	2015		2019	
			Average	Median	Average	Median
c.l. ratio	Capital Labor ratio in Euro	(Tangible + intangible fixed assets)/Costs of employees	1.718	1.173	1.632	1.141
LP	Labor productivity in Euro	Operating revenues/Costs of employees	7.250	5.416	6.929	5.120
ROA	Return on assets in Euro	Profit before Taxes/Total assets	0.101	0.085	0.083	0.070

Source: Amadeus, own processing

The following table 2 presents us with a view of the country structure pattern of enterprises for the empirical part. The most represented here are enterprises from the Czech Republic and Poland. The distribution of enterprises between large enterprises (LEs) and small and medium-sized enterprises (SMEs) is very similar (10% LEs, 90% SMEs). In HOC, small and medium-sized enterprises slightly predominate (91%) but the difference is not very large compared to enterprises in the LOC group. We used the classification of SMEs by Commission Recommendation 2003/361/ESES to divide enterprises into small and medium-sized and large enterprises.

Table 2 Structure of enterprises by country and ownership concentration (BvD)

BvD	CZ	HU	PL	SK
LOC	278	102	212	137
HOC	90	8	69	24
Total	368	110	281	161

Source: Amadeus, own processing

3 Results

Ownership structure plays an important role in the management of enterprises, which in turn is reflected in the economic performance of enterprises. The first part of the analytical section will deal with the differences between the volume categories of low ownership concentration (LOC) and high ownership concentration (HOC) firms. The extent to which ownership structure affects the size and change in labour productivity is provided by the following table 3. Enterprises with LOC have significantly lower labour productivity and profitability. If we compare the indices (2019/2015) of labour productivity and ROA there is no obvious significant difference. For both groups, both labour productivity and profitability decline slightly.

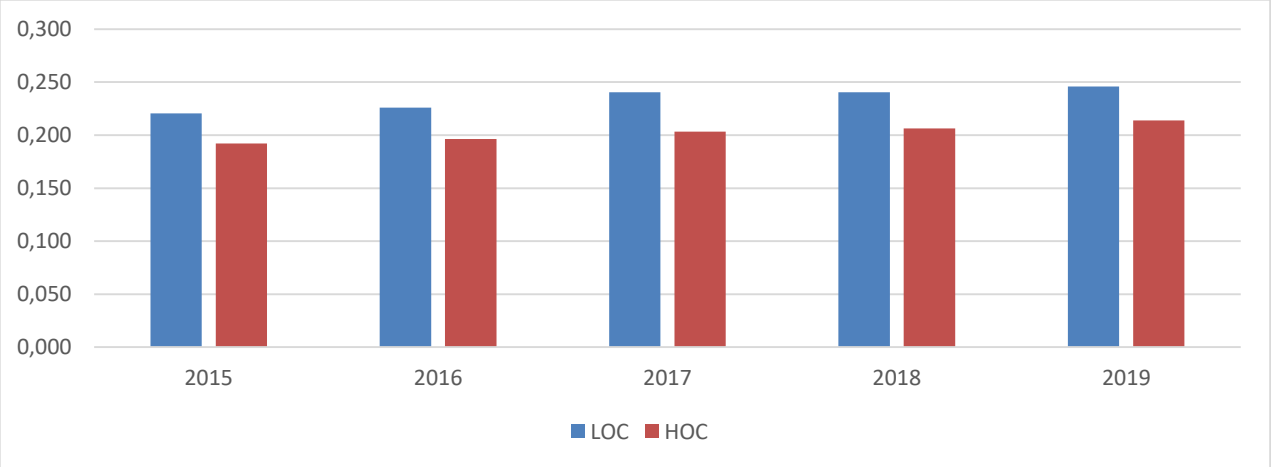
Table 3 Labour productivity and profitability in enterprise according ownership concentration (LOC, HOC) in EUR

	LP	Index LP 2019/2015	ROA	Index ROA 2019/2015
LOC	5.164	0.921	0.078	0.708
HOC	7.391	0.962	0.085	0.856

Source: Amadeus, own processing

The fall in labour productivity is not due to lower business performance but to the rising size of labour costs. This phenomenon is illustrated by the following figure 1 showing labour intensity, which measures the size of personnel costs per unit of sales. There is a clear upward trend for both groups of firms. The growth in personnel costs exceeds the growth in firms' revenues. We are moving at market prices and for this reason the effect of price changes is negligible. In the short term, this phenomenon is acceptable, but in the long term it may have a negative impact on labour productivity and profitability.

Figure 1 Development of labour intensity in EUR (li = Costs of employees/ Operating revenue)

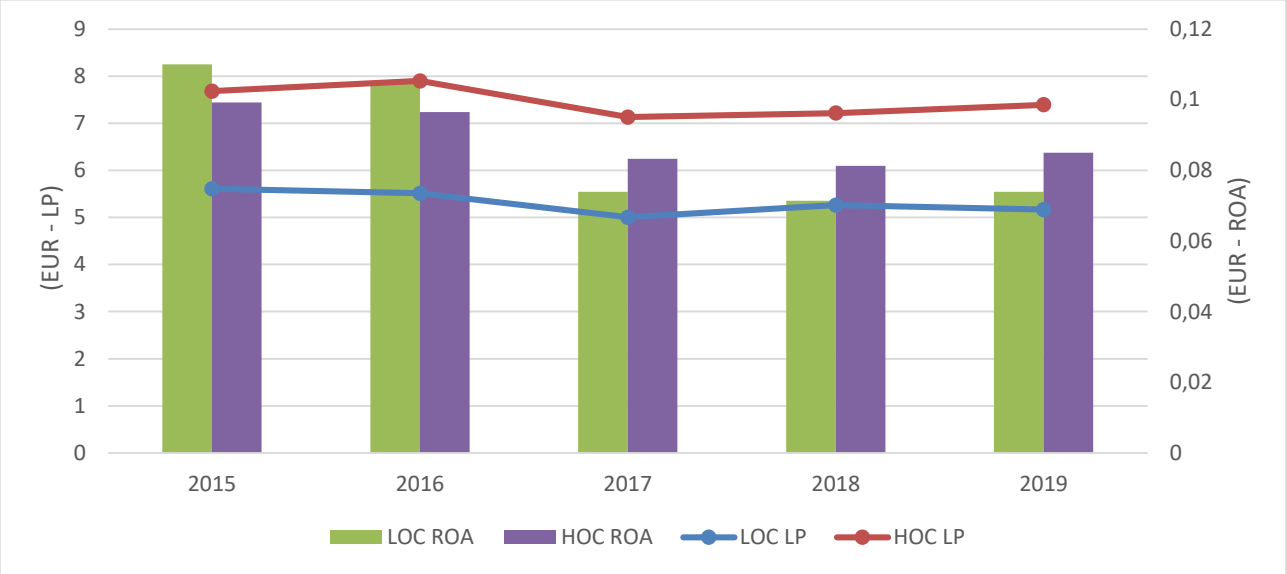


Source: Amadeus, own processing

The next part dealt with the evolution of labour productivity among the categories of enterprises under study. It is clear that there is a significant difference between the two categories (Figure 2). The magnitude for LOC firms is approximately 70% of the magnitude of HOC labour productivity. In terms of the business cycle, the evolution of labour productivity is very similar for both groups. In terms of return on assets, the difference is minimal. In 2015 and 2016, the ROA of LOC enterprises exceeded that of HOC enterprises. On the contrary, in the last 3 measured years, the opposite

phenomenon has occurred where the profitability of assets of HOC enterprises slightly exceeds the profitability of LOC enterprises.

Figure 2 Development of labour productivity and ROA



Source: Amadeus, own processing

Using ANOVA analysis, it was found (Table 4) that labour productivity for Machinery and Equipment Manufacturing sector is not statistically significantly different among firms by size ($p>0.05$; we do not reject the null hypothesis of agreement of means at 0.05 level of significance). On the contrary, there was a statistically significant difference in labour productivity across the V4 countries ($p<0.05$; we reject the null hypothesis of a coincidence of means at the 0.05 significance level). In terms of the ownership concentration of enterprises, a significant difference was found between enterprises divided by ownership concentration (BVD methodology). The above finding says that we reject at 0.05 level of significance the null hypothesis of agreement of means for the HOC and LOC categories.

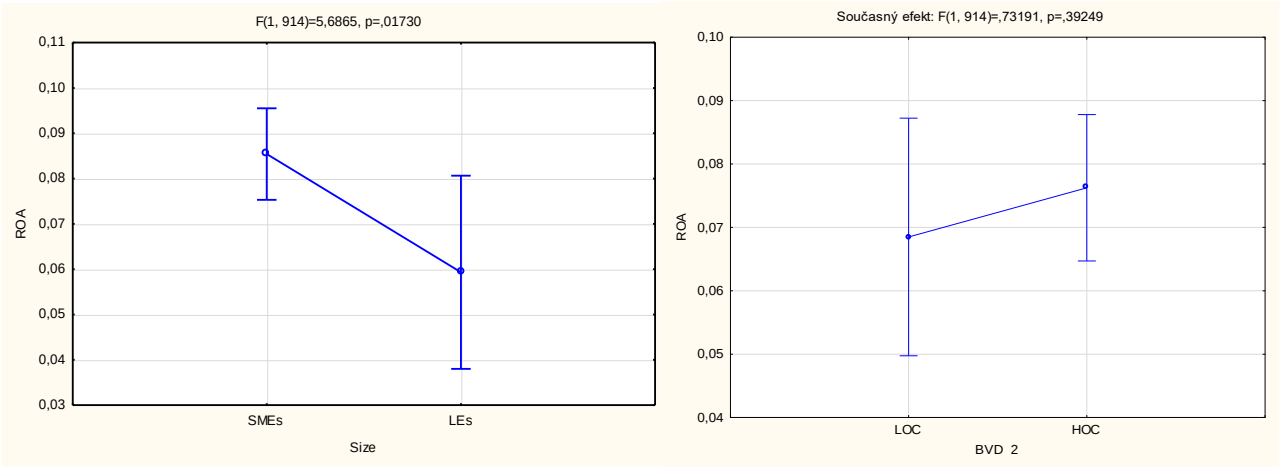
Table 4 The results of ANOVA – labour productivity

	Sum of Squares	df	Mean Square	F	Sign.
Country	862,12	3	287,37	7,5283	0,000056
Size	0,30	1	0,30	0,0079	0,929045
BVD	683,02	1	683,02	17,8931	0,000026

Source: Amadeus, own processing

Another indicator monitored was the return on assets (ROA). The values of the test statistic and the p-value are presented in Figure 3. The analysis proves that ROA is homogeneous across countries and in terms of ownership concentration (BVD) ($p>0.05$; we do not reject the null hypothesis of a matching of means at the 0.05 significance level). At the same time, there is a statistically significant difference in ROA between SMEs and large enterprises ($p<0.05$; we reject the null hypothesis of a matching of means at the 0.05 significance level). The interval bars indicate 0. 95 confidence intervals.

Figure 3 The results of ANOVA - ROA



Source: Amadeus, own processing

4 Conclusions

Concentration of ownership largely limits the way and possibilities of managing the enterprise However, there is no consensus on whether ownership concentration also affects a company's economic performance. It is important to note that labour productivity growth is in fact influenced both by internal intra-firm factors (e.g. concentration of ownership business strategy (Svarova & Vrchota, 2014)) and significantly external factors (e.g. spillover effects, regional factor (Dušek, 2015; Mura & Hajduova, 2021)). The study of Gregori et al. (2021) points out the transformation of the ownership structure over time. This paper is focused on assess the impact of ownership concentration on firm productivity in manufacturing in the V4 countries (Czech Republic, Slovakia, Poland, Hungary). An empirical analysis of 920 firms found a large difference in the magnitude of labour productivity between the categories of firms with low ownership concentration (LOC) and high ownership concentration (HOC). Low ownership concentration enterprises account for approximately 70% of the labour productivity of high ownership concentration enterprises. On the other hand, no significant difference in terms of ownership concentration was found for return on assets. This conclusion was confirmed by ANOVA, which showed a statistically significant difference in terms of ownership concentration for labour productivity but not for profitability. A large effect of firm size was found for profitability. Research limitations could be the fact that the authors focused only on selected economic indicators of the economic performance of enterprises and some were not taken into account. Future research will focus on the impact of ownership structure on indebtedness of enterprises.

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References

Aymen, B. M. M. (2014). Impact of ownership structure on financial performance of banks: Case of Tunisia. *Journal of Applied Finance and Banking*, 4(2), 163.

Aguiar-Diaz, I., Ruiz-Mallorqui, M. V., & Trujillo, L. (2020). Ownership structure and financial performance of Spanish port service companies. In *Maritime Economics & Logistics*, 22(4), 674–698. Palgrave Macmillan Ltd. https://doi.org/10.1057/s41278-019-00130-w

Aluchna, M., & Kaminski, B. (2017). Ownership structure and company performance: A panel study from Poland. In *Baltic Journal of Management*, 12(4), 485–502. Emerald Group Publishing Ltd. https://doi.org/10.1108/BJM-01-2017-0025

Boddin, D., Raff, H., & Trofimenko, N. (2017). Foreign ownership and the export and import propensities of developing-country firms. *The World Economy*, 40(12), 2543–2563. https://doi.org/10.1111/twec.12547

Dušek, J. (2015). International Cooperation of Regional Authorities of the Czech Republic: History, Presence and Future. Conference Proceedings "18th International Colloquium on Regional Sciences" (pp. 300–305). Masaryk University - Faculty of Economics and Administration. https://doi.org/10.5817/CZ.MUNI.P210-7861-2015-40

Gregori, W. D., Martinez Cillero, M., & Nardo, M. (2021). The effects of cross-border acquisitions on firms' productivity in the EU.

Horobet, A., Belascu, L., Curea, Ștefania C., & Pentescu, A. (2019). Ownership Concentration and Performance Recovery Patterns in the European Union. Sustainability, 11(4). https://doi.org/10.3390/su11040953

Chiang, M.-H., & Lin, J.-H. (2007). The Relationship between Corporate Governance and Firm Productivity: Evidence from Taiwan's manufacturing firms. Corporate Governance: *An International Review*, 15(5), 768–779. https://doi.org/10.1111/j.1467-8683.2007.00605.x

Montgomery, D. C., & Runger, G. C. (2007). *Applied statistics and probability for engineers* (4th ed). Wiley.

Mura, L., & Hajduova, Z. (2021). Measuring efficiency by using selected determinants in regional SMEs. *Entrepreneurship and Sustainability Issues*, 8, 487–503. https://doi.org/10.9770/jesi.2021.8.3(31)

Palaniappan, G. (2017). Determinants of corporate financial performance relating to board characteristics of corporate governance in Indian manufacturing industry an empirical study. *In European Journal of Management and Business Economics* (Vol. 26, Issue 1, pp. 67–85). Emerald Group Publishing Ltd. https://doi.org/10.1108/EJMBE-07-2017-005

Švárová, M., & Vrchota, J. (2014). Influence of competitive advantage on formulation business strategy. *Procedia Economics and Finance*, 12, 687–694.

Risks of unfavorable demographic development of population aging on public finances of the Czech economy

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Abstract: The aging of the population is accompanied by many economic and social changes. A comprehensive health and social system is set aside within the framework of public finances to finance the needs of seniors. According to demographic forecasts, an enormous increase in the social group of the population in the post-productive age - seniors - is expected in the Czech economy from 2035 onwards.From this period, the growth rate of the group will continue to accelerate. Based on the forecast of the expected growth of the mentioned population group, the debt of public finances would reach up to 230% of gross domestic product in 2068 under the currently set state fiscal policy. In this context, we can talk about intergenerational imbalances and the consequent fiscal unsustainability of public finances. For the above reasons, it is quite certain that the current social and health system is not ready for aging and will not be sustainable in its current form. In order to achieve an overall intergenerational balance, the most appropriate tool is a combination of such measures that lead to a balance, especially for current generations and separately for future generations. These instruments consist mainly in the implementation of the reform of the financial security of the social and health care system.

Key words: population aging, social and health system, risks to public finances
JEL Classification: A12, B41, E00, H11

1 Introduction

Changes in the development of the population as a result of its aging will significantly affect the macroeconomic level of the Czech Republic. It is therefore possible to speak of a growing component of the economically inactive population (post-productive age) without proper compensation with the component of the economically active population (productive age). In this context, today the problems associated with the process of demographic aging are especially discussed in connection with the disproportion of the age structure of the population (Ghenţa, Mladen; 2015). This is one of the most important demographic processes, which is characterized by a change in the age groups of the population. The argument about the negative impact of population aging on the economies of today's European countries (including the Czech Republic) is based on the fact that the productive employed generation (Duernecker & Vega-Redondo; 2018) bears the main burden of financing welfare state programs. While the main beneficiaries of the most important fiscal spending programs are the elderly. The aging of the population is changing the age structure in favor of the old generation at the expense of the working age generation.

The expected demographic changes with the aging population of the Czech Republic will thus have a significant impact on its economy in the coming decades, specifically on the labor market and subsequently on the public finance system. The growing number of social groups of seniors will also require an increase in expenditures from the social health system - old-age pensions, social support and assistance benefits, health and social care (Ghenţa, Mladen; 2015). This can be seen as the essence of the main potential risks to public finances that the Czech economy may face in the coming decades. These risks will not be completely eliminated, only mitigated through the established integrated economic and social policy on pronatality measures, support for employment of seniors and a comprehensive reform of the social health system, especially in the field of pensions, health and social care.

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.2 Data and methodology

Demographic aging of the population is caused by changes in the nature of its reproduction and changes according to the representation of biological generations, more precisely the child and reproductive component. The proportion of older people in the general population is increasing due to declining fertility levels, improving mortality rates and mainly due to increasing life expectancy (Jackson, 1998). There are two basic types of demographic aging. The first type of aging occurs by widening the lower part of the age pyramid due to a decrease in fertility and subsequent slower growth of the child component in the population. The second type of population aging occurs at the top of the age pyramid, due to improved mortality. As a rule, both introduced types are related and take place simultaneously. However, the share of seniors may grow at the expense of the declining number of people of reproductive age (Kalibová, 2008).

In preparing the article, demographic aging in the Czech Republic is monitored by measuring the shares of age groups in the total population on the basis of indices, which is through comparative numbers (age index, productive load indices) and average age or median age (Caldwel, 2006). The most common is the share of the three main age groups of the population, which are defined according to the expected economic activity of most people at a given age (Klufová, Poláková; 2010). It is therefore a pre-productive component of the population, which is usually stereotypically defined at the age of 0-14 years (or 0-19 years). The productive component of the population consists of persons aged 15–64 (or 20–64) and the age group of post-productive persons aged 65 and over (age group 65+). Based on the age categories divided in this way, the aging process is interpreted using indicators of average age and age index (number of persons aged 65 + per 100 children aged 0-14) of dependency index I. (number of children aged 0-14) per 100 persons aged 15-64), addiction index II. (number of persons aged 65 and over per 100 persons aged 15–64) and economic burden index (number of children aged 0–19 and number of persons aged 65+ or more per 100 persons aged 20–59). The most common characteristic used in international comparisons is the proportion of people aged 65 and over in a given population. In this context, the old age dependency ratio is used as the ratio between the number of people aged 65 and over (the age at which they are generally economically inactive) and the number of people aged 15 to 64 and its value is expressed per 100 people of working age (15–64 years). With regard to the specifics of monitoring potential risks to public finances in the context of population aging in the Czech Republic, the elaboration of the article requires in particular the application of methods of analysis, comparison, synthesis, observation and generalization.

3 Research results

3.1 Historical aspects of the development of unfavorable demographic development due to the aging of the population

Within the demographic processes in the economy, the reproduction of the population is a key position, as it is a decisive factor in the creation of the age structure. The annual number of children born and the birth rate are affected by the extent and structure of the female contingent, the proportion of women living in marriage and the age of marriage, and especially the fertility of married women; the fertility of unmarried women is less important in our conditions. The development of fertility of married women is significantly influenced by the scope of family planning and the planned numbers of children in families, as well as ensuring their "implementation" of contraceptive levels or enabling abortion in case of unwanted pregnancy (Hoff, 2011). Even this comprehensive view of the issue of birth development gives an idea of the complexity of evaluating the process of reproduction, especially in a long period of time.

In the second half of the 20th century, two factors significantly affected the development of the birth rate. These included the adoption of the Act on Abortion, which resulted in a sharp decline in female fertility since 1958, and later (1968-1973) the adoption of a set of pronatal measures that led to a rapid rise and a relatively long period of maintaining high fertility levels (Wynnyczuk, 1974). At the same time, there was a combination of the effect of higher numbers of young women and significantly increased fertility of married women. Gradually created "socialist models" of employment, remuneration, housing and consumption, with increasing leveling, led to the emergence of a special consumer society. Its peculiarity lay on the one hand in the preferences of selected narrow groups of the population (cheap purchases of quality goods, including foreign ones, obtaining housing, access to universities, etc. for high-ranking employees of party and state bodies), on the other hand in the qualitatively low level of modern industrial goods with a high consumption of cheap food for the rest of the population. For most people without information about a significant improvement in living conditions in developed countries, this way of life (state paternalism) suited, because it did not force their own activity (this manifested itself mainly in building and furnishing family houses and recreational facilities) and guaranteed comfortable, albeit low social security (except for old-age pensioners). Only a small part of the population was aware of the considerable doubt of degenerative development - intelligence and especially young people, who had more unbiased information and thus the possibility of comparison with developed countries (Hoff, 2011). Only a small number of people showed active resistance and did not accept the generally accepted way of life. In the indicated social and societal climate, supported by the adoption of various measures of a socially pronatalistic nature, good conditions

have arisen for high early marriage and reproduction (Wynnyczuk, 1984). The pronatal concept of state and party economic policy of the then Czechoslovakia thus led to a relatively rapid growth of the population. Supported immigration from Slovakia and a significant reduction in emigration abroad also contributed significantly to this.

After 1980, after the effect of measures to help families with children was exhausted, the population climate deteriorated again, largely due to the unhappy, unpromising situation of society as a whole. New young generations of women have taken former pronatal measures for granted, and no new motivational measures have been taken. After the events of November 1989 and the transition to a democratic political system with a market economy, positive political changes could not manifest themselves because they were accompanied by a weakening of social security for families with children, local unemployment and the opening of other personal perspectives (Hoff, 2011). Children in families with the possibilities of self-realization of parents, their business, travel abroad and especially with the trend of the required increase in personal living standards came into the strongest competition so far. In new social conditions, new models of reproductive behavior were created, approaching Western European countries (Burcin, Kučera, 2011). This was also the case in the early 1990s for other Eastern European populations after the fall of totalitarian regimes with a centrally controlled economic system (Hoff, 2011).

3.2 Basis for identifying potential risks to public finances from an aging populationiscal impacts of population aging

In essence, risks mean a potential danger that the expected phenomena will not take place and at the same time represent a term for the designation of the processes themselves, associated with such a danger as economic loss, etc. They are one of the main motivating elements of the decision-making process. On the one hand, they result from the necessity of choice, on the other hand, they force choice. Based on the risk reduction strategy, larger risks can be divided into a number of smaller ones. Depending on the state of readiness, risks can be identified for the expected - conscious and unforeseen. In essence, the risk involves the risk of adverse development, so it is biologically comparable to microorganisms, which, provided certain conditions are met, change their latent existence in the onset of infection. To prevent these changes, prevention or treatment that mitigates or completely eliminates the causes of risks is of paramount importance. In order to prevent economic losses, it is necessary for the selection of basic strategic measures in the economic and social sphere, the correct identification of risks, which can be guided from several aspects. These are, for example, risk reduction strategies: sufficient reduction, transfer or dialogue within the economic policy consensus. Another identification of the risk is its assessment of the probability of occurrence: risks that are completely or partially negligible, second and third degree. The cause, extent and probability of the occurrence of economic risk allow their quantification and their compilation for the creation of practical economic and social policy (Blomé, Borell, Håkansson, 2020).

According to the forecasts of the population development of the Czech Republic, it is clear that in the coming decades it will face very significant demographic changes, caused mainly by low birth rates (after 1990 in connection with the transformation of the economy) and the associated aging population. Disproportions in the structure of the population will very significantly affect the entire economy of the Czech Republic, as well as all systems based on the redistribution of funds from economically active individuals to economically inactive - ie the entire system of public finances (Caldwell, 2006). This is a logical and inevitable consequence of the increasing old age dependency ratio (Muszyńska, Rau; 2012). This can be seen as the nature of the risk to public finances due to the demographic development of an aging population (Muffels, 1997).

3.3 Current analysis of the age structure (for 2020)

The population development of the Czech Republic in 2020 was significantly affected by the covid-19 pandemic. Anti-epidemic measures or the epidemic itself were reflected in almost all monitored demographic processes, in many cases long-term trends were interrupted, or existing minima / maxima within the last ten years were rewritten (Esteve, Trias-Llimós; 2021).

During the period under review on 1 January and 31 December 2020, the population of the Czech Republic increased by 7.8 thousand, which was less than a fifth increase compared to 2019. The balance of foreign migration remained positive, reaching 26.9 thousand, but year-on-year was 39% lower (Czech Statistical Office; 2020, 2021). A significant decrease in population, the highest since the beginning of the 21st century, by 19.1 thousand, was recorded naturally. The balance of the population by marital status at the end of 2020 showed a larger year-on-year increase in single, resp. decrease in married persons in the population.

After a six-year period of growth, the number of marriages decreased significantly in 2020 (by 9.5 thousand to 45.4 thousand) as well as the intensity of marriages. There were also fewer divorces (21.7 thousand), the divorce rate was the

lowest since the beginning of the century. The number of live births decreased slightly for the third year in a row (to 110.2 thousand), but the total fertility rate stagnated at 1.71 children per woman. The number of deaths in 2020 climbed to 129.3 thousand (up 16.9 thousand year on year) and was the highest since 1987. Record high numbers of deaths were concentrated in the last three months of the year, when the autumn wave of the coronavirus epidemic broke out in the Czech Republic. Deteriorated mortality conditions pushed the ever-increasing life expectancy back about seven years, in men by 1 year to 75.3 years and in women by 0.7 years to 81.4 years (Czech Statistical Office, 2021).

Despite the specificity of 2020, the population in the three main age groups continued to develop in the same direction as in previous years. During 2020, the child component of the population (0–14 years) grew by 9.5 thousand people to 1.72 million and thus represented 16.1% of the total population (1.6% more than at the beginning of 2011). The population of seniors aged 65 and over also continued to grow, by 26.7 thousand to 2.16 million people (Czech Statistical Office, 2021). The share of seniors in the population exceeded one-fifth for the first time (it was 20.2%, 4.6% more than at the beginning of 2011). However, for both children and seniors, the growth rate in 2020 was the lowest in a decade. At the end of 2020, the widest main age group of persons of working age (15–64 years) was 6.82 million inhabitants, ie 63.8% of the total (at the beginning of 2011 they accounted for 69.9%). The group of people of working age has been declining in number for twelve years in a row, by 28.4 thousand in 2020, however, its year-on-year decreases have been more modest in the last three years than at the beginning of the decade.

The continuing growth of the seniors component, its numerical superiority over the children's component and the numerical reduction of the working-age population contribute to the gradual aging of the population. The average age of the population of the Czech Republic, which has been steadily rising since the early 1980s, increased by one tenth year-on-year to 42.6 years in 2020. Over the last decade, since the beginning of 2011, it has increased by less than two years (for men by 1.8 years and for women by 1.7 years). The difference between the average age of men and women thus slightly decreased from 3.0 to 2.8 years, when in 2020 the average age of men was 41.1 years and women 44.0 years. The median age, which divides the population into two equally large parts, increased more than the average age of the population during 2011–2020, from 39.8 to 43.3 years, ie by 3.5 years. Since 2016, the median age has exceeded the average age of the population (by 0.7 years in 2020). At the same time, the difference between the sexes in the median decreased more, when at the beginning of 2011 it was higher for women by 3.1 years, at the end of 2020 the difference was 2.5 years (Czech Statistical Office, 2018). Half of the men were younger, resp. older than 42.0 years, while the female population was divided in half by the age of 44.5 years (Czech Statistical Office, 2021).

The aging of the population is also reflected in the development of indices, which describe the mutual numerical relationship of individual age groups. The age index, which compares the number of dependent sections of the population (seniors and children), increased between the extreme monitored years from 108 to 126 seniors aged 65 and over per 100 children aged 0–14. The values of the economic dependency index, which compares the numerical relationship of population components generally referred to as unproductive (0–19 years and 65+ years) and economically productive (20–64 years), have also been growing steadily over the last decade (Czech Statistical Office, 2021). Between the initial state of 2011 and the final state of 2020, the index steadily increased from 55 to 69 persons outside the productive age to 100 persons of the productive age. The growth of the dependency index was mainly a reflection of the development of the number of seniors components, which grew significantly in relation to the number of people of working age, between 2011 and 2020 from 24 to 34 people aged 65 and over per 100 people aged 20-64 (relatively by 41%). In recent years (since 2013), however, the number of 0–19 year-olds to one hundred and 20–64 year olds has also been growing (from 31 people in 2013 to 35 people in 2020)

3.4 Forecast of the expected development of the aging of the Czech population

According to documents from the Czech Statistical Office, a further reduction in the working age population can be expected. According to the results of its demographic projection, the largest numerical reduction in the population of the Czech Republic aged 15 to 64 should occur between 2035 and 2045, by 4.5% (Novotná & Volek, 2014). In 2055, 53.7% of the population of the Czech Republic should belong to this age category. The focus of the population in the economically active age, which represents strong years born in the 1970s, will gradually shift to a higher age due to the aging of individual generations and thus naturally change the age structure of the population (Pavelka, 2017). From 2022, the focus of the population will be the age group 45-49, from 2027 the age group 50-54, etc. In 2037, the position of the numerically strongest age group should be taken by 60-64 years, ie people of pre-retirement age, and by the middle of the century this maintain position (Novotná & Volek, 2014).

From the above facts, it is almost certain that a fundamental problem would occur after 2035. During this period, the strong years of the aforementioned 1970s will begin to retire. If we want to deal with the effects of the expected demographic development on the economy of the Czech Republic, it is necessary to take into account the longer-term dynamics of the age structure of the population, including their relevant predictions (Abraham & Laczo, 2018). These

facts are evident from the following Table 1, 2 with demonstrated milestones from 2025 to 2065 at five-year (Table 1) and ten-year (Table 2) time intervals.

Table 1 Development of the composition of the population of the Czech Republic by age groups in the years 2025 - 2065 (selected years in%)

Age		2025	2035	2045	2055	2065
0 – 14		14.9	13.0	13.3	13.9	13.2
15 – 64		63.4	62.5	57.1	53.7	54.6
65 +		21.7	24.5	29.6	32.4	32.2

Source: Czech Statistical Office 2020 and own processing

Table 2 Characteristics of the age structure and load indices of the productive component of the population of the Czech Republic between 2000-2065, selected years (in %)

Demographic indicator	2000	2010	2015	2020	2025	2035	2045	2055	2065
Average age	38.8	40.6	41.6	42.7	43.9	46.3	47.5	48.3	49.0
Age index	83.1	107.0	117.1	128.7	145.6	187.8	222.5	232.7	2436
Dependency index I.	23.9	20.2	22.5	24.2	23.5	20.8	23.4	25.9	24.2
Dependency index II..	19.8	21.6	26.3	31.2	34.2	39.1	52.0	60.2	58.9
Economic burden index	59.3	54.6	59.0	66.9	72.0	74.0	89.7	103.3	100.8

Source: Czech Statistical Office 2020 and own processing

3.5 Application of generational accounting and the system of public finances in the context of demographic forecasting

The beginnings of generational accounting date back to 1991 with a presentation in Generational Accounts: A New Approach to Fiscal Policy Evaluation. The authors A. Auerbach, J. Gokhale and L. J. Kotlikoff presented here the main idea that became the basis of the concept of generational accounting (Gokhale, Raffelhüschen, & Walliser; 1995). His initial philosophy is based on the fact that each individual is both a payer and a recipient of transfers during their life. According to the life cycle hypothesis from the Italian economist Franco Modigliani's taxes, the authors chose that the amount of taxes and transfers depends on age (Egorov & Harstad, 2017). If society is divided into three basic groups according to age, pre-productive population, economically active - productive population and seniors - post-productive population, it can be stated that only the middle group pays more money into public budgets than it draws from them (Wawrosz & Valenčik, 2014). On the other hand, young and old people contribute only a limited amount to public budgets (Newbert, 2018). It follows, therefore, that every individual in society is, at a certain age, either a net payer or a net recipient. Young and old are mainly net beneficiaries (they receive more from public sources than they pay themselves). On the contrary, the middle group as productive are net payers, ie they contribute more to public budgets than they receive. Nevertheless, pensioners are also economically active and are recipients of earnings, as the Table 3 shows.

Table 3 Development of employement of the seniors in the Czech Republic (selected years, in % of total employment)

	2010		2017		2019	
	total	**women**	**total**	**women**	**total**	**women**
60 – 64 years	3.78	2.76	5.82	4.72	5.90	4.95
65 +	1.55	1.43	2.45	2.38	2.87	2.73

Source: Czech Statistical Office 2020 and own processing

This can be interpreted on the basis of income tax and health insurance. These requirements are paid only if the individual is working. He naturally pays a certain percentage of his salary, so he is a payer of tax and health insurance. On the contrary, children and senior citizens who are not involved in activities on the labor market do not pay this tax or

the mentioned insurance, on the contrary, they receive various transfers from the state. Therefore, this group of people (children and the elderly) tend to be net beneficiaries. Current policy actions usually have longer-term effects. For example, the reform of the pension system will affect both the current generation and the future generation. The current generation may be affected, for example, by an increase in income tax. If the current system generates debt, then someone will have to pay it in the future, which will affect future generations (Džbánková & Sirůček, 2013). Generation accounts thus show what amount of net taxes an individual can expect within the current or future generation. - ie how much money an individual is likely to pay into the system and how much he is likely to receive on transfers from the state during his lifetime (Gokhale, Raffelhüschen, & Walliser; 1995). Generation accounts should present results in a way that provides a basic comparison between generations. Merely quantifying the values of net taxes would not provide such a comparison. Based on the results from the generation accounts of both generations, it is possible to determine possible intergenerational balance or imbalance and, in the long run, also fiscal sustainability or unsustainability of public finances. The growing share of expenditure on old-age pensions in total pensions in the Czech Republic is shown in the Table 4.

Table 4 Development of expenditures on pensions in the Czech Republic (selected years)

	2002	**2010**	**2019**
Pensions total (thousands of CZK)	210439949	340161856	459308361
Of which old-age pensions (in %)	71.65	78.19	83.22

Source: Czech Social Security Administration 2021 and own processing

In terms of the theory of public choice, generational accounts show how politics should redistribute resources between generations if current politics remains unchanged for individuals living together. At the same time, generation accounts are an information source on the long-term sustainability of current policy. It is sustainable provided that there are no changes on the revenue or expenditure side to maintain the zero-sum equation. This means that current policy is sustainable if the value of the net taxes of future generations and current births does not contain any differences. Otherwise (if there are any differences in the value of the lifetime net taxes of future generations and current births) it is the long-term unsustainability of public finances and current policy.

3.6 The nature and genesis of risks of instability of public finances

The expected trend of the decline of the population of the Czech Republic in the productive age until the year 2100 (by 40%) will be significantly reflected in the available number of human resources (ie supply) on the labor market. Problems with meeting the needs of employers were evident even before 2020 (the beginning of the covid-19 pandemic), when many companies and industries showed a long-term shortage of workers in a relatively wide range of qualifications. At the same time, it must be borne in mind that a similar situation may arise after the end of economic measures in connection with the covid-19 pandemics in a number of other economies, including advanced ones. The shortage of labor force caused by demographic development can thus be exacerbated in real terms by unfavorable migration trends, ie the departure of the Czech labor force abroad under better conditions (Šetek, Alina; 2018). The risk of weakening economic growth is linked to the above-mentioned risk of labor shortages. In this context, it can be assumed that aggregate demand in the economy will tend to increase (mainly due to growing more consumer-intensive age groups, new technologies and prolonging life expectancy), but will also hit the production capacity barrier - especially the lack of human resources (Leitmanová; 2000; Ghenţa, Matei, & Mladen; 2015).

In the chain reaction of the expected macroeconomic effects of the unfavorable demographic development with the aging of the population, a significant reduction in public finance revenues (state budget, social and health insurance funds) cannot be neglected. This is logical, as the expected decline in the population of the Czech Republic in working age (by almost 40% by 2100) will undoubtedly be reflected in the tax revenues of the state budget (Zubíková, Švejnová-Höesová & Chytil; 2021). Primarily, lower levies can be expected due to the lower number of productive age taxpayers whose income will be taxable. Secondly, we also expect lower taxes on corporate income, where the lack of human resources in the work process is very likely to be reflected in lower prosperity and corporate profits, and subsequently in autonomous taxes (excise duty, value added tax). On the other hand, an increase in transfer payments can be expected, such as the current non-insurance social security benefits paid under state social support and social assistance for the senior segment (care allowance for the provision of gerontological social services, mobility allowance, housing allowance..) as the proportion of the post - productive age category in the population will increase significantly.

Not only the state budget depends on the levies of economically active persons, but also the entire system of insurance benefits based on selected social insurance. This should be affected by the expected demographic development to the same significant extent as the state budget. The social insurance system mainly finances old-age pensions, but also

sickness benefits. In the case of sickness benefits, however, the impact should not be so significant, because along with the decline of the economically active population, the number and volume of sickness benefits paid should also decrease. It is logical that the situation will be completely worse in the case of old-age pensions, as the increase in the number of pension insurance benefits will be relatively significant and often accompanied by forced valorisation due to inflation (Šetek, Alina; 2019). Expressed by the value of the old age dependency ratio discussed above, the degree of dependence of category 65+ on the productive age category will increase roughly twofold by 2100 (Zubíková, Švejnová-Höesová & Chytil; 2021). While maintaining the parameters of the pension system, this would very simply mean that the contributions of the economically active would have to roughly double in order to maintain the current income standard of pensions.

As with the state budget and the social security system, a similar risk can be identified in the health insurance system. It is obvious that similar effects as the state budget or the social insurance system will also be recorded by the public health insurance system, from which health care is financed. This system should also become a deficit, while maintaining the current parameters, with a significantly higher indicator of the old age dependency ratio. The reason is the expected reduced number of payers, ie economically active persons, on the one hand, and a significantly higher number of persons in the post-productive age (state insured persons) on the other.

The sustainability of the public health insurance system and the related levels and availability of health care is also a key issue. The public health insurance system works on a very similar principle as the pension system (ongoing financing), so the above-described effects of the unfavorable demographic development can be expected here as well. The number of state insured persons, especially in the form of seniors, should increase significantly, while real "sponsors" in the form of economically active persons should decrease sharply. With a smaller volume of funds in the health insurance system, on the other hand, demand for health care services can be expected to grow with a higher number of people in the 65+ category. In comparison with the category of persons of productive age, the category of persons 65+ has long spent up to three times higher volume of funds (Czech Statistical Office, 2020). However, the possibility of a significant increase in statutory health insurance contributions, which would at least partially reduce this risk, does not seem very realistic in this case either.

4 Conclusion

It is clear from the above facts that the Czech Republic will face very significant demographic changes in the coming decades, caused mainly by low birth rates and the related aging of the population. These changes will significantly affect the whole economy, as well as all systems based on the redistribution of resources from the economically active population to the economically inactive, ie the whole social and health system, which is part of public finances (Francois, Vlassopoulos; 2008). The potential risks of expected changes can be divided into two basic areas, namely economic (due to insufficient saturation of the labor market, weakening economic growth, lower living standards, significant decline in state budget revenues, loss of resources in the social and health insurance system) and social risks (sustainability pension system and living standards of seniors, sustainability of the health insurance system, level and availability of gerontological social services, sustainability of organizations fully or partially dependent on the public finance system, etc.). A partial possible outline of the reduction of the mentioned risks lies in pronatal measures, in the use of the work of migrants and in the stimulation of the participation of seniors (persons 65+) in the labor market.

It is obvious that the specific parameters of the expected changes will develop in the coming years and make longer-term predictions more accurate. However, the fundamental expected trends should not be affected by these parametric changes. It can be considered socially appropriate to discuss in a timely and factual manner all the tools, measures and ways that can help the Czech economy cope with the potentially adverse effects of the expected changes.

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References

Abraham, A. & Laczo, S. (2018). Efficient Risk Sharing with Limited Commitment and Storage. *Review of Economic Studies*, 85(3), 1389-1424.

Burcin, B., & Kučera, T. (2011). 5. Perspektivy populačního vývoje České republiky v období transformace společnosti (1992–2010). *Dvacet let sociodemografické transformace*.

Caldwell, J. C. (2006). Demographic theory: A long view. In *Demographic transition theory* (301-320). Springer, Dordrecht.

Duernecker, G., & Vega-Redondo, F. (2018). Social networks and the process of globalization. *The Review of Economic Studies*, *85*(3), 1716-1751.

Džbánková, Z., & Sirůček, P. (2013). Rationality in Economics-Male and Female Perspektives.

Esteve, A., & Trias-Llimós, S. (2021). Die COVID-19-Pandemie: Die Rolle von Demografie und Demograf* innen. *Discussion Paper. Population and Policy, Population Europe*, (13), 8-12.

Egorov, G., & Harstad, B. (2017). Private politics and public regulation. *The Review of Economic Studies*, *84*(4), 1652-1682.

Francois, P., & Vlassopoulos, M. (2008). Pro-social motivation and the delivery of social services. *CESifo Economic Studies*, *54*(1), 22-54.

Ghenţa, M., Matei, A., & Mladen, L. (2015). Performance Measurement in Social Care Services for Older People. *Romanian Journal for Multidimensional Education/Revista Romaneasca pentru Educatie Multidimensionala*, *7*(2).

Gokhale, J., Raffelhüschen, B., & Walliser, J. (1995). The burden of German unification: a generational accounting approach. *FinanzArchiv/Public Finance Analysis*, 141-165.

Hoff, A. (Ed.). (2011). *Population ageing in Central and Eastern Europe: Societal and policy implications*. Ashgate Publishing, Ltd..

Klufová, R., & Poláková, Z. (2010). Demografické metody a analýzy. *Demografie české a slovenské populace. Praha: Wolter Kluwer ČR*.

Jackson, W. A. (1998). *The political economy of population ageing*. Books.

Kalibová, K. (2008). Populace světa v letech 1950–2007. *Demografie*, *50*(4), 288-296.

Leitmanová, I. (2000). Vývoj trhu práce z regionálního hlediska [The development of labour market from regional point of view]. *Politická ekonomie*, *2000*(2).

Muffels, R. J. A. (1997): Stárnutí a flexibilizace. Hrozba nebo výzva pro sociální stát? In: Rabušic, L.: Česká společnost a senioři. Sociální, ekonomické a politické aspekty demografického stárnutí české společnosti.1. vyd., Brno, Masarykova univerzita.

Muszyńska, M. M., & Rau, R. (2012). The Old-Age Healthy Dependency Ratio in Europe. *Journal of population ageing*, *5*(3), 151-162.

Novotná, M., & Volek, T. (2014). *Labour as a factor of production in the context of gross value added growth in sector A. Scientia Agriculturae Bohenica (SAB).* Czech University of Life Sciences Prague. (2), 129-135.

Newbert, S. L. (2018). Achieving social and economic equality by unifying business and ethics: Adam Smith as the cause of and cure for the separation thesis. *Journal of Management Studies*, *55*(3), 517-544.

Pavelka, T. (2017), Long-term unemployment in the Czech Republic and the effect of distraints. *11th International Days of Statistics and Economics.* Praha. CzechRrepublic, 1153-1162.

Šetek, J., & Alina, J. (2018, April). Economic Aspects of the Amortization of Human Capital in the Public Sector. In *INPROFORUM 2017*.

Šetek, J., Alina, J., & Bajer, D. (2019). RETIREMENT AGE IN THE CONTEXT OF PUBLIC FINANCE IMPLICATIONS. *Studies of Socio-Economics & Humanities/Socioekonomické a Humanitní Studie*, *10*(2).

Wawrosz, P.; & Valenčik, R. (2014). *How to Describe Affinities in Redistribution Systems.* 18th International Conference CURRENT Trends in Public Sector Research. 212 – 220.

WYNNYCZUK V. (1974): Populační klima v ČSSR. Praha, Čs. výzkumný ústav práce a sociálních věcí (Výzkumné práce, řada B, č. 60 - interní publikace).

WYNNYCZUK V. (1984): Mezinárodní srovnání populačního vývoje a populačnich opatření v ČSSR a Evropě 1950-1984. Praha, Výzkumný ústav rozvoje a práce.

Zubíková, A., Švejnová-Höesová, K., & Chytil, Z. (2021). Vybrané determinanty zaměstnanosti osob v postproduktivním věku na trhu práce v České a Slovenské republice. *Politická ekonomie*, *2021*(2), 170-192.

Population statistics 2017. Czech Statistical Office (2018).

Population statistics 2018. Czech Statistical Office (2019).

Population statistics 2019. Czech Statistical Office (2020).

Population statistics 2020. Czech Statistical Office (2021).

Statistical yearbook 2019. Czech Social Security Administration (2021)

Sales as a love affair: A salespeople's perspective on flirting and physical attractiveness in B2B Sales

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Abstract: Physical attractivity has tremendous impact on how humans are perceived in interaction. It has effects on perceived traits such as intelligence or social skills as well as how humans are treated in private and business context. From perspective of the social cognition theory (Fiske, Cuddy, & Glick, 2007) affiliation lays beneath these effect. This goes in line with the less researched flirtatious behavior. Hence, both physical attractivity and flirtatious behavior are looked at in context of B2B sales. Physical attractivity in personal sales has gained some research attention while research on flirtatious behavior in sales and service is scarce. Therefore, I conducted an exploratory approach in order to gain insights into the practical experience world of B2B salespeople. I lead expert interviews with 11 salespeople from different branches in Germany with the goal to understand their subjective perceptions of flirting and physical attractivity in personal sales interaction. Results show that affiliation is perceived as an important factor in sales interaction, while flirting is perceived as effective but dangerous as it provides a risk of losing authority as a sales expert. Practical and theoretical implications are discussed.

Keywords: Social Cognition, Sales, Physical Attractivity, B2B, Nonverbal Behaviour.
JEL Classification: D91, M31, Z13

1 Introduction

From different scientific perspectives, we know about the impact of attractivity and affiliation in our everyday lifes. Both physical attractivity and affiliation have tremendous effects on our private lifes and career. This is called the „what is beautiful is good stereotype" (Dion, Berscheid, & Walster, 1972). Physically attractive employees get promoted more often (Agthe, Spörrle, & Maner, 2011), they are perceived as more amiable, humorous, intelligent and socially skilled than more unattractive people (Feingold, 1992). Women and men who are perceived beautiful get a raise in salary more often (Frieze, Olson, & Russell, 1991) and even judges tend to give lighter sentences to beautiful people. Finally, our reward center is activated when beautiful people give us a look (Downs & Lyons, 1991).

Even in our childhoods physical attractivity affects our lifes and development on several levels. In early life unattractive children experience academic disadvantages (Parks & Kennedy, 2007; Ritts, Patterson, & Tubbs, 1992) and teachers evaluate more attractive pupils better and give them better grades (Clifford & Walster, 1973).

In this paper, I focus on the effects of physical attractivity and flirting in the context of B2B sales. Chaiken (1979) could show that physically attractive people can raise more funds, as people considered more unatttractive. Kulesza, Szypowska, Jarman, and Dolinski (2014) focused on sales interaction and found benefical effects for attractivity and mimicry behaviour of salespeople. Hence, I postulated as a research question:

1. How do salespeople perceive the role of physical attractivity in B2B sales?

Regarding physical attractivity concerning the perspective of theories of nonverbal behaviour, one can especially take into account the two dimensions of social cognition: Status and Affiliation. (Fiske et al., 2007). Status is sometimes in literature named verticality because it refers to vertical social relationships meaning someone having a higher social status than another one. Affiliation refers to horizontal social relations. It denotes social interpersonal attraction in horizontality. The significance of affiliation gets clearer when looking at its contrary. Social exclusion was often correlated with death for our ancestors (Baumeister & Leary, 1995).

An important signal of affiliation is physical touch that seems to be comparable with grooming of primates. Physical touch is a signal of social support and the acknowledgment of interpersonal relationships. It increases with interpersonal intimacy (Guerrero & Andersen, 1991). Another significant signal for affiliation beyond touch is "nonverbal involvement" (Edinger & Patterson, 1983). It is sometimes referred to as nonverbal immediacy (Limbu, Jayachandran, Babin, & Peterson, 2016). It typically includes touch, close interpersonal distance, gaze, and forward lean (Ambady & Weisbuch, 2010). During interaction individuals show a tendency to synchronize behaviour. That is measurable and related to current

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affiliative motives (Bernieri, Reznick, & Rosenthal, 1988). Research could discover a cluster of nonverbal immediacy behaviour which signal positive affect, availability and interpersonal closeness in relationships (Guerrero & Andersen, 1991). Touch, eye contact, direct body orientation, closer proxemic distances , positive facial expression and affiliative tones of voice contribute to these immediacy behaviours.

Regarding the importance of affiliation in social cognition the question arises, how affiliation affects B2B sales. Gadzhiyeva and Sager (2017) showed that importance in their research. I tie in with their work and focus on one specific aspect of affiliation and take flirtatious behaviour of salespeople in B2B environment into account.

Hall (1993) found that waitresses express a behaviour of flirting, talking and smiling with male customers (Hall, 1993). Frisby, Dillow, Gaughan, and Nordlund (2011) showed that flitrious behaviours differ between genders by assessing the dimensions of physical and social attraction, affiliation, dominance and conversational effectiveness. Men are evaluated as more dominant and affiliative than women in flirtious interaction, while dominance was not perceived as attractive and did not contribute to effective communication. As well, men showed significantly more interest in women when women flirted for sexual motives while attraction in women decreased when men flirted for fun. Therefore, I formulate a second research question:

2. How do salespeople perceive and use flirtatious behaviour and its effects in B2B sales?

The goal of this paper is to gain insights in the subjective experience of salespeople in the B2B environment.

2 Methods

In order to achieve the goal of this paper, I used a qualitative research approach.

2.1 Survey procedure

Describing the survey procedure, open guided interviews are lead. The type is expert interviews that see the researcher as an "incompetent" interlocuter on the specific topic. By working with the interview guideline, the expert has the chance to become familiar with the research topic. Familiarity should ensure a relaxed, unbureaucratic atmosphere. The researcher should engage with the language of the expert. The aim of this qualitative research is for the researcher to recognise the typicality of the research object. The focus is on thematic units and passages that belong together in terms of content across several interviews (Meuser & Nagel, 1991, 2009). The interviews are held via Microsoft Teams and recorded with the consent of the interviewpartners. The interview language was German as it is both the interviewers and the interviewees native language.

2.2 Selection of interview partners

I selected 11 interview partners that can offer personal insights and perspectives into different facettes of personal B2B sales interaction. They were contacted via LinkedIn and asked to participate in an interview based research on salespeople's behaviour in the B2B environment. Anonymity was ensured.

The interviews are executed in the form of expert interviews (Meuser & Nagel, 1991, 2009). The selection of experts can help to deeply understand the concept attractivity and flirtatious behaviour by outlining the experiences of experts who participate in customer interaction in their daily routines. They come from different industries in Germany and can be seen as part of the sphere of action themselves. Nine men and two women were interviewed. It is aimed at integrating practioners' perspectives on attractivity and flirtatious behaviour to gain insights on how these concepts are perceived in practical sales. All of the interviewed experts interact in B2B sales environment.

The experts offer a broad view on the different branches nutritional supplements, artificial intelligence, ink and printing, consulting, building automation, real estate, insurance, trade fair & exhibition. office supplies, HR Software and industrial knives. Therefore, it is ensured that perspectives are broad and cover different perspectives and backgrounds on the various interactions in B2B Sales.

2.3 Reparation and evaluation of interviews

The preparation of the interviews is based on the verbal transcription (Mayring, 2016). This allows for a complete text capture, which forms the basis for a detailed interpretative evaluation.

On this basis I built a phenomenological analysis (Mayring, 2016). Phenomenology has the main thought to understand subjective meaning structures and intentions. It is by purpose subjective and focuses severely on understanding the inner core behind the obvious in the perceived reality of participants in a matter. Variation in the sense of presenting a matter in different contexts is a key element of phenomenology. Two basic ideas characterize phenomenological analyses. Firstly, a phenomenon is described from a subject's point of view regarding their intentions

as starting point. Secondly, a reduction to the essence by varying the phenomenon is aspired. The evaluation was performed with the software f4analyse version 3.1.1 by the manufacturer audiotranskription.

3 Research results

From the interviews, several insights into the perceived imortance of physical attractivity and flitatious behaviour in sales interaction can be gained. The research questions are answered in one chapter each. Firstly, salespeople's perception of the role of physical attractivity is illustrated in chapter 0. Secondly, their perception and use of flirtatious behaviour is depicted in chapter 0.

3.1 Salesperson's physical attractiveness

In my research, I could find that most of the interviewpartners considered physical attractiveness as a key element in the salesinteraction. Attractivity was partly experienced as an outside factor highly related being optically perceived.

"You can go so far in the sense that you simply dress well and look well groomed. So that I don't appear there now with a five-day beard, which is totally unkempt, and the hair not done and not showered, but I appear there freshly shaved or at least well-groomed, made beard, made hair, nice outfit, that one collects there at least times no minus points on the side, but in the lucky case then rather plus points." (TR206979, paragraph 77)

Moreover, both competence and likeability are associated with physical attractivity.

"Well, I do think that in general an attractive person just tends to seem more competent, that was the term I was looking for, more competent, because we all like to think in boxes to kind of explain the complex world to ourselves, and then quickly make a gradation from the first impression." (TR206979_1, para. 50)

"Is important, is definitely important. One has found-, so it is important because attractiveness makes likeable." (TR206979, para. 75)

Setting a different persepective on attractivity, it is experienced that a „normal" attractivity is perceived as healthy for succesful sales.

"But if someone is mega-unattractive, then I think that even if you don't say it, you're more inclined not to use them in sales, because that's the-. You are presenting the company to third parties. And that is of course already a question. So on television, the daytime news presenters and so on, they're not ugly either. So that's always a question of-. But they are not, I say casually, so sex gods, who stand around there. That's just a normal attractiveness, which also appeals to a broad mass of people here." (TR206979_2, para. 99)

Moreover, the phenomenon gets highlighted that physical attractivity is an attribute which is only used behind closed doors for sales success when looking at the phrase „*even if you don't say it" (TR206979_2, para. 99).* This gets enhanced by the perspective of another interview partner: *"That's why, so for sales, resume without picture, that's unthinkable," (TR206979_2, para 99).*

Regarding the flipside of attractivity, statements even more clearly outspoken. I experienced that statements regarding ugliness and unattractvity were harsher than their opposite as if a taboo was broken and in the interview they were finally allowed to speak their subjective truth and set social rules apart:

"Success, winning type, innovative, blah blah blah. And then obese. So no offense meant, but-." (TR206979_3, para. 28)

"I don't want to say now that ugly people aren't successful or that anyone automatically equals smart just because they look like shit or something, I don't know. But I do think there's a connection there." (TR206979_3, para. 22)

"If you have more of a radio face, it's hard to be with the customer, too.[...], it's just factually like that." (TR206979_9, para. 169)

Another perspective when varying attractivity is, that people are attractive due to inner states and their charisma, while physical characteristics contribute less to perceived attractivity.

"But what also perhaps comes conditioned again by the fact that attractive people perhaps have a higher self-esteem or are more, more self-confident simply. And there I would perhaps ignite more, radiate more fire and more charisma or simply seem more vital." (TR206979_3, para. 22)

"So anyone who says, "This has no impact," they're lying. I really have to say, so blatant. So I do think that if you're attractive, bracketed, you're more attractive, you're charming, you're kind of polite, that's worth extremely much. And that reminds me-. Those are just good values. So attractiveness is not a value, but polite, courteous, friendly, respectful.

These are values that are appreciated. Whether young or old, it makes no difference, they are appreciated. And I do believe that it plays a role that someone is attractive. Then you might be inclined to do more, or act differently, or whatever." (TR206979_2, para. 97)

Compringsingly summarized, the phenomenon of physical attractivity is perceived as a very important factor in salesinteraction, even though its value is discussed behind closed doors and even more not something that is discussed openly in business. Moreover, attractivity is associated with personal attributes as compentence, trust or charisma. Additionally, inner values seem to be an important facette of non physical atttractivity.

3.2 Salesperson's flirtatious behaviour

Regarding flirtatious behaviour and sexappeal in the context of B2B sales interaction, perspectives and variations of the phenomen differ. The phenomenon seems to be related to an emotional brisance.

Firstly, enhancing effects of flirtatious behaviour are experienced.

"Think that can have a positive impact. Clearly, depending on the industry in any case. Especially in this craft industry, if he now a very, very nice lady dressed up running around, then that is certainly at least times nice to look at and then there is maybe times the one or other bonus point." (TR206979_10, para. 45)

Perspectives of women differed in the interviews. While there was on the one hand the perspective that flirting can undermine competence and weaken the expert position, there was the other perspective expressing the mindset „everything that works is allowed".

"And I also believe that as a woman, one rather often undermines one's competence there, if one goes there too quickly into any flirtatious approaches and also to be put there more quickly into some pigeonhole." (TR206979_1, para. 46)

"As long as no one grabs my ass, [...] so I'm relatively okay with it, yeah" (TR206979_4, para. 75)

The same female sales expert additionally gave insights that in interaction with men she showed more phsical contact than in same sex interaction with women.

"I think I'm touchy with men, more touchy than I am with women." (TR206979_4, para. 43)

"If you're comfortable with it yourself and if you're comfortable with saying, okay, you get a compliment, why not?" (TR206979_4, para. 75)

Men as well referred to the feeling of a flirty effect, that happens „in the moment" and symbolizes a setting of fast affiliation in combination with a light sense of desire and playfulness in the interaction. It seems, that in some interactions the break with classical professional rules of distance creates affiliation and emotional connection, even though the phenomenon is highly depending on the situation.

"Has something already with a certain flirty effect has it simply to do. And that's just, yeah, that fits. So that's, yeah, I think that's just the way it is. I'm-, I'm also happy, there are also enough women who just play along with that. But I always have the feeling that women try to be a bit more professional and very distant. It's often harder to get to them, especially from woman to woman, yes. And I don't have to give you anything, because you are also a woman, and I wasn't given anything either, that is often such a reaction, yes." (TR206979_4, para. 49)

Questioning, when flirting might result in opposite results and contradict sales success, it gets highlighted that a sense of classyness and courtesy is essential for interaction:

"If they say, "Ms. [name erased], you can put on your pencil skirt here. If you're comfortable in there and you can walk around in high heels all day, go for it, yeah." then. But it should be-, yeah, sexy, why not? Yeah, not cheap stop, that's important." (TR206979_4, para. 75)

Concludingly, sales interaction is compared with dating by the interview-partners as it is a setting in which likeability has to be created within first moments. Moreover, an atmosphere of intimicy, trust and sympathy is perceived beneficial for sales success. Therefore, this emotional closeness is provoked by salespeople. In the meantime, the salesdyade is characterized by uncertainty and surprise, at least when regarding the first interaction with the customer.

"But customers in principle, how you come across, in principle, an exciting question. It's like dating. You never know what it's going to be like." (TR206979_4, para. 33)

4 Conclusions

Putting the matter in a nutshell, one can say that both physical attractivity and flirtatious behaviour are considered beneficial for relationships between salespeople and customers and therefore for sales success. Regarding the statements

of the salespeople, both physical attractivity and flirting seem to be beneficial factors that are preferred to be discussed behind closed doors. As well a sense of joy in creating affiliation to customers seems to shape the interaction

For further research, it should be considered to collect a broader picture of attractivity and flirtatious behaviour in sales with a quantitative approach. As well, customers‘ perspective should be collected an mapped with salespeople’s view.

Regarding limitations, women are underrepresented in the sample of interviewed experts. For future research womens‘ perspective should be more considered when varying the phenomena of physical attractivity and flirtatious behaviour in B2B sales interaction. As well, the focus could not be set in B2C sales in this paper. Hence, this perspective should be taken into account in future research.

References

Agthe, M., Spörrle, M., & Maner, J. K. (2011). Does being attractive always help? Positive and negative effects of attractiveness on social decision making. *Personality & Social Psychology Bulletin*, *37*(8), 1042–1054. https://doi.org/10.1177/0146167211410355

Ambady, N., & Weisbuch, M. (2010). Nonverbal Behavior. In S. T. Fiske, D. T. Gilbert, & G. Lindzey (Eds.), *The Handbook of social psychology* (5th ed.). Hoboken, N.J., [etc.]: Wiley. https://doi.org/10.1002/9780470561119.socpsy001013

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Bernieri, F. J., Reznick, J. S., & Rosenthal, R. (1988). Synchrony, pseudosynchrony, and dissynchrony: Measuring the entrainment process in mother-infant interactions. *Journal of Personality and Social Psychology*, *54*(2), 243–253. https://doi.org/10.1037/0022-3514.54.2.243

Chaiken, S. (1979). Communicator physical attractiveness and persuasion. *Journal of Personality and Social Psychology*, *37*(8), 1387–1397. https://doi.org/10.1037/0022-3514.37.8.1387

Clifford, M. M., & Walster, E. [Elaine] (1973). The Effect of Physical Attractiveness on Teacher Expectations. *Sociology of Education*, *46*(2), 248. https://doi.org/10.2307/2112099

Dion, K., Berscheid, E., & Walster, E. [E.] (1972). What is beautiful is good. *Journal of Personality and Social Psychology*, *24*(3), 285–290. https://doi.org/10.1037/h0033731

Downs, A. C., & Lyons, P. M. (1991). Natural Observations of the Links between Attractiveness and Initial Legal Judgments. *Personality & Social Psychology Bulletin*, *17*(5), 541–547. https://doi.org/10.1177/0146167291175009

Edinger, J. A., & Patterson, M. L. (1983). Nonverbal involvement and social control. *Psychological Bulletin*, *93*(1), 30–56. https://doi.org/10.1037/0033-2909.93.1.30

Feingold, A. (1992). Good-looking people are not what we think. *Psychological Bulletin*, *111*(2), 304–341. https://doi.org/10.1037/0033-2909.111.2.304

Fiske, S. T., Cuddy, A. J. C., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, *11*(2), 77–83. https://doi.org/10.1016/j.tics.2006.11.005

Frieze, I. H., Olson, J. E., & Russell, J. (1991). Attractiveness and Income for Men and Women in Management. *Journal of Applied Social Psychology*, *21*(13), 1039–1057. https://doi.org/10.1111/j.1559-1816.1991.tb00458.x

Frisby, B. N., Dillow, M. R., Gaughan, S., & Nordlund, J. (2011). Flirtatious Communication: An Experimental Examination of Perceptions of Social-Sexual Communication Motivated by Evolutionary Forces. *Sex Roles*, *64*(9-10), 682–694. https://doi.org/10.1007/s11199-010-9864-5

Gadzhiyeva, N. M., & Sager, K. L. (2017). Maximizing the persuasiveness of a salesperson: An exploratory study of the effects of nonverbal immediacy and language power on the extent of persuasion. *Revista De Psicología Del Trabajo Y De Las Organizaciones*, *33*(2), 83–93. https://doi.org/10.1016/j.rpto.2017.03.001

Guerrero, L. K., & Andersen, P. A. (1991). The Waxing and Waning of Relational Intimacy: Touch as a Function of Relational Stage, Gender and Touch Avoidance. *Journal of Social and Personal Relationships*, *8*(2), 147–165. https://doi.org/10.1177/0265407591082001

Hall, E. J. (1993). Smiling, Deferring, and Flirting. *Work and Occupations*, *20*(4), 452–471. https://doi.org/10.1177/0730888493020004003

Kulesza, W., Szypowska, Z., Jarman, M. S., & Dolinski, D. (2014). Attractive Chameleons Sell: The Mimicry-Attractiveness Link. *Psychology & Marketing*, *31*(7), 549. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=edb&AN=96396899&lang=de&site=eds-live&scope=site

Limbu, Y. B., Jayachandran, C., Babin, B. J., & Peterson, R. T. (2016). Empathy, nonverbal immediacy, and salesperson performance: the mediating role of adaptive selling behavior. *Journal of Business & Industrial Marketing*, *31*(5), 654–667. https://doi.org/10.1108/JBIM-03-2015-0048

Mayring, P. (2016). *Einführung in die qualitative Sozialforschung* (6., neu ausgestattete, überarbeitete Aufl.). Weinheim: Beltz.

Meuser, M., & Nagel, U. (1991). *ExpertInneninterviews - vielfach erprobt, wenig bedacht: ein Beitrag zur qualitativen Methodendiskussion*. Westdt. Verl.: Westdt. Verl. Retrieved from https://www.ssoar.info/ssoar/bitstream/document/2402/1/ssoar-1991-meuser_et_al-expertinneninterviews_-_vielfach_erprobt.pdf

Meuser, M., & Nagel, U. (2009). Das Experteninterview — konzeptionelle Grundlagen und methodische Anlage. In S. Pickel, G. Pickel, H.-J. Lauth, & D. Jahn (Eds.), *Lehrbuch. Methoden der vergleichenden Politik- und Sozialwissenschaft: Neue Entwicklungen und Anwendungen* (1st ed., pp. 465–479). Wiesbaden: VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-91826-6_23

Parks, F. R., & Kennedy, J. H. (2007). The Impact of Race, Physical Attractiveness, and Gender On Education Majors' and Teachers' Perceptions of Student Competence. *Journal of Black Studies*, *37*(6), 936–943. https://doi.org/10.1177/0021934705285955

Ritts, V., Patterson, M. L., & Tubbs, M. E. (1992). Expectations, Impressions, and Judgments of Physically Attractive Students: A Review. *Review of Educational Research*, *62*(4), 413. https://doi.org/10.2307/1170486

Challenges of the Fourth Industrial Revolution for Companies and Employees

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Abstract: The Fourth Industrial Revolution (4IR) represents a challenge for the economy as a whole: it affects all communities and the way individuals as well as companies do their everyday routines, which need to adopt and adapt to it. The risk is for the latter to be inadequate for a changing environment in which it carries out its activities and for the former not possessing the proper new skills and competences. The 4IR represents an opportunity for companies as they can increase their profits and monitor their value chain and workers can enjoy more flexibility at work and avoid monotonous and dangerous tasks. Companies have a determinant role in providing programs that allow for the acquisition and the enhancement of competences and skills to work in their environment. The focus of the present paper is on the challenges companies face in adopting the novelties introduced by this disruptive change. Through the means of a questionnaire, it is investigated what are in order of importance the perceived main strategical barriers that obstacle them from becoming highly digitalized and complete the digitalization process according to owners and employees of Slovak and Italian companies. In addition to that, characteristics of the companies (e.g., dimension and foreign participation) are tested to see whether they affect the digitalization of companies and training practices.

Keywords: Industry 4.0, digitalization, strategic barriers, challenges for the economy, unemployment
JEL Classification: O33, 039

1 Introduction

From last decade, economy has been facing massive changes that affect and revolutionize all communities: the 4th Industrial Revolution (4IR), also known as Industry 4.0 and digitalization. The term was firstly used during the fair of Hannover (Germany) in 2011, however, it started to become popular only in 2013, when the "Industry 4.0 Manifesto" was announced by German National Academy of Science and Engineering (Acatech) (Kurt, 2019). 4IR has tremendous consequences for both people and companies (regardless of their sector), mainly brought by a mere digitalization of our everyday routines and organizational processes. Tasks can now be performed with the aid of autonomous machines, which are able to do repetitive jobs and even perform some high-skilled tasks. It is thus important for people as well as companies to be able to catch up with the latest technologies. Otherwise, the risk is for companies to lag behind competitors and loose contact with their environment and impossibility to be employed in smart companies (i.e., companies featuring with up-to-dated practices and technologies) or not be able to perform some everyday tasks that are being digitalized – e.g., bureaucracy - for individuals. Examples of technologies 4.0 are: Public Digital Identity Systems, Artificial Intelligence (AI), Virtual and Augmented Realities, block-chain, big data and automation.

Thanks to the 4IR and to a successful implementation of Industry 4.0 projects, companies can potentially increase revenues and profits thanks to a better control over costs, better monitor of productions and the control over the entire value chain. 4IR is an opportunity that they have to take if they wish to improve, succeed, increase their wealth and cope with a fierce competing world. On their side, employees can enjoy more flexibility in their jobs, perform less exhausting and avoid less dangerous jobs.

This current revolution requires a certain mindset and organizational disposition that can support the Industry 4.0 practices. Not always people have the required elastic mindset, though. Indeed, some individuals believe that advanced technology and automation will in the future replace them displaying, as a consequence, resistance to welcome the 4IR. The assumption is based on several analytical studies (now common knowledge) conducted at macro level. It should be opted for micro- and meso- analyses, which are however seldomly conducted (e.g. Freddi, 2017; Fossen and Songner, 2018). It is argued that from this perspective, studies on the issue give a more positive picture of automation and of Industry 4.0, in general. Furthermore, even though many jobs will disappear, jobs that currently do not exist will be created to satisfy the demand of smart companies (Freddi, 2017). According to Eberhard et al. (2017), 65% of children who is starting primary school will do a job that does not exist yet. Apparently, high-skilled tasks that foresee a certain

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degree of flexibility, judgement and common sense will continue to be performed by humans (Autor, 2015). What it seems inevitable is the dismissal of very low-skilled workforce that will unlikely be able to have the demanded skills. For them, governments are developing a universal basic income, which would guarantee adequate income for living (Gera and Singh, 2019).

As it happened for the previous Industrial Revolutions, employees will likely migrate to higher positions, which will require increased specialization and soft skills (e.g., cooperation, empathy and problem-solving). This shows the central role that cognitive tasks will have in the future (Frey and Osborne, 2013). Companies' role is to prepare the organizational environment and train their employees to use new technologies and acquire soft and hard skills needed to work in such a new environment. Companies can do that with training and periodical retraining programs (refresher courses). Skills development is key as it is considered a strategic management tool that guarantees to deal with innovative business practices (Nyhan, 1998). However, employees might resist change as it might imply for them, for example, loss of prestige and power and because it will be demanded them to learn something completely different from what they were used to (e.g., De Wit, 2017). This might be mitigated if companies provide them the right training and motivation. In this way, it is likely to make them accept the new reality and make it easier to overcome challenges of Industry 4.0. In addition to the psychological aspect, finance and culture are relevant too. Financial availability is very important as with an insufficient amount of financial resources, it would be hard to digitalize an organization. Lastly, culture is relevant and it is greatly influenced by the context in which a company operates. For example, a culture supporting entrepreneurial activity is likely to encourse the will to continuously innovate.

The aim of this study was to understand what are perceived by employees working in different positions and owners to be the most critical challenges and obstacles companies deal with and that make more difficult for them to complete the digital transformation towards a smart company. Furthermore, it was asked them to rank strategic barriers found by Marcon et al. (2019) in their study. Strategic barriers concern all those elements that an enterprise should take into consideration before taking a decision, delineating a path to follow and carrying out its everyday operations in a digitalized organization.

In addition to this objective, it was possible to identify differences between Slovak and Italian companies with respect to digitalization as well as their management practices. Lastly, attributes of companies, namely, dimension, foreign participation and smart working were tested to see whether they have any significant impact on the digitalization of companies. To fulfill the goals, managers' opinions working in companies based in the Slovak Republic and Italy were collected by means of a questionnaire.

2 Methods

In this paper were investigated the challenges that companies struggle with in order to implement Industry 4.0 and it was aimed to evaluate the impact certain characteristics have on the digitalization of a company (foreign participation, smart working location) and it is observed whether work position influences managers' perception of significant barriers. The following was hypothesized:

H1: Strategic aspects worry more top managers and owners; lower managers are worried more by operating aspects.

H2: Smart working is a driver of 4IR.

H3: In big companies more attention is given to the formation of employees than small ones.

For this end, a questionnaire was sent to managers of companies based in Slovakia and Italy by email to companies: in total, 102 answers were collected divided as follows: 62 from Italy and 40 from Slovakia. 38 out of 102 had foreign participation in their capital structure; only 4 companies were publicly/state owned. The sample was heterogeneous as the companies carried out their activities in more than 30 different sectors and respondents worked in different positions and belonged to diverse age courts. Because the sectors are numerous and because in some of them very few companies operate (one or two in some cases), the need was to group them so that to avoid the risk of close to zero variances, which would not allow further analysis. As such, two main categories were identified: **service** and **tangible** products industries (63 for the former and 37 for the latter; 2 answers were not classifiable). Similarly, work positions of respondents were grouped under 5 labels: **lower managers**, **middle managers**, **top managers**, **owners** and **others** (other positions). Taking into consideration the dimension of companies, **very small** (less than 10 employees) were 26, **small** (10-49 employees) 22, **midsized** (50-249 employees) 26, and **large** companies (over 250 employees) 28.

The questionnaire was divided in **3 parts**: classification of companies and employees, Likert scale and ranking questions. Likert scale questions comprised personal, marketing and customer, strategical and technological innovation and smart working. The third part demanded the respondents to rank barriers – among the identified by Marcon et al.

(2019) through a qualitative research - in order of importance barriers concerning strategic aspects of the digitalization. In the same vein, it was asked them to rank three main categories of barriers: strategic, operational and human resources.

For the Likert scale questions, the internal consistency was tested with the aid of Cronbach's Alpha. The result was satisfactory: a coefficient of 0.843 was obtained (acceptable coefficients are considered those higher than 0.7 in social science according to e.g., Gardner, 1995). The Likert scale questions then were tested along with selected characteristics of companies listed in the introduction. Since Likert scale is ordinal, the assumption of normal distribution is violated. Therefore, non-parametric tests should be performed. That was done using Mann-Whitney U test for those characteristics with two possible groups (for instance, ownership could be private or State/public) and Kruskal-Wallis tests for groups greater than two. For this latter test, it was examined further which group/s significantly differ/s from the other as it does not tell much about what precisely is the difference: Bonferroni post-hoc test was executed.

The method chosen for the analysis of the ranking question was the Garrett ranking method. To know more see Garrett's publication "Statistics in Psychology and Education" (1926).

3 Research results

The research gave important insights about the assessment of the barriers considered the most relevant as well as it confirmed **H1** in the third section. Moreover, statistical tests conducted on Likert scale questions showed in many cases differences among the groups and confirmed **H2** and **H3**. Besides, the results showed some differences between Slovak and Italian companies in the use of technology 4.0 and management routines.

3.1 Barriers towards digitalization

Table 1 summarizes the answers of interviewees from the most to the least critical barrier, regardless their specific job position. Here, the first four barriers were analyzed more in depth.

- **Customer need**, ranked first, is indeed determinant for the survival and success in business of any company, which must be able to adapt to a continuously changing demand in order to satisfy their needs.
- **Governance** was chosen as second. Indeed, during time of changes, it is likely that power is redistributed and its structure undergoes a more or less profound alteration (e.g. De Wit, 2017). Therefore, some managers of any category that lose power to the advantage of others (a zero-sum game), may start to display a certain degree of resistance to change. One of the fears of top managers is that decision-making might pass to the floor level when implementing Industry 4.0 (Majumdar et al., 2021).
- **Market entrance** was ranked on average as third. This choice might reflect the concerns that an enterprise has when it has to deal with competitors and consumers in a digital environment. The industry 4.0 brings about new and integrated market channels such as omni-channels comprising the ones ranging from the traditional (direct marketing) to the more modern (e.g. e-shops, social-media channels). Competitors may relatively easy copy the technology of a company and use them at their own advantage. It is thus needed to use rights on machinery needed to carry out operations in a digitalized market (for example digitalized intellectual property and patents).
- **Risk taking**, a generic barrier related to risks in digitalization and, the fourth barrier for importance here, reflects the uncertainty about the unknown and unfamiliar situation resulting at the end of the digital reorganization of a company, which can be reduced thanks to "suitable training" before the change actually occurs (Müller, 2019).

Table 1 Ranking of strategic barriers according to respondents' perception

Rank	Strategic
1	Customer need
2	Governance
3	Market entrance
4	Risk taking
5	Offer
6	Short Term vision
7	Transparency
8	Trust

Source: Own processing

The last part of section three showed that managers and owners' belief seem to reflect their everyday occupations (**H1** was corroborated). See **Table 2** for a recap of what they consider the priorities. For owners and top managers, the most

relevant obstacle to overcome for digitalization is of **strategic** nature, followed by human resources barriers and operational barriers. Indeed, their tasks usually include activities such as long-term planning, monitoring and assessment of the implemented strategy. Oppositely, for lower managers the most important are, in order, the **operational** ones, strategic and human resources barriers, that is they are more concerned about the short-term. Their activities usually regard mere production or the delivery of a service.

Table 2 General ranking of barriers according to respondents' position

Rank	Top Managers & owners	Lower managers
1	Strategic	Operational
2	Human Resources	Strategic
3	Operational	Human Resources

Source: Own processing

3.2 Other findings

From the survey, other relevant results were found as well. Accordingly, Slovak companies appeared in a more **advanced stage of digitalization** with respect to the other group of surveyed companies in Italy. Significative differences were found in the usage of big data analysis, the employment of Artificial Intelligence (AI), and end-to-end planned supply chain (the integration of supply chain the supplier to the final customer by the means of clouding techniques and based on machine learning algorithms), which make Slovak companies somewhat closer to the status of "**Digital Champion**" (PwC, 2014). Another difference from Italy was how strategy is intended. Slovak companies tended to opt for a more **deliberated strategy** rather than **emergent** one. Furthermore, it was not so common for all employees (managers and other workers) to participate to all the steps of the strategy from its formulation to its implementation. Italian ones, oppositely, looked **more "democratic"** in that regard, with all categories of workers engaged in the process.

Drivers of digitalization have been identified in **smart working** (confirming **H2)** and **foreign participation** (**Table 3** and **4**). The findings showed that the presence of the latter determined in most of the cases a greater technological level and diigital vision which can support the digital transformation, perhaps because of a much higher external pressure by shareholders as well as other groups of stakeholders to innovate. The former was forcely adopted by many companies around the world (mostly those not producing necessary goods) to cope with the spread of New Coronavirus (COVID 19). Not only it had an impact on the acceleration of the digitalization process, but also had it required employees to deepen their knowledge and acquire new IT competences in order to work remotely.

Table 3 Foreign participation and technological advancement

Foreign capital	T1	T2	T3	T4	T5	T6
No	4.66	3.98	3.19	3.77	2.42	5.11
Yes	5.58	5.47	4.74	5.29	3.53	5.82
Total	5.00	4.54	3.76	4.33	2.83	5.37
Sig. (2-tailed)	***.016***	***.000***	***.000***	***.000***	***.001***	***.046***

Source: Own processing

T1: Your company has a digital vision clearly stating strategy and culture needed to support digital transformation.

T2: The use of big data analysis has increased in the last years in your company.

T3: Artificial Intelligence (AI) is extensively used in your company.

T4: Supply chain is end-to-end planned in your company.

T5: Augmented Reality (AR) and Virtual Reality (VR) are used by employees, among the other applications, for self-learning and training.

T6: You believe that in the next future new technologies will increase your company's profits.

Table 4 Smart working

Location	SW1	SW2
Italy	4.79	5.29
Slovakia	5.73	5.92
Total	5.17	5.55

Source: own processing

SW1: Smart working made you and your colleagues to deepen your technological knowledge.

SW2: In certain ways, smart working accelerated the process towards a "smart" company.

Analyzing **Table 5**, generally, proper training to obtain the required competences was provided by the majority of the surveyed companies with the exception represented by very small companies, in which perhaps there are not enough resource and time to dedicate to the training and retraining. In contrast, it emerged how large companies were advanced from this point of view as they can probably spend part of their profits to guarantee that a specialized personnel provide the right training and retraining programs to the employees. The test showed also significant differences in P5, P6 and S5. In P2 there is no significance difference: small companies guatantee training to use specific technologies. **H3** was thus corroborated in items P5, P6 and S5.

Table 5 Training and company size

Company size	P2	P5	P6	S5
Very small companies	4.35	3.38	3.19	3.5
Small companies	5.41	4.68	4.82	4.82
Med-sized companies	5.58	5.08	4.88	4.54
Large companies	5.36	5.18	5.32	5.32
Total	5.17	4.59	4.56	4.55
Sig. (2-tails)	*0.339*	***0.016***	***0.044***	***0.018***

Source: own processing

P2: Your company provides you proper training in order to use a specific technology.

P5: Your company emphasizes training programs aimed to improve your soft skills (effectively communicate, ability to work in group and manage stress).

P6: Your company emphasizes training programs aimed to improve your hard skills (technical skills such as being able to communicate in a foreign language, IT skills).

S5: Your company provides refresher (retraining) courses periodically.

4 Conclusions

Companies and people need to be ready to welcome the 4IR and continue their innovation process. The acquisition of the necessary competences and enhance their soft- and hard- skills would allow workers to expand and improve their personal knowledge and cope with the digital transformation, otherwise this change is likely to exclude them. Companies risk to loose competitiveness and in turn run out of their businesses. Therefore, the duty of the companies - as it is stressed here - is to prepare the organizational environment with training and retraining programs specific of the Industry 4.0 initiatives. The questionnaire confirmed the advantage of large companies which perhaps can employ specialized personnel that can train the employees and have the resources for that. Respondents from very small companies scored relatively low compared to individuals working in other companies, reflecting a lack of suitable training. It was argued that it is highly recommended to guarantee such training even in very small companies. The absence of a staff in charge of that may be an obstacle itself: it is realistically more difficult self-learning, especially something completely unfamiliar. When planning, they should try to find a time gap in which conduct some periodical training and hire external expert for teaching: benefits are likely to overcome the costs. Intensive training and supplementary education leads to the gaining of skills and know-how necessary for the introduction of Industry 4.0 (e.g. Müller, 2019). Besides, two drivers of the Industry 4.0 have been found: foreign participation in capital structure and smart working that contributed (and it is still contributing) to the enhancement of competences and a deepening of IT knowledge.

Other obstacles are represented by psychology such as resistance to change, threats to loose power and a closed mindset, culture – that may motivate people to abandon their status quo - and financial availability – the available resources to purchase novel technologies. Taking into consideration strategical barriers - according to the questionnaire - customer needs, governance, market entrance and risk taking are perceived to be the main barriers inhibiting 4IR. From the general ranking of barriers, strategic - human and operational - it emerged how the everyday concerns of respondents influence their choice for a determined barrier instead of another (strategic for owners and top managers who deal more

with activities meant for the long-term and operational for lower managers who are more concerned with short term operations).

Other findings regard differences between Slovak and Italian companies. Slovak companies and (a little less) Italian based companies have a good digitalization level and their practices are more or less in line with the Industry 4.0 initiatives. Curiously, there it seems to be a different approach to the strategizing process. In Italy, it seems that deliberative strategies are preferred and decisions are not taken, as it happens in Slovakia, only by those in the highest positions. The higher engagement in strategizing may lead to important benefits for the companies that opt for this model as it may mean more likelihood acceptance of the transformation – or generally of other decisions - because everybody would have contributed to the strategy, as new strategy implies change.

The study has some limitations. Firstly, the analysis was conducted in two European countries and secondly, the sample was not so large that makes it hard to generalize it. In future research, the sample may involve countries from other continents so that to see how the barriers are ranked. Another possibility may be to focus on fewer industries and compare the barriers and challenges companies from different industries face to complete the 4IR. From a construction perspective of the questionnaire, certain aspects may not have been caught (e.g. other barriers).

References

Amaral, A. & Peças, P. (2021). SMEs and Industry 4.0: Two case studies of digitalization for a smoother integration. *Computers in Industry*, 125. doi: 10.1016/j.compind.2020.103333

Autor, D. H. (2015). Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives*, 29(3), 3–30. doi: 10.1257/jep.29.3.3

De Wit, B. (2017). *Strategy: An International Perspective*. 6.ed. Hampshire, UK: Cengage Learning EMEA. ISBN: 978-1-4737-2515-7.

Eberhard, B., Podio, M., Alonso, A. P., Radovica, E., Avotina, L., Peiseniece, L., Sendon, M. C., Lozano, A. G. & Solé, P. (2017). Smart work: The transformation of the labour market due to the fourth industrial revolution (I4.0). *International Journal of Business and Economic*, 10(3), 47-66. doi: 10.25103/ijbesar.103.03

Fossen, F. M., Sorgner, A. (2018). The Effects of Digitalization on Employment and Entrepreneurship. Available at http://conference.iza.org/conference_files/MacroEcon_2018/sorgner_a21493.pdf

Freddi, D. (2017). Digitalisation and employment in manufacturing: Pace of the digitalisation process and impact on employment in advanced Italian manufacturing 68 companies. *AI & Society*, 33, 393–403 (2018). doi: 10.1007/s00146-017-0740-5

Gardner, P. L. (1995). Measuring Attitudes to Science: Unidimensionality and Internal Consistency Revisited. *Research in Science Education*, 25(3), 283-289. doi: 10.1007/BF02357402

Garrett, H. (1926). *Statistics in psychology and education*. New York, Longmans, Green and Co. LCCN 26004149.

Gera, I. & Singh, S. (2019). A Critique of Economic Literature on Technology and Fourth Industrial Revolution: Employment and the Nature of Jobs. *The Indian Journal of Labour Economics*, 62, 715–729.doi: 10.1007/s41027-019-00191-8

Kurt, R. (2019). Industry 4.0 in Terms of Industrial Relations and Its Impacts on Labour Life. *Procedia Computer Science*, 158, 590–601. doi: 10.1016/j.procs.2019.09.093

Majumdar, A., Garg, H., Rohan, J. (2021). Managing the barriers of Industry 4.0 adoption and implementation in textile and clothing industry: Interpretive structural model and triple helix framework. *Computers in Industry*, 125 (2021). doi: 10.1016/j.compind.2020.103372

Marcon, É, Marcon, A., Le Dain, M., Ayala, N. F., Frank, A. G. & Matthieu, J. (2019). Barriers for the digitalisation and servitization. *Procedia CIRP*, 83 (2019), 254-259. doi: 10.1016/j.procir.2019.03.129

Müller, J. M. (2019). Assessing the barriers to Industry 4.0 implementation from a workers' perspective. *IFAC PapersOnLine*, 52(13), 2189–2194. doi: 10.1016/j.ifacol.2019.11.530

Nyhan, B. (1998). Competence development as a key organisational strategy experiences of European companies. *Industrial and Commercial Training*, 30(7), 267–273. doi: 10.1108/00197859810242897

PWC, 2014. Industry 4.0 - Opportunities and Challenges of the Industrial Internet. *www.pwc.de/industry4.0*. Retrieved September 20, 2021. Available at: https://i40-self-assessment.pwc.de/i40/study.pdf

The Determinants of Foreign Direct Investment Inflows in Slovakia

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Abstract: Foreign direct investment (FDI) policies play an important role in the economic growth of developing countries around the world. Attracting FDI inflows through conductive policies has therefore become a key battleground in emerging markets. The prospect of new growth opportunities and excessive profits is supported by large capital inflows into various industries and types of opportunities. And this has led to competition between states in formulating flexible policies and providing incentives to attract private investors for more and more investment. In light of the above, the paper emphasizes the trend of FDI in Slovakia after economic reforms, the sectoral and national share of FDI, the way in which FDI affected the growth of the Slovak Republic. Various factors that play an important role in attracting FDI to a particular situation are also examined. The efforts of national governments to attract maximum foreign direct investment are also examined.

Keywords: foreign direct investment, determinant, gross domestic product, science and research, infrastructure, policy, forecast
JEL Classification: B22, E17, F62

1 Introduction

Economic relations at the international level are realized by the movement of goods and services at the international level, as well as by the international movement of capital and labour (Bende-nabende, 2017). A key form of foreign capital infiltration into our economy is foreign direct investment (Piketty, 2017; Hintošová, 2021). In general, economic theory, investment is considered to be an economic activity in which an entity forgoes current consumption with a view to increasing the product in the future (Oldřich, 2014). Foreign investment is one of the forms of realization of long-term international movement of capital (Papula, 2017).

We can define at the microeconomic level the determinants of FDI and the company's behaviour by product life cycle theory, which explains the various stages of the company's entry into foreign markets by dividing product life into stages - the process a product goes through from when it is first introduced into the market until it declines or is removed from the market (O'Meara, 2015; Gontkovičová, 2016). Hand in hand goes an eclectic paradigm theory, also known as the ownership, location, internalization (OLI) model or OLI Framework, which is a three-tiered evaluation framework that companies can follow when attempting to determine benefits of foreign direct investment (FDI) impact (Mankiw, 2015; Lomachynska, 2021). In general, however, the country must meet fundamental criteria such as political stability, a functioning legal system, macroeconomic stability (Tintin, 2013).

We understand FDI as a complex concept and it is not clear to determine what impact the growth of investment inflows in the country will have on its overall economy (Bailey, 2018). On the other hand, from strategic point of view a company will always persuade own goals which creates positive and negative impacts (Secil. 2016). Therefore it is up to strategic management planning to understand each individual determinant and use it for and use these localization factors in creating goals, plans and strategic decisions with the opportunity to obtain more effective profitable results (Liargovas, 2012; Ali 2010; Pradhan, 2019).

2 Methods

The main goal of the final work is to evaluate, based on scientific methods, the development and prospects of the inflow of foreign investment to Slovakia regarding strategic management planning. A set of individual sub-objectives was also chosen, which helped us to correctly evaluate the results of the work and achieve the set goal. Beside the main information line additional channels will support the observed data, including structures of different entities and data analysis. Once

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the information from other subjects is documented, the basis for the preview is obtained, which will lead to the final form of the final recommendations.

The work procedur eis based on professional literature and scientific articles related to the issue, quarterly data provided by the NBS in the Macroeconomic Database (complemented by SARIO's annual reports for 2019 to 2020),followed by statistical and mathematical methods. Under this terms we used following procedure to work with our models, using Summary statistics, Correlation matrix, Regression analyses – in order to fullfill our hypothesis:

- Hypothesis 1 (H1): Foreign direct investments in Slovakia are influenced by Gross Domestic Product (GDP)
- Hypothesis 2 (H2): Foreign direct investments in Slovakia are influenced by, Infrastructure Investments Scientific research and development (SRaD)
- Hypothesis 3 (H3): Foreign direct investments in Slovakia are influenced by Trade openness (TrO)

Based on these information we are able to use forecast function - FORECAST projects a future value along a line of best fit based on historical data. Both functions calculate a future y-value by using the linear regression equation:

$y = a + bx$

Where the a constant (intercept) is: $a = \bar{y} - b\bar{x}$

And the b coefficient (slope of the line) is: $b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

The values of $\bar{x}$ and $\bar{y}$ are the sample means (averages) of the known x-values and y-values. All information is supplemented by annual reports of government institutions dealing with foreign trade and investment issues together with the current wording of legislation.

3 Research results

Foreign Direct Investment in Slovakia averaged 234.43 EUR Million from 2004 until 2020, reaching an all-time high of 2101.80 EUR Million in June of 2006 and a record low of -1538.50 EUR Million in September of 2020. The COVID-19 pandemic is and will be a major slowdown in FDI inflows, especially between 2020 and 2021. As we can see for ourselves on the 2020 prep graph, it is really significant and will greatly influence the future development of individual determinants.

In 2019, net FDI inflows for Slovakia was 2,312 million US dollars. Though Slovakia net FDI inflows fluctuated substantially in recent years, it tended to decrease through 2000 - 2019 period ending at 2,312 million US dollars in 2019. Slovakia Foreign Direct Investment (FDI) increased by 58.6 USD mn in Dec 2020, compared with an increase of 258.1 USD mn in the previous month. Slovakia Foreign Direct Investment: USD mn net flows data is updated monthly, available from Jan 2008 to Dec 2020. The data reached an all-time high of 1.2 USD bn in Dec 2008 and a record low of -1.8 USD bn in Sep 2020.

3.1 State assistance for FDI and model specification

As of December 31, 2019, the SARIO agency had registered and 51 investment projects in progress, in the total volume of almost 5.7 billion with the potential to create more than 28,200 new jobs. This study is based on the data collected for 11 independent variables of foreign direct investment determinants for Slovakia in a period of quarterly data from 4th quarterly 2002 till 4th quarterly 2019.

Comparison of the number and parameters of projects under development 2016—2020

	2016	2017	2018	2019	2020
Number of projects in progress	66	76	70	51	64
Potential work in progress projects	1.8 billion €, 23,800 new work positions	4,2 billion €, 31 000 new work positions	2,7 billion €, 24 000 new work positions	2,7 billion €, 24 000 new work positions	5,9 billion €, 31 230 new work positions

Source: own processing

In this work we would like to find out about relationships between Inflow of FDI and selected determinants. We also will look for evidence in The Granger causality test if statistical hypothesis test for determining whether one-time series is useful in forecasting another. Out of 11 determinants used in this work we have selected 3 most significant. Quaterlly

data of selected determinants are later used as basis for forecasting. Forecasting model results are comapred with annual reports of NBS and Ministry of Finance of Slovak Republic. In this work following determinants were used:

- GDP - Gross domestic product (GDP) is a monetary measure of the market value of all the final goods and services produced in a specific time period. The sign of the coefficient is expected to be positive.
- Trade openness -in this study trade openness is computed as export plus import divided by GDP. The sign of the coefficient is expected to be positive.
- Market Size - GDP and Demography, Population of the Slovak Republic are used as a proxy of the market size. The sign of the coefficient for GDP and population growth is expected to be positive.
- CPI - the most well-known indicator of inflation is the Consumer Price Index (CPI), which measures the percentage change in the price of a basket of goods and services consumed by households. CPI is expected to be negative and significant.
- Demographic indicators linked to research -unemployment is often used as a measure of the health of the economy. It can go hand in hand with the Scientific research and development. More investments to research and development tend to lower unemployment. The sign of the coefficients is expected to be positive.
- Infrastructure & investments- in this study Constructions (SoIC). and gross fixed capital formation are used as a measure of infrastructure and Investment structure - Scientific research (SRaD). Wexpect both positive correlations with FDI coefficient.
- Subsidies - subsidies tent to indicate a healthy relationship to business stimulus. FDI as a part of business environment is expected to have positive coefficient.

Our data were subjected to regression analysis to describe the relationships between a set of independent variables and the dependent variable. Regression analysis produces a regression equation where the coefficients represent the relationship between each independent variable and the dependent variable. We used the standard regression formula with our data set as followed:

$$FDI = \beta_0 + \beta_{(1)}\, GDP + \beta_2\, NX + \beta_3\, SRaD + \beta_4\, SoIC + \beta_5\, CPI + \beta_{(6)}\, PoSR + \beta_7\, QWaI + \beta_8\, VAT + \beta_9\, TrO + \beta_{10}\, U + \beta_{11}\, PAB + \neg\varepsilon$$

Where GDP denotes gross domestic product, NX denotes net export, SRaD & SoIC denotes investment structure for research and infrastructure, CPI denotes as core inflation, PoSR denotes Slovak population, QWaI represents quarterly wages for all industries, VAT represents tax on production and import, TrO denotes as trade openness, U denotes for unemployment rate and PAB stands for total subsidies paid. Symbol ε represents a disturbance or error term which includes all other factors affecting y.

We used regression to determine the strength and character of the relationship between one dependent variable (FDI) and a series of other variables (known as independent variables). We will therefore take a closer look at the individual regression values. The Regression Coefficient is the constant 'b' in the regression equation that tells about the change in the value of dependent variable corresponding to the unit change in the independent variable . In our case only in VAT with coefficient 0,729182396 we can find a tendency which indicates a positive correlation, meaning that both variables move in the same direction together. A negative correlation can be seen in NX value -0,000296489, SRaD with value -0,000725967, SoIC with value -0,000317776, CPI coefficient value -0,103894129, PoSR with value -0,021216444 and PAB with value -0,000150919.

According to this regression model, which is presented in Table 1.0[2], our regression was 119.0603095 + 0.000308076x1- 0.000725967x2 + 1.09846E-05x3. According to P-value in Table 1.0, the intercept of our model is highly significant (0.001) < alpha (0.01) and is expressing that if GDP, SRaD and TrO would be equal to 0, then in that case the FDI inflow would be 119.0603095. GDP with its P-value in our model is highly statistically significant (0.005) < (0.05) and we can assume that every increase by 1 amount in GDP would increase the FDI by 0,000308076 units. On the other hand, the last indicators in our model were SRaD (0.78) > (0.05) and TrO (0.97) > (0.05) with its P-value, which is not significant in our model. So the statement that every increase by 1 in SRaD would increase the FDI by 0.000725967units and in the case of TrO by 1,09846E-05 is not reliable.

[2] Used determinants are gross domestic product – GDP, invest into scientific research and development SRaD and trade openess TrO

Table 1.0 - Regression result of selected determinants

	Coefficients	P-value
INT.*	119,0603095	0,001046634
GDP	0,000308076	0,005128956
SRaD	-0,000725967	0,785613837
TrO	1,09846E-05	0,977581229
QWaI	0 ,003935404	0,256269 .

Source: own processing

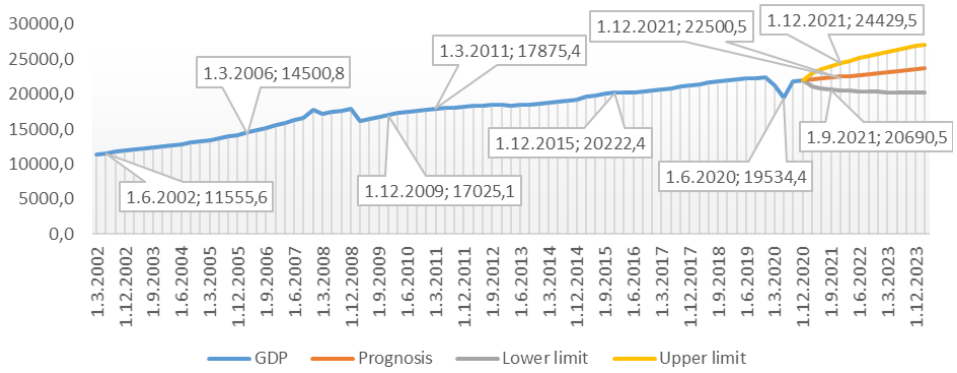
*stands for intercept

Although our calculations did not bring any unexpected results, on the contrary, they confirmed that the inflow of foreign investment is a delicate matter and varies from project to project. The number of determinants that each project on the green field chooses is individual and directly proportional to the concept**.** Selected determinants, which were most significant in the model are Gross domestic product (GDP) and Trade openess (TrO). Since our model shows that SRaD is not a usefull determinant we will continue to make forecast with follwoing determinant - Quarterly average wages for all industries (QWaI).

3.2 GDP expenditure method indicator forecasting

Public finances assume the drawing of the Covid reserve in the amount of more than 1 billion eur in 2021. From 2022 onwards, the assumption of structural consolidation at 1% of GDP per year. The drawdown of the resources from the recovery and resilience plan of Slovak Republic will begin in the second half of 2021 and will support the economy significantly in 2022. In the second half of the year, the beginning of the drawdown of the rural development program by Ministry of Agriculture and Rural Development of the Slovak Republic, which spills over into stronger growth in 2022. It is therefore estimated that the next time horizon until 2024 will have the basic effect of drawing on EU funds.

Figure 1 GDP expenditure method selected values as of 1. 12. of the year.



Source: Own processing

We compared our forecasts with the forecast from the Ministry of Finance of the Slovak Republic. The financial institute has estimated that the forecast will improve in 2020 thanks to stable consumption and a faster recovery in foreign trade. It also mentions slower growth for the years 2021 - 2022 due to strict measures, especially in the first half of 2021. In the second half of the year, the beginning of the drawdown of the RDP, which spills over into stronger growth in 2022.

Table 2 The slowdown in economic growth due to the second wave - Real GDP

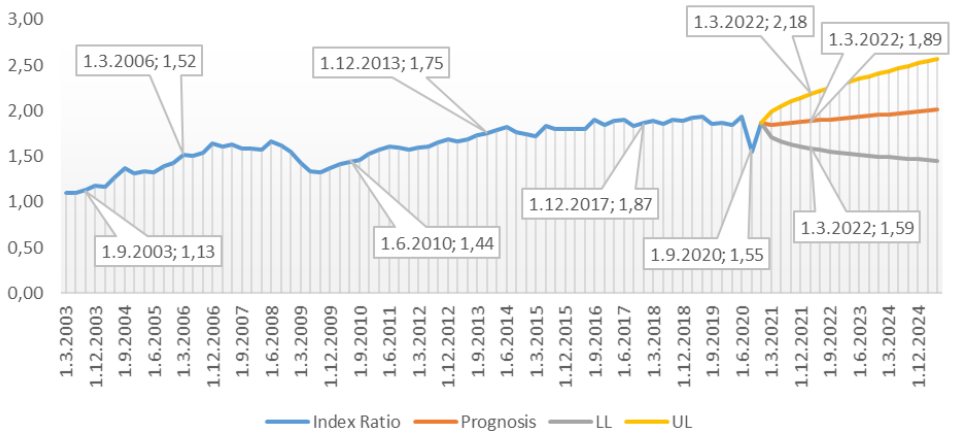
2019			2020			2021		
20_Sep	**21_Feb**	**Δ**	**20_Sep**	**21_Feb**	**Δ**	**20_Sep**	**21_Feb**	**Δ**
2,4	2,3	-0,1	-6,7	-5,8	0,9	5,5	4,3	-1,2
2022			**2023**			**2024**		
20_Sep	**21_Feb**	**Δ**	**20_Sep**	**21_Feb**	**Δ**	**20_Sep**	**21_Feb**	**Δ**
2,4	3,9	1,5	3,3	2,5	-0,8	-	0,7	-

Source: own processing according to data from Ministry of Finance of the Slovak Republic

3.3 Trade openness indicator forecasting

An empirical measure of trade openness is defined as the ratio of total trade to GDP, and represents a convenient variable routinely used for cross-country studies on a variety of issues. The development of trade openness and our subsequent forecast speaks of a slight decline, followed by an increase in 2019. In the absence of the COVID-19 pandemic crisis, the trade openness index would have a gradual increase. However, despite the secret pandemic, our indicator has managed to pick up and its future development will determine the degree of restriction of government institutions to exports and imports.

Figure 2 Trade openness indicator and selected values as of 1. 12. of the year.

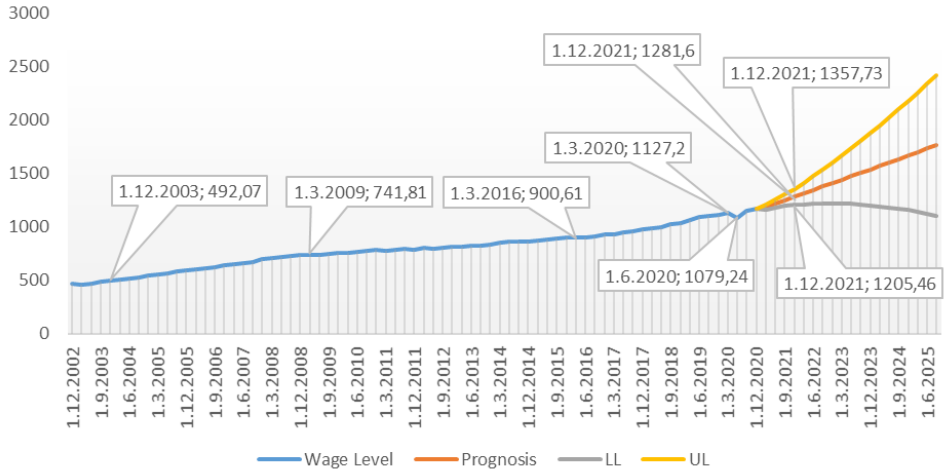


Source: Own processing

3.4 Quarterly average wages indicator forecasting

The average nominal monthly wage of an employee in the Slovak economy reached EUR 1,113 in the third quarter and increased by 4.2% year-on-year. After a unique decline in the nominal value of the average wage in the last quarter, monthly wages increased by an average of EUR 45 year on year in the third quarter. After taking into account the inflation rate, real wage growth reached 2.7%. Compared to the 2nd quarter of 2020, the seasonally adjusted average wage increased by 6.7%.

Figure 3 Quarterly average wages and selected values as of 1. 12. of the year.



Source: Own processing

The volatile period caused by the Covid-19 pandemic in the third quarter has not yet had a significant impact on wage growth. The average nominal monthly wage of an employee in the Slovak economy reached EUR 1,113 in the third quarter and increased by 4.2% year-on-year. After a unique decline in the nominal value of the average wage in the last quarter, monthly wages increased by an average of EUR 45 year on year in the third quarter. After taking into account the inflation rate, real wage growth reached 2.7%. Compared to the 2nd quarter of 2020, the seasonally adjusted average wage increased by 6.7%.

3.5 Selection of determinants according to green field projects

However, an important element in the selection of determinants affecting FDI is always the nature of the investment plan of individual investors and companies. What is suitable for the IT segment, for example, may not be directly important for the logistics segment. Using 11 selected determinants, we found that the greatest influence on decision-making is classically the country's GDP, taxes, demography, living standards of the population and infrastructure. By establishing the hypothesis of causality between selected determinants, we found that not all determinants directly affect FDI and the regression model confirmed this. Which results in the explanation that not every FDI project requires the same criteria.

4 Conclusions

The inflow of foreign direct investment is a key factor in the development of the country's economy. The determinants of the inflow of foreign investment differ individually depending on the nature of investment projects. However, there are common determinants such as infrastructure, the country's GDP or the level of the minimum wage. In order for Slovakia to remain an interesting country for investment projects, it is necessary to continue to stimulate individual determinants and to support the inflow itself with the following points.

Using regression models, we demonstrated the individual causal relationships between determinants. We were also able to succesfully confirm all 3 hypothesis. These determinants (GDP, SRaD and TrO) are among few which are key factors in investment decision making proces in case of FDI. Moreover, we subjected selected determinants to the analysis of the prognosis until 2023 and thus gained the opportunity to point out the positive probable development of determinants despite the COVID-19 pandemic.

An important factor in the inflow of FDI is, for example, support from state institutions such as SARIO agencies or SBA agencies, their activity must continue to be supported. Significant determinants such as infrastructure, science and research and education or the technological maturity of the country must be the primary goal of our government. ICT communication channels must continue to be maintained and managed in such a way as to reduce the bureaucratic burden on all actors. Maintain the country's political stability and supporting small and medium size local businesses should also be recognize as primary points.

References

Piketty, T. *Capital in 21st Century*. Cambridge: Belknap Press, 2017, p. 640, ISBN 9780674430006

Bende-Nabende, *A. Globalisation, FDI, regional integration and sustainable development: theory, evidence and policy, Aldershot: Ashgate*, e-book , 2017, 0-7546-1937-0

Rejnuš, O., *Finanční trhy*. Praha: Grada, 2014, s. 768, ISBN: 9788024736716

Mankiw, N. G., *Macroeconomics* - Ninth Edition, Duffield, 2015. p. 608, ISBN: 9781319154035

Papula, J., (2017). *Manažérska ekonomika - ako teória obohacovaná skúsenosťami a trendmi v manažmente*. Bratislava: Wolters Kluwer, s. 258, ISBN 9788075528070

Pradhan, R., Arvin, M. B., Bahmani, S., & Hall, J. H. (2019). Attaining economic growth through financial development and foreign direct investment. *Journal of Economic Studies*, 46(6), 1201-1223. doi:10.1108/JES-04-2018-0136

Liargovas, P. G., Skandalis, K. S. Foreign Direct Investment and Trade Openness: The Case of Developing Economies. *Social Indicator Research*, 106, 323–331 (2012). [available on-line]: https://doi.org/10.1007/s11205-011-9806-9

Gontkovičová B., et al. (2016). *The selection of the host country on the basis of FDI indices*. JIAS – Košice, č. 2, [available on-line]: https://www.researchgate.net/publication/317181625

O'Meara, Graeme (2015). Examining the Determinants of Foreign Direct Investment. *Undergraduate Economic Review* 11(1), Article 13. [available on-line]: http://digitalcommons.iwu.edu/uer/vol11/iss1/13

Seçil H. D. et al., (2016) Foreign direct investment via m&a and domestic entrepreneurship: blessing or curse?, [available on-line]:
https://publications.aston.ac.uk/id/eprint/29026/1/Foreign_direct_investment_via_M_A_and_domestic_entrepreneurship.pdf

Bailey, N. (2018). Exploring the relationship between institutional factors and FDI attractiveness: A meta-analytic review. *International Business Review*, 27(1), 139-148. doi:10.1016/j.ibusrev.2017.05.012

Hintošová, A. B., & Barlašová, T. (2021). The role of investment promotion policy in attracting foreign direct investment: The case of slovakia. *Public Administration Issues*, (5), 27-40. doi:10.17323/1999-5431-2021-0-5-27-40

Lomachynska, I., Babenko, V., Yemets, O., Yakubovskiy, S., & Hryhorian, R. (2021). Impact of the foreign direct investment inflow on the export growth of the visegrad group countries. *Estudios De Economia Aplicada*, 38(4) doi:10.25115/eea.v38i3%20(1).4007

Tintin, C. (2013). The determinants of foreign direct investment inflows in the central and eastern european countries: The importance of institutions. *Communist and Post-Communist Studies*, 46(2), 287-298. doi:10.1016/j.postcomstud.2013.03.006

Ali, F. A., Fiess, N., & MacDonald, R. (2010). Do institutions matter for foreign direct investment? *Open Economies Review*, 21(2), 201-219. doi:10.1007/s11079-010-9170-4

The Interaction Between Stock Prices and Price of Crude Oil

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Abstract: Recently, we have seen many changes and innovations in the financial and commodity markets. Financial markets became more closely linked to commodities as crude oil as investors began to look for new investment opportunities in times of financial market stagnation. The level and dynamics of crude oil price have important social and political consequences. They have an impact on producers' incomes and consumers' purchasing power. The study entailed the cause-and-effect relationship, and dynamic correlation between price of crude oil and prices of selected indexes. This study aims to analyse the relationship between financial markets and price of crude oil. Results shows that indeed, the relationship between crude oil price and financial markets exists. A long-run relationship was spotted in the case of Shanghai composite index price and crude oil price as well as cause and effect of crude oil over indexes. Other than that, the dynamic conditional correlation exists between crude oil and MSCI world, crude oil and SP500 indexes. The recommendation and suggestion for investors are also described within this study.

Keywords: crude oil, indexes, financial market, volatility, dynamic correlation, cause, and effect
JEL Classification: C32, G15, Q02, Q41

1 Introduction

There is growing evidence that commodity prices and stock prices move together and that the link between them has strengthened (Mustafa & Erhan, 2016). The connection between these two markets was also acknowledged by (Nicolau, 2010) who implies that based on economic theory, commodity prices have a positive relationship with interest rates and interest rates have a negative relationship with bonds or shares. Also introduced the linkage of financial derivates and commodities. As reported by (Chorafas, 2005) to him the important player which is connecting these two derivates is inflation according to which there is negative relationship between inflation and financial derivatives. From the point of view of investments, (Rehman & Vo, 2021) see commodities as a popular asset for novice investors as well as for experienced traders, regulators, and academics. Study conducted by (Domanski & Health, 2007) provides evidence, that presence of investors increased in years 1998-2006, which they found based on increasing number of commodity derivatives contract. The study of (Ali & et al., 2020) was monitoring valuable role of commodities for international stock markets. This study opens possibilities for further examination of interaction between stock prices and not only crude oil but also precious metals. (Sardana, 2019) was looking into the correlation between commodities and S&P 500 index. It was showing 13 commodities and how they are correlated with this index. From the study which was concluded by (Qiao, 2015) of the correlation between prices of three kinds of bulk commodities namely oil, copper, aluminium and five selected stocks indexes, namely SSE, SP500, ASX, RTS, TSX we could see that there is existence of correlation between indices and commodities. The most significant were Oil/SSE, Oil/SP500, Oil/ASX, Oil/RTS, Oil/TSX, Copper/ASX, Copper/RTS, Aluminum/SP500, Aluminum/ASX, Aluminum/RTS and Aluminum/TSX. Other than that, this study was done in between years 2003 and 2013 so in the time when financial crisis occurred. Study shows that after the financial crisis correlation between commodities and indices increased even more. (Musawa, 2017) exanimated influence of copper and crude oil (commodity prices) on stock market performance namely LuSE price index. He used Distribution lag, cointegration and vector error correction. He was analysing data from 2004 till 2016 and he found out that oil has negative influence on this index. The study of (Hussin & et al., 2013) about Islamic share prices in Malaysia and crude oil price again provided positive relationship. Other than that, it shows that oil price effects Islamic stock return in long run as well as in short run. (Tarek & Derbali, 2016) found empirical evidence that correlation between commodity and Islamic stock markets are time-varying and highly volatile. Similar results were found also by (Khan & Masih, 2014) who emphasised the role of financial crisis in 2008 and its impact on this relationship. (Murphy, 2015) compared stock and commodities by CRB index which shows commodity prices and S&P 500 between 2006 and 2012. He found out that these two markets

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started to be linked together more after the financial crisis in 2008. From the research of (Nirmala, 2018), where he examines relationship between commodity and equity markets from 2013 and 2018 by usage of VAR cointegration we could see that he found out that in long run there is no correlation between these two markets. Another research conducted by (Mohamed & Rault, 2010) was focused on oil prices and stock markets in GCC countries from the June 2005 till May 2010. He found out that Saudi stock market significantly affect oil prices. (Xu & et al., 2020) was examining crude oil and its ability to serve as hedging asset. To do that, he needed to investigate the correlation between crude oil and stock index. He was focusing on economies of US, Japan, China and Hong Kong and he found out that just in China, oil can serve as hedging asset by 90%. In long term, correlation between stock market and oil is higher in the long run but lower in short run which makes oil in short run stronger as hedging asset.

2 Methods

To examine whether there is a cause-and-effect relationship between the two variables, we use Engle-Granger Causality test, by proving that they share a common long run trend. The hypotheses for Engle-Granger Causality test are as follows:

(H0): There is no long run causal relationship between the two variables. If the (probability) P > 5%, then the null hypothesis (H0) is accepted.

(H1): There is a long run causal relationship between the two variables. If the (probability) P < 5%, then the null hypothesis (H0) is rejected (Al-Ameer & et al., 2018).

To conclude this test, we need to conclude unit root test to verify stationarity and VAR to detect lag length.

Basic formula for Granger Causality test is:

$$Y_t = a_0 + \sum_{i=1}^{n} a_i Y_{t-i} + \sum_{j=1}^{n} \beta_j X_{t-j} + \varepsilon_{1t} \quad (1)$$

$$X_t = x_0 + \sum_{i=1}^{n} x_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + v_{1t} \quad (2)$$

where:

Y_t = vector

X_t = variables

β and α = coefficients

α and x = constant

n = optimal number of lags

ε and v = are vectors of the error terms

To describe volatility clustering phenomenon, which is occurring in financial time series, the autoregressive conditional heteroscedasticity ARCH model (Engle, Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation, 1982) is being used to conclude dynamic conditional correlation. The dynamic conditional correlation DCC-GARCH model proposed by (Engle, Dynamic Conditional Correlation A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models, 2002) was used to study the dynamic correlation between the stock markets and crude oil. It has two steps: first use GARCH model to estimate the conditional variance, afterwards use the results from the first step to estimate conditional correlation. Model is following:

$$y_t = Cx_t + \varepsilon_t$$

$$\varepsilon_t = H_t^{\frac{1}{2}} v_t$$

$$\mathrm{H}_t = D_t^{\frac{1}{2}} R_t D_t^{\frac{1}{2}}$$

$$R_t = diag(Q_t)^{-\frac{1}{2}} Q_t diag(Q_t)^{-\frac{1}{2}}$$

$$Q_t = (1 - \lambda_1 - \lambda_2)R + \lambda_1 \widetilde{\epsilon_t} - 1\ \widetilde{\epsilon_{t-1}}' + \lambda_2 Q_{t-1}$$

(3)

where:

Y_t = is an m × 1 vector of dependent variables

C is an m × k matrix of parameters.

X_t is a k × 1 vector of independent variables, which may contain lags of y_t

$H_t^{\frac{1}{2}}$ = is the Cholesky factor of the time varying conditional covariance matrix H_t

V_t = is an m × 1 vector of normal, independent, and identically distributed innovations

D_t = is a diagonal matrix of conditional variances

For that purpose, we also set the following hypothesis:
(H0): there is no dynamic correlation between variables
(H1): there is dynamic correlation between variables

After obtaining DCC-GARCH, the significance of DCCα and DCCβ implies that the estimators obtained by this model are dynamic and time-varying. DCCα measures the short-run volatility impact, which means that the persistency of the standardized residuals from the previous period and DCCβ measures the lingering effect of a shock impact on the conditional correlations, which is the persistence of the conditional correlation process. The sum of the DCCα and DCCβ are less than one, which indicates that the conditional correlations in the models are not constant over time.

3 Data collection

To inspect cause and effect relationship and dynamic conditional correlation we have to choose appropriate analysis and diagnostic tests. Methodology contains empirical estimation of the connection between crude oil and stock prices, for which we used prices of indexes S&P 500, MSCI world, MSCI emerging markets, Euro Stoxx 50, Shanghai Composite and MOEX. Data were collected on monthly basis from January 2011 till October 2020, and the main source of statistical data was one of the best global finance platforms Investing.com.

4 Research results

To undergo the testing procedure for time series data, it is necessary to test stationarity (Keong, 2014). For this purpose, we decided for an Augmented Dickey-Fuller test and Kwiatkowski–Phillips–Schmidt–Shin test. According to both tests all variables are stationary at 1st difference. To choose the optimal lag, we estimated VAR model and within this model we choose Akaike information criterion (AIC), which suggested 6 lags for our model.

4.1 Engle-Granger Causality Test

When we are looking into the long run cause and effect of commodities on indexes, we spotted more commodities to reject H0 hypothesis of causality. Table 1 presents results of Engle-Granger Causality test in case of crude oil cause on indexes. This table suggest that Crude oil prices are a reason that effects all indexes in long run. In all cases we could reject H0 hypothesis and accept alternative on 0.1% significance level. Calculation of indexes cause on crude oil price however shows no cause and effect between them.

Table 1 Engle-Granger Causality test commodities cause on indexes

commodity		**Indexes**					
		Eurostoxx 50	MOEX	MSCI emerging	MSCI world	Shanghai	SP 500
crude oil	**Prob.**	0.0033**	2.E-05**	5.E-06**	6.E-07**	0.0055**	5.E-05**

Source: own data processing. EViews 10

4.2 DCC GARCH model

To conclude DCC GARCH model, we needed to see if our data are characterized by a time-varying volatility. For that purpose, we conclude ARCH model which test heteroskedasticity of our data, according to which in crude oil, MOEX, MSCI emerging markets, MSCI world and SP 500, an ARCH effect was present at 5% level of significance. This means that we could conclude DCC GARCH Model on these variables.

Looking at the sum of the coefficients α+β in Table 2, our results show that volatility is highly persistent in case of crude oil/MSCI (0.9) world crude oil/SP 500 (0.91), given that this sum is very close to 1. From table 2, we can also interpret alpha and beta indicators. The significance of DCCα and DCCβ implies that the estimators obtained in the DCC-GRARCH are dynamic and time-varying. DCCα implies that there is short run volatility impact and DCCβ implies that there is long run volatility impact. Crude oil/Eurostoxx 50 P-value for DCCα is 0.17 which greater than 5% level of significance, which tells us that there is no short run spill over of volatility from crude oil to Eurostoxx 50. P-value for DCCβ is 0.99 which implies that there is no long run spill over of volatility from crude oil to Eurostoxx 50. Sum of estimates of DCCα and DCCβ is positive, and it is not greater than 1. Same applies on crude oil/MOEX where DCCα is

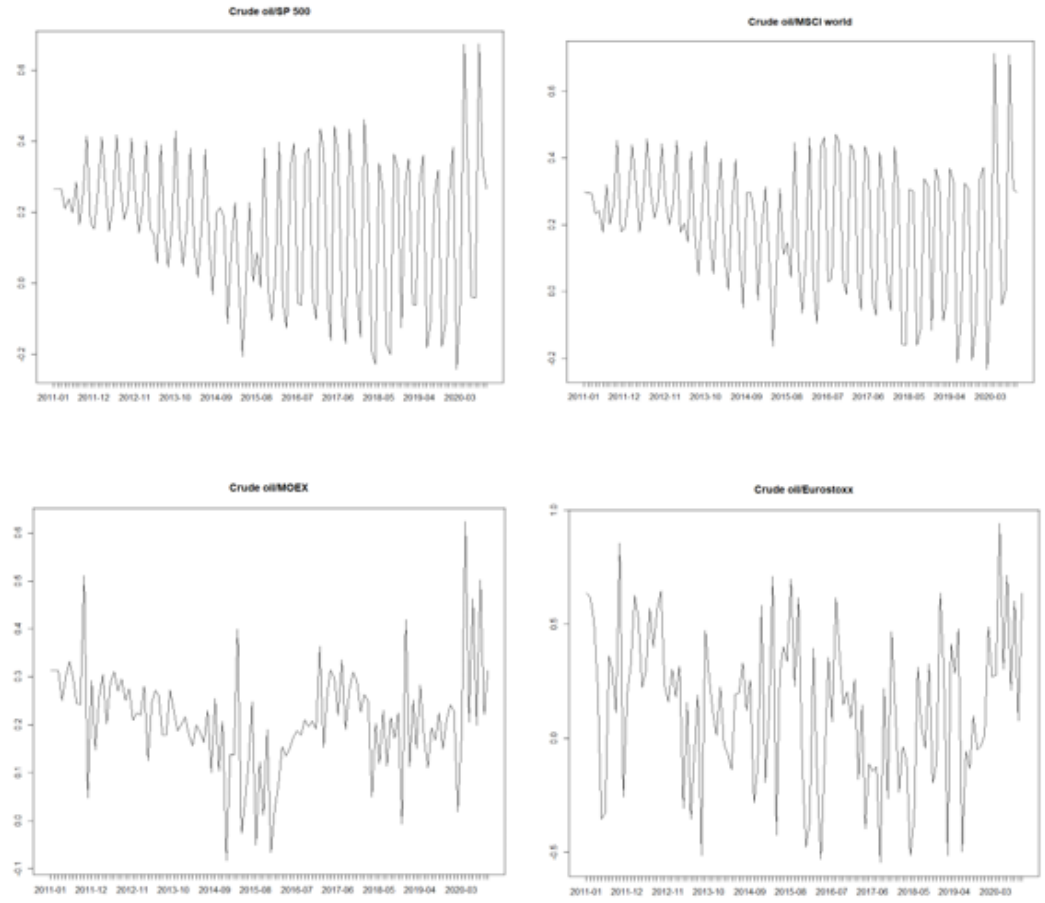
0.66 and DCCβ P-value is 0.99. Crude oil/MSCI world P-value for DCCα is however 0.000 which is less than 5% level of significance, which tells us that there is a short run spill over of volatility from Crude oil to MSCI world. P-value for DCCβ is 0.99 which implies that there is no long run spill over of volatility from Crude oil to MSCI world. Sum of estimates of DCCα and DCCβ is positive, and it is not greater than 1. Similar interpretation is also for crude oil/SP 500 where P-value for DCCα is 0.000 which greater than 5% level of significance and P-value for DCCβ is 0.99.

Table 1 Engle-Granger Causality test commodities cause on indexes

	Optimal parameters	**estimates**	**P-value**
crude oil/Eurostoxx 50	DCC α	0.123640	0.175445
	DCC β	0.000020	0.999984
	Sum α & β	0.123660	
crude oil/MOEX	DCC α	0.410825	0.665847
	DCC β	0.000000	0.999987
	Sum α & β	0.411000	
crude oil/MSCI world	DCC α	0.895041	0.000000**
	DCC β	0.000916	0.999269
	Sum α & β	0.895957	
crude oil/SP 500	DCC α	0.910246	0.000000**
	DCC β	0.000000	0.997472
	Sum α & β	0.910000	

Source: own data processing. RStudio Pro

Figure 1 DCC between crude oil and indexes



Source: own data processing. RStudio Pro

Recommendations and suggestions

Based on the results of our research, we would like to recommend a few suggestions which are demonstrated below:

- Investors can use this study findings in decision making whether to invest in crude oil or indexes and in which particularly. Because there is cause and effect relationship of crude oil on all indexes, and not vice versa, we can conclude that, if investor will decide to invest into the crude oil, and price of some index will fall, it won't affect the price of crude oil. However, in case when investor will decide to invest into the indexes, any price change in crude oil, will affect the price of indexes. Because the correlation was spotted in between crude oil and MOEX, MSCI world, SP500 and Eurostoxx, we can be sure that these four indexes are influenced by oil price the most. Investor can take our results into the consideration when deciding in what portfolio he will decide to invest.

- Cause and effect relationship on indexes was spotted in crude oil which gives investors a message that they share a common long run trend, so they should be aware before investing about this relationship.

- Crude oil is the type of commodity, which is highly linked and corelated with indexes, as indexes prices rise, correlation between indexes and crude oil is increasing. In short run, the biggest linkage we can see is in case of MOEX, Eurostoxx50, MSCI world and SP500. Lowest it is in case of MOEX but still quite volatile, which gives investors the message that it is not recommended to use crude oil for diversification of investors' portfolio. For a risk seeker type of investors, it doesn't matter if they invest into oil or indexes, because both of them move in same direction.

5 Conclusions

Economic theory explains possible connection of commodity and financial markets. It states that inflation is the main indicator, which connects these two markets. According to this economic theory, commodity prices have positive relationship with interest rates and high inflation and interest rates and high inflation has negative relationship with bonds or shares. There are many studies proving that stock prices and commodity prices interact between each other. There is historical evidence that a change in commodity prices have significant impact on economic and financial development, so we expected that the correlation between these two should be quite strong. Both, the stationary testing and lag length served as base for causality testing, by which we were trying to find out if there is between crude oil and indexes long run cause and effect. Crude oil has long run cause and effect on all indexes, cotton on Eurostoxx 50, MOEX, MSCI emerging, MSCI world and SP 500, Therefore, it can be said that these index prices and crude oil prices do have a link that can be addressed or considered in order to get the most benefit out of it. Last analysis which we concluded in our thesis was aimed to find dynamic conditional correlation between indexes and commodities. For this purpose, we tested heteroskedasticity of our data, according to which in crude oil, MOEX, MSCI emerging markets, MSCI world and SP 500, an ARCH effect was being present. That is the reason why we analysed dynamic conditional correlation just on these variables. Results shows that dynamic conditional correlation was presented in between crude oil and MSCI world, crude oil and SP500. In case of crude oil and MSCI world we found short run spill over of volatility from crude oil to MSCI world and short run spill over of volatility from crude oil to SP 500. The correlation between the commodities and indexes, where ARCH effect was presented, was estimated with the DCC. Dynamic correlation of the price returns between commodities and indexes from January 2011 till October 2020 was illustrated. We were able to see, that in SP 500 and MSCI world shares many similarities in volatility with crude oil. In each DCC is visualised obvious decline from beginning of 2020 when Covid-19 crisis began. In almost all cases, sharp rise was presented after crisis from 2009, which is visible in mid of 2011 except in figure of crude oil/SP500 and crude oil/MSCI world. Crude oil also, as shown in our results, is highly correlated with indexes, as indexes prices rise, correlation between indexes and crude oil is increasing. In times of crisis as it is on the beginning of 2020, correlation between indexes and crude oil is negative and tent to decrease.

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References

Al-Ameer, M., & et al. (2018). The Relationship of Gold Price with the Stock Market: The Case of Frankfurt Stock Exchange. *International Journal of Energy Economics and Policy, 8*(5), 357-371.

Ali, S., & et al. (2020). Revisiting the valuable roles of commodities for international stock markets. *Resources Policy, 66*. doi:10.1016/j.resourpol.2020.101603

Chorafas, D. N. (2005). *The Management of Bond Investments and Trading of Debt.* doi:10.1016/B978-0-7506-6726-5.X5001-0

Domanski, D., & Health, A. (2007, March). Financial investors and commodity markets. *BIS Quarterly Review*.

Engle, R. (1982, July). Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica, 50*(4), 987-1007. doi:10.2307/1912773

Engle, R. (2002, July). Dynamic Conditional Correlation A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models. *Journal of Business & Economic Statistics, 20*(3), 339-350. doi:10.1198/073500102288618487

Hussin, M. Y., & et al. (2013). The Dynamic Interaction between Islamic Stock Market and Strategic Commodities. *Journal of Islamic Economics, Banking and Finance, 9*(3), 53-68. doi:10.12816/0001611

Keong, M. C. (2014). *Relationship between Commodities Market and Stock Market: Evidence from Malaysia and China.* Faculty of Business and Finance.

Khan, A., & Masih, M. (2014). Correlation between Islamic stock and Commodity markets: An investigation into the impact of financial crisis and financialization of commodity markets. *MPRA Paper - 56979*.

Mohamed, A., & Rault, C. (2010). Causal relationships between oil and stock prices: Some new evidence from gulf oil-exporting countries. *International Economics, 122*, 41–56. doi:10.1016/S2110-7017(13)60029-3

Murphy, J. J. (2015). *Trading with Intermarket Analysis: A Visual Approach to Beating the Financial Markets Using Exchange-Traded Funds (Wiley Trading)* (Vol. 1st edition). Wiley.

Musawa, N. (2017). The Effect of Commodity Prices on Stock Market Performance in Zambia. *American Journal of Economics*, 259-262. doi:10.5923/j.economics.20170705.07

Mustafa, I., & Erhan, I. (2016). The Interaction between stock prices and commodity prices: East Europe and Central Asia Countries. *International Journal of Economics and Finance Studies, 8*(2), 94-106.

Nicolau, M. (2010). Financial Markets Interaction between Economic Theory and Practice. *The Annals of Dunărea de Jos University Fascicle I. Economics and Applied Informatics*, 16(2), 27-36.

Nirmala, S. (2018, May). Relationship Between Commodity And Equity Markets: Evidence From India. *International Journal for Research in Engineering Application & Management, 4*(5), 595-599. doi:10.18231/2454-9150.2018.0271

Qiao, Y. (2015). Dynamic correlation between selected world major stock markets and commodity markets. *Dissertation thesis*. doi:doi.org/10.24124/2015/bpgub1015

Rehman, U. M., & Vo, V. X. (2021). Energy commodities, precious metals and industrial metal markets: A nexus across different investment horizons and market conditions. *Resources Policy,*70. doi:10.1016/j.resourpol.2020.101843.

Sardana, S. (2019, April 11). *The relationship between commodities and traditional assets*. Retrieved from FT ADVISER: https://www.ftadviser.com/investments/2019/04/11/the-relationship-between-commodities-and-traditional-assets/

Tarek, C., & Derbali, A. (2016). A Dynamic Conditional Correlation between Commodities and the Islamic Stock Market. *Journal of Energy Markets, 9*(1), 65-90. doi:10.21314/JEM.2016.137

Xu, S., & et al. (2020). Can Crude Oil Serve as a Hedging Asset for Underlying Securities?—Research on the Heterogenous Correlation between Crude Oil and Stock Index. *Energies, 13*(12: 3139). doi:10.3390/en13123139

Australia- UK Free Trade Agreement:

A Commentary

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Abstract: Australia, like many other nations, has been pursuing Free Trade Agreements (FTAs) as a result of the staled WTO negotiations, post-Doha Australia currently has fifteen active FTAs, with another seven under negotiations, including the Australia-UK FTA – the focus of this paper. Following Brexit, the UK has been very keen to demonstrate to the rest of the world that, once the 'shackles and burdens' of the EU were removed, it could forge ahead as 'Global Britain', making its presence in the world predominant once again. This appears to be a nostalgic appeal to the old days of the bygone empire, one that no longer exists. Despite some set-backs, it seems that Australia and the UK will enter into an FTA in the near future, once the advanced-stage negotiations have been completed. This will be the UK's first, and so far, the only post Brexit FTA. Given the considerable historical, legal, political and cultural ties between Australia and the UK an FTA between these nations was probably always going to be a comparatively easy accomplishment. Whilst the overall ties are no doubt important, the Australia-UK economic activity is far less important now than it has been since the days of early colonization. Australia is economically tied to Asia, with only a relatively small proportion of economic activity remaining with the UK. The composition of exports from Australia to the UK matches the comparative advantage theory as both nations have little, if any, overlap in goods they export/import to each other. This paper provides a background to the Australia-UK economic ties with a commentary on the likely impact the Australia-UK may have from the Australian perspective, highlighting areas of concern and making suggestions for improving the negotiations towards a final outcome.

Keywords: colonialism, free trade agreements, export markets, import tariffs, people movement.
JEL Classification: F19, F54, F69

1 Introduction

This qualitative paper considers the benefits and challenges of the proposed Australia-UK Free Trade Agreement (AuUKFTA) from an Australian perspective, providing a commentary on the economic significance of AuUKFTA mainly in the trade in goods, but also briefly on FDI.

The paper firstly provides a brief historical perspective on Australia's current 'colonial' status, following which the cultures of each nation are considered. Next, the composition of Australia's exports to the UK and imports from the UK are provided, highlighting the current relatively low economic ties between these nations. This is followed by a commentary on selected topics from the proposed AuUKFTA before reaching the conclusion.

Australia's 'colonial' status

It is important to understand Australia's current "independent" status as a nation, in order to fully comprehend the ties that bind it with the UK, as this will provide greater insight into the development of the AuUKFTA being negotiated between these two countries.

Australia was not discovered by the British, indeed other Europeans had visited this island continent well before the arrival of the British. In 1606, "the Dutch explorer Willem Janszoon landed on the western side of Cape York Peninsula" (National Library of Australia, 2021) and further exploration in 1642 led to an island south of the continent they named Van Diemen's Land (now Tasmania) in honour of "Anthony van Diemen, governor general of the Dutch East Indies" (Wallenfeldt, 2021). However, there was no desire to conquer or colonise the land because it was too far and of not enough interest. This changed after Captain Cook's Endeavour landed "at Botany Bay on 29 April 1770" (Office for the Arts Department of Infrastructure Transport Regional Development and Communications, 2020). Following Captain

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Cook's visit and reports, eventually "the British colony of New South Wales was established in 1788 as a penal colony" (Parliament of New South Wales, 2021). Other settlements gradually formed in Australia, and subsequently, States and Territories were established and in 1901 Australia became a federated nation by virtue of a new constitution.

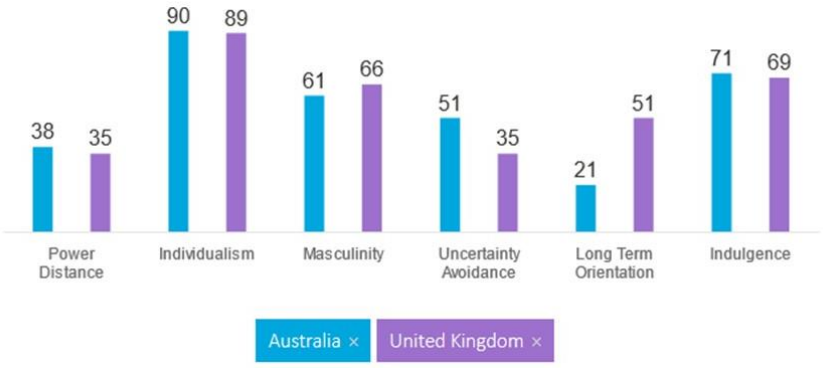
To this day, Australia cannot be regarded as a truly independent nation because of two essential factors. The first is that Australia is a federated constitutional monarchy, with the Governor-General, as the Queen's representative, continuing to play a major role in governance matters at the federal level, although not involved in the day-today running of the nation. The importance of this vice-regal role was witnessed in 1975, with the removal of the then Prime Minister Gough Whitlam by Sir John Kerr, the then Governor-General. Australia remains under British influence/control from a governance viewpoint, yet, to put this into perspective, the intervention of the Governor-General has only occurred once since 1901, the point is, it may occur again.

The second factor is that Australia cannot be considered to be post-colonial, because how the indigenous people – the Aborigines – were treated and are still discriminated against. "As many as one in three Aboriginal and Torres Strait Islander children were taken from their families and communities between 1910 and the 1970s, under racist government policies that tried to force Aboriginal people to assimilate with white Australians" (Nogrady, 2019, p. 423), in what was coined by the Human Rights and Equal Opportunity Commission as the 'Stolen Generations' period. Although children are now no longer forcibly removed from their families, there is a general awareness that Aborigines are discriminated against in the wider community. At best, Australia sits somewhere between **pericolonialism**, that "acknowledges the thorough pervading nature of settler colonialism and marks it as something that, for indigenes, must be gotten around, under, or through" (Weaver, Womack, & Warrior, 2006, p. 39) and **paracolonialism**, that "refers to classic conquest with active settler colonialism" (Acabado, 2017, p. 3). For the above reasons, we argue that Australia cannot yet be considered post-colonial, and will not be able to do so until it is mature enough to forge its own independence as a fully independent republic, such as those of other ex-British colonies, such as India. Until this change materialises, Australia will retain some form of 'umbilical cord' to the UK – an important consideration in the context of economic and other ties.

Australia and UK – a cultural comparison

A comparison of the Australian and UK cultures is shown at Figure 1 where, as expected, a high level of similarities is evident. Indeed, the relationship between these two nations has been summed up by Australia as "the United Kingdom is one of our most like-minded partners in the world" (Department of Foreign Affairs and Trade, 2021a).

Figure 1 Australia and UK cultural comparison



Source: (Hofstede Insights, 2021)

From the six cultural dimensions shown in Figure 1, only uncertainty avoidance and long-term orientation indicate somewhat significant differences. In terms of uncertainty avoidance, the British are more comfortable with ambiguous situations, and in the work environment they tend to have fluid processes and are flexible to changing landscapes, whereas the Australian culture is comparatively less comfortable on these aspects. In long term orientation, Australia scores quite low, and this translates into respect for tradition, a poorly developed 'save for the future' attitude, and a focus on achieving quick results, with not enough thought given to the longer-term aspects of activities. By comparison, the British have a greater long-term orientation, although it does not have a particularly high score. The similarities between the two cultures and their historical development have more than likely resulted in a much easier negotiation process than may otherwise have been the case. Testament to this is that the UK could not begin independent free trade agreement negotiations until the completion of Brexit, and in less than two years since then, it has managed to reach advanced negotiation stage with Australia. This may well be described as 'warp speed' in the Australian context, as other relationships have certainly not proceeded at such a fast pace. For example, discussions with India have been ongoing since 2011, with no immediate result expected in the near future.

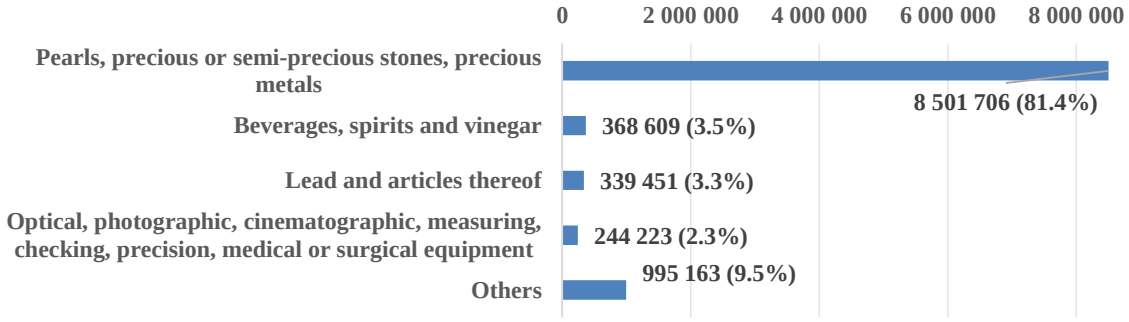
Beyond cultural ties, other links exist between Australia and the UK on a world scale, and although not directly related to the FTA in question, these may nevertheless have been catalysts to expedient negotiations. Historically, as a colony, Australia assisted the UK's war efforts in both World War I and World War II. Both nations are part of the 75 year old Five Eyes security agreement, originally "forged under the pressure of the Second World War" (Nicholson, 2019), that Australia joined in 1956. According to Nicholson (2019) "the Five Eyes only exists because of the close bonds – strategic, material, and cultural – between Western Anglosphere relations". Finally, another consideration for Australia seeking other free trade agreements (FTA) is its need to economically decouple from China, its current major trading partner, because there is an unhealthy economic interdependence that is already witnessing wolf warrior diplomacy in selected industries, despite the existence of an FTA (Bergami, Gontmakher, & Tichá, 2020).

It is important to consider Australia's exports and imports as well as Foreign Direct Investment (FID), in order to provide relevant background to the issues relevant to this paper.

According to 2020 data from the International Trade Centre (2021a, 2021b), by value, Australia ranks as the world's 21st largest export nation, and the 24th largest import nation, whereas the UK ranks 11th in exports and 5th in imports. Historically, as a result of white colonisation, Australia's trade has been linked to the UK, and it was not until about 40 years ago that Australia shifted its trade focus towards the geographically more proximal Asia.

The composition of Australia's exports to the UK for 2020 is shown at Figure 2. Precious metals (gold) and stones dominate the composition of exports to the UK with this category accounting for approximately 81.4% of the total value. Other categories of products are of little value, accounting for less than 4% each. The composition of exports to the UK reflects the reliance Australia continues to have on primary resources.

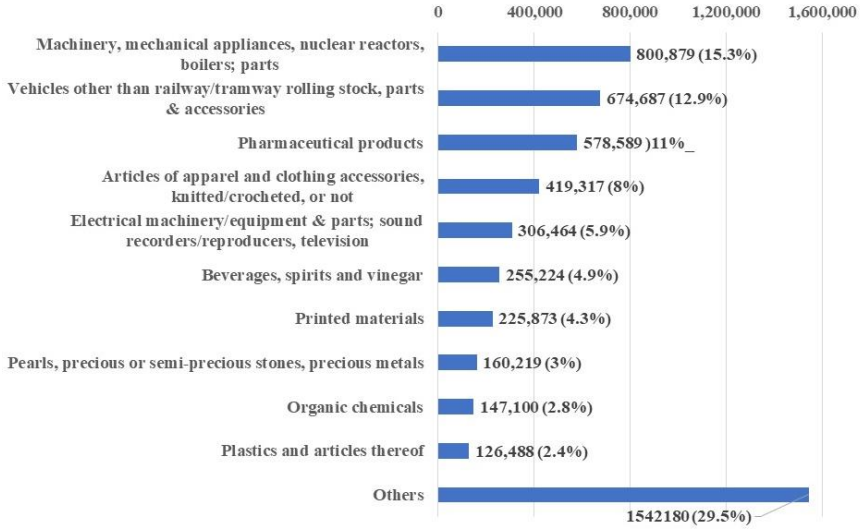
Figure 2 Australia's exports to the UK 2020 (USD Thousand)



Source: International Trade Centre (2021a) and own elaboration

In terms of imports from the UK, there is a much more diversified product portfolio, as shown in Figure 3.

Figure 3 UK's exports to Australia 2020 (USD Thousand)



Source: International Trade Centre (2021b) and own elaboration

Comparison of the data from Figures 2 and 3 reveals almost no crossover of products, with the exception of the beverages category, that shows two-way trade, although this is very modest, at less than 5% and precious stones and metals that, for Australia is the major exports, whereas for the UK it represents only 3%. The current pattern of trade

between Australia and the UK appears to reflect David Ricardo's theory of comparative advantage as each nation is providing the other what they are best at producing. Furthermore, the Hecksher-Ohlin (H-O) theory of trade patterns predicts that nations have a propensity to export products that use their abundant factors intensively. As examples, in the case of Australia, its manufacturing base is small, and has been shrinking over the past four decades, with little or no activity in sectors such as household electric (refrigerators, washing machines, air conditioners) and electronic consumer goods (televisions, computers, mobile telephones). Conversely, Australia has a dominant position in the world stage for mineral resources, and in particular gold - the bulk of the product exported to the UK in the precious metals category. In fact, Australia is the world's second largest producer of gold and is estimated to hold the world's largest reserves at 17% of global supply (Department of Mines Industry Regulations and Safety, 2018).

Trade statistics only provide part of the overall economic picture, with FDI being another important aspect. The UK is the second largest FDI partner, accounting for 18.5% (AUD 737. billion) of the 2020 total (Department of Foreign Affairs and Trade, 2020b). Australian FDI ranks the UK as the second investment destination, accounting for 20.2% (AUD 615.2 billion) of the 2020 total (Department of Foreign Affairs and Trade, 2020a). The majority of inward FDI in Australia is in the mining and quarrying sector, accounting for just over 35% of its total (Department of Foreign Affairs and Trade, 2020b). Significantly, the UK is estimated to own 27% of mining activity in Australia (Aulby, 2017).

Having provided some background to Australia's economic position in terms of trade and FDI, the next section provides a brief literature review on aspects of the AuUKFTA.

Literature review

As FTA that has not yet concluded, there is a dearth of information available in the public domain, making a formal literature review impossible. Virtually all of the reporting to date has been either via relevant government websites extolling the benefits of the AuUKFTA (Department for International Trade, 2021a; Department of Foreign Affairs and Trade, 2021b), or though reporting via the media (Murphy, 2021; Scott, 2021; van Leeuwen & Coorey, 2021), providing summary briefs with little analysis. There has been little focus given to identifying issues of concern in this agreement, and this paper provides some recommendations for improving the current status quo in the discussion section that follows the methodology.

2 Methods

This paper focuses on current developments and analysis of historical data to determine the level of economic, cultural and strategic links between Australia and the UK and the management of an FTA that incorporates aspects of politics, strategy and security. Suggestions for changes in the final draft of the FTA are based on recent events.

3 Discussion

It is important to remember that "the term 'free trade agreement' is, in fact, a misnomer" (Athukorala, 2020, p. 14). This is because FTAs are not 'free trade' in the ordinary meaning of the words. An FTA is an agreement between two or more nations typically allowing for tariff decline on imports and other non-tariff barriers reductions. Tariff reductions vary greatly between agreements, and may exclude some industries/specific products, or phase out tariffs over time, but not necessarily to zero. Indeed, in AuUKFTA, some concessions given to Australia are not immediate, as outlined below.

Beef. Tariff Rate Quota (TRQ) will have a duty-free yearly quota of 35,000 tonnes on entry into force (EIF). This will rise in equal instalments until year 10, when it will reach 100,000 tonnes, with out of quota tariffs remaining at MFN levels, until their elimination at the end of year 10. During years 11 and 15 the volume threshold will rise equally to 170,000 yearly tonnes, but with a proviso for a safeguard duty of 20% for the remainder of the year, once quota thresholds have been reached. Current MFN rate for UK imports of beef from Australia range from 12% + between GPB 147 and 254/100 kg, depending on the type of meat (Wright, 2020). The proposed agreement would have a significant beneficial effect on Australian export pricing.

Sheepmeat. TRQ volumes will have a duty-free yearly quota of 25,000 tonnes on entry into force (EIF). This will rise in equal instalments until year 10, when it will reach 75,000 tonnes, with out of quota tariffs remaining at MFN levels, until their elimination at the end of year 10. During years 11 and 15 the volume threshold will rise equally to 125,000 yearly tonnes, but with a proviso for a safeguard duty of 20% for the remainder of the year, once quota thresholds have been reached. Current MFN rate for UK imports of sheepmeat from Australia range from 12% + between GPB 140 and 260/100 kg, depending of the type of meat (Wright, 2020). The proposed agreement would have a significant beneficial effect on Australian export pricing.

Sugar. There will be a duty-free quota of 80,000 tonnes per year on EIF, rising to 220,00 tonnes by year 8. Tariffs will be progressively equally over 8 years.

The ability to obtain preferential tariffs is no doubt beneficial, but even with these concessions, the overall impact of AuUKFTA is likely to be minimal, not the great deal announced by both nations' Prime Ministers. In fact, UK Policy Observatory modelling "highlighted the limited economic impact of the agreement, with an increase in output for the UK of 0.07% and for Australia an increase of 0.16%" (Davies, 2021), estimating "the UK may see an increase in exports of 0.35%, while Australia's exports are simulated to increase by 2.2%" (Gasiorek & Larbalestier, 2021). Given that Australia's exports are already at a low base, these estimates point to the AuUKFTA being more of a political manoeuvre than a real economic gain initiative. Indeed as the UK Prime Minister said "it's more important politically and symbolically" (van Leeuwen & Coorey, 2021).

Apart from tariffs, a fundamental requirement of any FTA is the question of product origin determination, as preferential treatment is only afforded to the partner nations' products. In the case of the AuUKFTA, the details of product specific rules (PSR) have not been yet finalised. However, in-principle, PSR are to "respect UK sensitivities in agricultural sectors such as fisheries and dairy, and do not include Regional Value Content (RVC) rules for agricultural goods. PSRs which enable UK automotive exports, including an RVC of 25% for cars" (Department for International Trade, 2021b). RVC is typically used in regional (multi-party) FTAs, where a broader interpretation of origin is applied. With RVC the requirement that a product should have a minimum percentage of domestic content from the FTA partner to qualify for preferential treatment is replaced with a wider origin application, allowing for the accumulation of content across a number of partners (the region) – in this case, the UK, crown dependencies and its overseas territories. The UK has a significant motor vehicle industry and it is in its favour to have a lower origin threshold to reap the maximum benefits of the agreement. Australia would have had no objection to this clause as it no longer has domestic car manufacture. In terms of the administration of tariff preference, decision has not yet been reached as to whether origin certification will need to be at government level, via the provision of official certificates of origin issued by Chambers of Commerce, or whether self-certification - a much easier, cheaper and faster, but less secure form of verification - will be acceptable to the respective customs authorities. We recommend self-certification, as it is already in place in a number of Australian FTAs because it has proven to be low risk and a more expeditious option in customs clearance matters.

Although the in-principle text of the agreement makes reference to climate change and the Paris Agreement, there are no specific climate change targets, as Australia would not agree to these (Scott, 2021). This could be an embarrassing point for the UK, as it holds itself out to be a leader in combating climate change. Given the UK will host the COP26 in Glasgow later in 2021, it seems strange capitulation could occur so easily, especially as on 20 September at the UN General Assembly Climate Roundtable, Boris Johnson (2021) stated "in the years to come, the only great powers will be green powers". Australia has significant problems in dealing with the climate change issue. There is no national energy policy and continuous changes to other policies on renewables and research into lessening the impact of climate change have seen a number of projects de-funded. There is little doubt that successive right-wing governments have failed to produce any cohesive national policy on emission targets. Australia is seen by many on the world stage as essentially being recalcitrant on emission targets, as this does not appear to be a main focus of the current right-wing government. We recommend that Australia should reconsider its position on climate change and take steps to neutralize the mining sector lobby influence – an industry that "is 86% foreign owned and has spent over $541 million in the last ten years on lobbying Australian governments through its peak lobby groups, which are dominated by foreign interests" (Aulby, 2017). Despite the importance of the mining sector to the economy, it is generally accepted that the impact of emissions on climate change will far outweigh any economic benefit in the long run. Perhaps Australia's current position can be better understood through its cultural lens that has a short-term orientation, but this does not assist in overcoming a long-term problem.

Finally, FDI conditions in the AuUKFTA appear to have been considerably diluted. As "higher investment screening thresholds for UK investors in Australia, meaning fewer UK investments are subject to review by the Foreign Investment Review Board"(Department for International Trade, 2021b). Due to lack of details about the thresholds, it is difficult to comment, but this issue raises concerns, as there is no demonstrated need to alter current FDI conditions in general. Diluting scrutiny may not be in the best national interest, an issue the Australian government has certainly used in defending some of its past decisions. We argue for no dilution in the current FDI conditions, for it may set a dangerous precedent with other nations, and limit government intervention is stopping undesirable FDI opportunities.

4 Conclusions

This paper has provided a commentary on the proposed AuUKFTA that, whilst agreed to in-principle, lacks much detail on which to provide further analysis. There are opportunities for Australia to get better long-term access to UK market sectors, such as meat and sugar, and for the UK to have reduced RCV for its automotive sector. We contend that origin self-certification on exports should be adopted as a trade facilitation measure. Reduced scrutiny on FDI remains a question

mark due to lack of details. On climate change, there is considerable concern and a paradoxical approach by the UK that, on the one hand champions its leadership role to the world, whist concurrently agreeing to an FTA that strips away any commitments towards the Paris Agreement - a particular concern with a recalcitrant Australia. We argue emission targets should form part of AuUKFTA. To do otherwise may make it more difficult for Australia to forge other FTAs with, for example the EU. Ultimately, the AuUKFTA is more bluster than substance, as its economic impact is expected to be minimal, and probably one of the most insignificant FTAs Australia has entered into thus far.

There is scope for further research into the practical impacts of the AuUKFTA on the trade in goods and other matters covered by it, once more details about its final clauses are released to the public.

References

Acabado, S. (2017). The archaeology of pericolonialism: Responses of the "unconquered" to Spanish conquest and colonialism in Ifugao, Philippines. *International Journal of Historical Archaeology, 21*, 1-26.

Athukorala, P. (2020). Free Trade Agreements in the World Trade System: Substance and Semantics. *Foreign Trade Review, 55*(1), 13-20.

Aulby, H. (2017). *Undermining our democracy: Foreign corporate influence through the Australian mining lobby*. Retrieved from Canberra, ACT, Australia:

Bergami, R., Gontmakher, A., & Tichá, L. (2020, 5-6 November). *Australia's need for economic decoupling from China.* Paper presented at the 14th International Scientific Conference INPROFORUM: Business Cycles – more than Economic Phenomena, České Budějovice, Czech Republic.

Davies, R. (2021). The UK-Australia trade agreement: what do we know so far? 9 July. Retrieved from https://research.senedd.wales/research-articles/the-uk-australia-trade-agreement-what-do-we-know-so-far/

Department for International Trade. (2021a, 15 June). UK-Australia Free Trade Agreement. Retrieved from https://www.gov.uk/government/collections/uk-australia-free-trade-agreement

Department for International Trade. (2021b, 17 June). UK-Australia FTA negotiations: agreement in principle. Retrieved from https://www.gov.uk/government/publications/uk-australia-free-trade-agreement-negotiations-agreement-in-principle/uk-australia-fta-negotiations-agreement-in-principle

Department of Foreign Affairs and Trade. (2020a). Statistics on where Australia invests. *Foreign Investment Statistics.* Retrieved from https://www.dfat.gov.au/trade/resources/investment-statistics/statistics-on-where-australia-invests

Department of Foreign Affairs and Trade. (2020b). Who Invests in Australia? *Foreign Investment Statistics.* Retrieved from https://www.dfat.gov.au/trade/resources/investment-statistics/Pages/statistics-on-who-invests-in-australia

Department of Foreign Affairs and Trade. (2021a). United Kingdom country brief. Retrieved from https://www.dfat.gov.au/geo/united-kingdom/Pages/united-kingdom-country-brief

Department of Foreign Affairs and Trade. (2021b). Why is the Australian Government pursuing a Free Trade Agreement (FTA) with the United Kingdom? . Retrieved from https://www.dfat.gov.au/sites/default/files/australia-uk-fta-benefits-fact-sheet.pdf

Department of Mines Industry Regulations and Safety. (2018, 21 February). Gold. Retrieved from https://www.dmp.wa.gov.au/Investors/Gold-1480.aspx

Gasiorek, M., & Larbalestier, G. (2021, 16 June). UK-Australia FTA – Elbow bumps and all. Retrieved from https://blogs.sussex.ac.uk/uktpo/2021/06/16/uk-australia-fta-elbow-bumps-and-all/#more-6039

Hofstede Insights. (2021). Country Comparison. Retrieved from https://www.hofstede-insights.com/country-comparison/australia,the-uk/

International Trade Centre. (2021a). Trade Map - International Trade Statistics Exports. Retrieved from https://www.trademap.org/Country_SelProduct_TS.aspx?nvpm=1%7c%7c%7c%7c%7cTOTAL%7c%7c%7c2%7c1%7c1%7c2%7c2%7c1%7c2%7c1%7c1%7c1

International Trade Centre. (2021b). Trade Map - International Trade Statistics Imports. Retrieved from https://www.trademap.org/Country_SelProduct_TS.aspx?nvpm=1%7c%7c%7c%7c%7cTOTAL%7c%7c%7c2%7c1%7c1%7c1%7c2%7c1%7c2%7c1%7c1%7c1

Johnson, B. (2021, 20 September). PM's remarks to UN climate roundtable: 20 September 2021. Retrieved from https://www.gov.uk/government/speeches/pms-remarks-to-un-climate-roundtable-20-september-2021

Murphy, K. (2021). Scott Morrison has agreed in-principle to a UK free trade deal. What's in it for Australia? *The Guardian*. Retrieved from https://www.theguardian.com/australia-news/2021/jun/16/scott-morrison-has-agreed-in-principle-to-a-uk-free-trade-deal-whats-in-it-for-australia

National Library of Australia. (2021). Who was the first European to land on Australia? Retrieved from https://www.nla.gov.au/faq/who-was-the-first-european-to-land-on-australia

Nicholson, A. (2019). Suspicion creeps into the Five Eyes. *The Interpreter*. Retrieved from https://www.lowyinstitute.org/the-interpreter/suspicion-creeps-five-eyes

Nogrady, B. (2019). Historical separations still affect Indigenous children. *Nature, 570*, 423-424.

Office for the Arts Department of Infrastructure Transport Regional Development and Communications. (2020). 250th anniversary of Captain Cook's voyage to Australia. Retrieved from https://www.arts.gov.au/what-we-do/cultural-heritage/250th-anniversary-captain-cooks-voyage-australia

Parliament of New South Wales. (2021). 1788 to 1810 - Early European Settlement. Retrieved from https://www.parliament.nsw.gov.au/about/Pages/1788-to-1810-Early-European-Settlement.aspx

Scott, G. (2021). Climate targets dropped from Britain-Australia free trade agreement. *The New Daily*. Retrieved from https://thenewdaily.com.au/news/2021/09/08/climate-commitments-uk-australia-free-trade/

van Leeuwen, H., & Coorey, P. (2021). Farm, visa deals wins FTA. *The Australian Financial Review*. Retrieved from https://www.afr.com/world/europe/gold-standard-uk-australia-trade-deal-clinched-after-compromises-20210615-p58110

Wallenfeldt, J. (2021, 15 July 2021). Van Diemen's Land. Retrieved from https://www.britannica.com/place/Van-Diemens-Land

Weaver, J., Womack, C. S., & Warrior, R. (2006). *American Indian Literary Nationalism*. Albuquerque, New Mexico: University of New Mexico Press.

Wright, R. (2020, 21 May). UK beef and lamb import tariffs to remain high post-Brexit. Retrieved from https://ahdb.org.uk/news/uk-beef-and-lamb-import-tariffs-to-remain-high-post-brexit

The Relationship between Innovation Leadership and Employee Performance

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Abstract: Innovation leadership plays an essential role in the organization's success through team and employee performance. Most companies seek to build success in their organizations with new ideas and solutions. Organizations that best practice recommendations for managers to become innovation leaders will cultivate company and employee performance outcomes. This study reviews outstanding journal articles and other relevant publications obtained from Scopus and Web of Science databases. The literature review guides further studies about innovation leadership and employee performance, especially in the aviation industry. We conduct this review using keywords innovation leadership, team innovation, and employee performance.

Keywords: Innovation leadership, Team innovation, and Employee performance
JEL Classification: G32, G33, C35

1 Introduction

Innovation plays a vital role in organizational achievement as we understand that innovation is not a new phenomenon. Arguably, it is as old as humanity itself. However, in spite of its obvious importance, innovation has not always got the scholarly attention it deserves. This is now rapidly changing. However, research on the role of innovation economic and social change has proliferated in recent years, particularly within the social sciences, and often with a bent towards cross-disciplinarily (Fagerberg, 2004).

Innovation leadership also owns a critical role in organizational success. According to (Gliddon & Rothwell, 2018), innovation is considered an essential part of the modern economy for an organization's growth, cultural development, or survival. And importantly, it is also considered an important part of humanity. Some researchers defined innovation leadership as synthesizing different leadership styles to influence employees to produce creative ideas, products, services, and solutions. It is a practice and an approach to change management (Gliddon & Rothwell, 2018). Groups, teams, organizations, and governments can implement innovation leadership to support the development of innovations (Gliddon & Rothwell, 2018).

It is recognized that the 21st-century organizations are nothing less than a modern-day industrial revolution wherein innovation now plays a critical role in determining organizational success (W. F. Cascio & Aguinis, 2008; Wayne F. Cascio & Aguinis, 2018).

For many years, the aviation industry has been known as one of the industries that have introduced significant innovations in many different areas. These innovations include technological transformations, safety procedures, and economic deregulation, allowing connections worldwide to take place in hours rather than days, shrinking distances, and opening possibilities for mass tourism (Lohmann & Pereira, 2019). The challenges the aviation sector will be faced with will require the instigation of new provisions, notably in terms of advances supporting more sustainable displacement of travelers, and a reduction in carbon emissions and waste, while at the same time offering more personalized and comfortable services in a safer and more secure environment (International Air Traffic Association (IATA), 2018). When considering predictions for the coming decades, many concerns related to safety and security remain. New solutions likely include recent technological trends, new virtual reality solutions; augmented reality environments; green environmental solutions.

Leadership in aviation has attracted much attention from many different perspectives. The enormous success of the low-cost airlines has contributed to the aviation industry's incredible innovation leadership skills in facing enduring business risks.

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In addition, employee performance is always a vital issue for organizations and has received copious research attention (Campbell, 1990). It can be defined as achieving individual work goals and fulfilling expectations set by the organization (Audenaert et al., 2016). For example, (Mensah, 2015) defines performance as the positive contribution of an employee to the organization's success.

As stated by the authors Narcisse & Harcourt (2008, p. 1152), that employee's "performance appraisal encroaches upon 'one of the most emotionally charged activities in business life' – the assessment of a man's contribution and ability."

Employee performance is said to be of great importance to organizations. Indeed, performance represents the "bottom line" in most organizations that employ workers. So, team leaders play essential roles in the innovation team within the organization. We can declare that team leaders are critical elements of an innovation team who can create the innovation environment and sustain the innovation spirit through their organization from the top management to lower levels.

However, by reviewing researches on Scopus and Web of Science databases, we recognize that few empirical studies aim to investigate the relationship between innovation leadership, team innovation, and employee performance, especially in the aviation industry. Thus, this study aims to conduct a conceptual framework to propose further research by illustrating the relationship between innovation leadership, team innovation, and employee performance.

Innovation and innovation leadership

Today, innovation in an organization can develop breakthrough, new-to-the-world products or services that expand market opportunity and accelerate revenue growth for their organization as the author (Kaminski, 2011) has stated that the diffusion of innovation refers to the process that occurs as people adopt a new idea, product, practice, philosophy, and so on.

Lundvall (Lundvall, 2013) suggests that innovation as an interactive learning process should be the core of innovation study. In his words, "the closest we get to such a core in innovation studies is the conceptualization of innovation as an interactive process involving many actors and extending over time."

The authors (Kline & Rosenberg, 2010) define innovation as involving the creation and marketing of the new. These gauntlets, singly and in combination, make the outcome of innovation a highly uncertain process. Thus, an important and helpful way to consider the process of innovation is as an exercise in management.

It is said that the vital role in the practice of innovation leadership is the innovation leader. Within an organization, people develop creative ideas that can become innovations. Creativity is a common human inspiration, and innovation leaders can inspire their followers by encouraging creativity. An innovation leader collaboratively develops a new idea with creative employees and key stakeholders and makes it real (Gliddon & Rothwell, 2018).

According to Carmeli (Carmeli et al., 2010), the authors' definition of innovation leadership covering the encouragement of individual initiatives, clarification of individual responsibilities, provision of clear and complete performance evaluation feedback, a strong task orientation. Besides, they also discuss that through innovation leadership, organization's leaders can cultivate the type of climate and orientation which eventually create a better fit between the organization and its environment for the better employee and team performance.

In addition, the strategic leadership from some authors' literature forming the basis for the discussion that innovation leadership plays a crucial role in cultivating strategic fit. And the writers (Chassagnon & Haned, 2015) define innovation leadership as the dynamic capability of an innovative firm to seize innovation opportunities due to a proactive investment policy and enhanced innovativeness.

They are basing on these varying discussions and definitions of innovation and innovation leadership. We view the role between innovation and innovation leadership that can create and maintain the team in innovation where the innovation leader is the key to all success in their organization.

The employee performance

Employee performance comes from job performance or achieved by someone; it is also called the work quality and quantity obtained by an employee in carrying out their duties following his responsibility.

According to Narcisse & Harcourt (2008, p. 1152) stating that employee's "performance appraisal encroaches upon 'one of the most emotionally charged activities in business life' – the assessment of a man's contribution and ability." And (Boxall & Purcell, 2011) indicating that implementing a well-defined process for evaluating Employee Performance plays a crucial role in a firm's smooth running.

Besides, Uddin (Uddin et al., 2013) also argues that although environmental and cultural factors support and develop employee performance, employee-related elements connect environmental, cultural factors, and employee performance. Further research is needed for a better understanding of these relations.

As Brayfield & Crockett (Brayfield & Crockett, 1955) mention, we have located relevant discussions in the per-personnel and psychological literature. A common assumption predominates— employee attitudes bear a significant relationship to employee performance.

Employee performance is of great importance to organizations. Indeed, performance represents the "bottom line" in most organizations that employ workers. Expanding knowledge of factors linked to employee performance improvement is important and beneficial for organizations (Abd El Majid & Cohen, 2015).

Therefore, this study also mentions innovation leadership may affect followers' performance and makes them go above and beyond their roles by enhancing their level of engagement and achievement.

The link among Innovation leadership, Team innovation, and Employee Performance

To keep a strong bond among innovation leadership, team innovation, and employee performance, and innovation environment is proposed to encourage organizations to maintain their positive climate to achieve better successful and sustainable growth in the organization.

According to (Diamantidis & Chatzoglou, 2019), organization environment-related factors. Although many organizational environment-related factors have been examined in the literature regarding their impact on employee performance, such as leadership, corporate trust, human capital investments, etc. (Bapna et al., 2013), this study turns its attention on management support, training culture, climate and environmental dynamism which all are coming from an innovation team in the organization.

A review of the relevant literature revealing that innovation is no longer viewed as solely stimulated through a burst of creativity by a talented individual. It is defined as an interactive process among people, structures, and interaction processes (Agrell & Gustafson, 1996; Van Offenbeek & Koopman, 1996; West, 1990). These authors also argued that innovation is a continuous process that consists of the participation of people and the interaction among them.

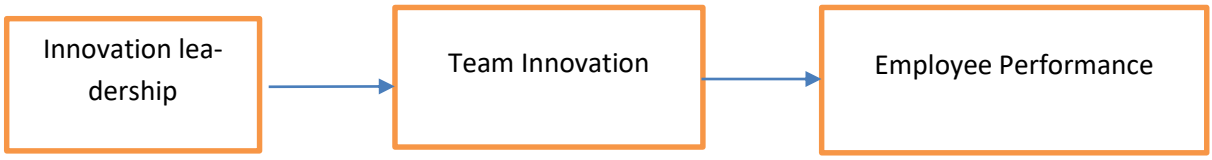
Team innovation is considered an important factor for organizational effectiveness. However, fostering innovation in teams remains a significant challenge for team leaders. Some authors also mention that nowadays, organizations have to foster innovation to ensure their competitive advantage in the marketplace (Anderson et al., 2014; van Knippenberg, 2017; Zhou & However, 2014). Most of the innovative work in organizations is performed by teams, in particular in knowledge-intensive industries(Anderson et al., 2014; Thompson & Choi, 2006; West, 2002)

A study from (Drach-Zahavy & Somech, 2001) focused on team innovation: "the intentional introduction and application within a team, of ideas, processes, products or procedures new to the team, designed to significantly benefit the individual, the team, the organization, or wider society." The author's definition emphasizes that innovation is related to intentional attempts of team members to arrive at anticipated benefits for the individual, the team, the organization, or the surrounding society, in contrast to top-down change.

The above studies imply that the team creates an innovative environment. The spiritual climate is the link among innovation leadership, team innovation, and employee performance in the development of mutual interaction processes is a crucial mechanism for team innovation.

Based on the above theoretical background, we develop a conceptual framework to propose further research by illustrating the relationship between innovation leadership, team innovation, and employee performance.

Figure1 Conceptual Framework



Source: Our research

2 Methods

A quantitative and qualitative approach should be applied to our hypotheses. We will conduct the survey study and questionnaire technique due to this research to use and test the relationship among variables (Saunders et al., 2009). Participants are those working in Aviation in Vietnam and having at least one working experience year in/her airline's carrier or airport ground handling organizations.

We will develop a questionnaire survey to collect data. The original questionnaire was developed in English based on the constructs and items of our studies. The sample size should be calculated more than ten times the most significant number of structural paths directed at a particular construct in the structural model (F. Hair Jr et al., 2014). Thus, the sample size of 100 is consistent with this study.

Concerning data analysis, SMART-PLS software is applied first to assess the internal consistency reliability, convergent validity, discriminant validity of the measurement, correlation matrix, the structure model, and test hypotheses. Then, the PROCESS model is utilized to study the interactive effects of innovation leadership, team innovation, and employee performance.

The study relied on journal articles and other relevant publications obtained from Scopus and Web of Science databases. We conducted a search using the keywords innovation leadership, team innovation, employee performance. Second, we included studies focusing on innovation leadership and employee performance-related concepts

Based on the criteria mentioned above, publications were found relevant and suitable for the present study.

3 Conclusions

For the literature's contribution, we could consider testing hypotheses as a proposed framework to determine the relationship between innovation leadership, team innovation, and employee performance.

In practice, managers or leaders should inspire or create an innovation environment that retains team innovation and employee performance.

In conclusion, published studies play an essential role in specifying the relationship of innovation leadership, team innovation, and employee performance and based on our understanding and literature study allow us for providing further identifies gaps after reviewing the literature of published studies and theories which solutions for improving employee performance and sustaining innovation spiritual in the team.

The conceptual model also suggests some studies in the future. Further studies in the innovation leadership context should evaluate this conceptual framework by employing qualitative research and test the above hypotheses through quantitative analysis in the aviation industry. Next, the model may be applied not only for an organization but also for its alliance.

Acknowledgment

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References

Abd El Majid, E., & Cohen, A. (2015). The role of values and leadership style in developing OCB among Arab teachers in Israel. *Leadership & Organization Development Journal*.

Agrell, A., & Gustafson, R. (1996). Innovation and creativity in work groups. *Handbook of Work Group Psychology*, 314–343.

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, *40*(5), 1297–1333.

Audenaert, M., Decramer, A., Lange, T., & Vanderstraeten, A. (2016). Setting high expectations is not enough: Linkages between expectation climate strength, trust, and employee performance. *International Journal of Manpower*.

Bapna, R., Langer, N., Mehra, A., Gopal, R., & Gupta, A. (2013). Human capital investments and employee performance: An analysis of IT services industry. *Management Science*, *59*(3), 641–658.

Boxall, P., & Purcell, J. (2011). *Strategy and human resource management*. Macmillan International Higher Education.

Brayfield, A. H., & Crockett, W. H. (1955). Employee attitudes and employee performance. *Psychological Bulletin*, *52*(5), 396.

Campbell, J. P. (1990). *Modeling the performance prediction problem in industrial and organizational psychology.*

Carmeli, A., Gelbard, R., & Gefen, D. (2010). The importance of innovation leadership in cultivating strategic fit and enhancing firm performance. *The Leadership Quarterly*, *21*(3), 339–349. https://doi.org/10.1016/j.leaqua.2010.03.001

Cascio, W. F., & Aguinis, H. (2008). *Staffing twenty-first-century organizations. The Academy of Management Annals, 2 (1), 133–165*.

Cascio, Wayne F., & Aguinis, H. (2018). *Applied psychology in talent management*. SAGE Publications.

Chassagnon, V., & Haned, N. (2015). The relevance of innovation leadership for environmental benefits: A firm-level empirical analysis on French firms. *Technological Forecasting and Social Change*, *91*, 194–207.

Diamantidis, A. D., & Chatzoglou, P. (2019). Factors affecting employee performance: An empirical approach. *International Journal of Productivity and Performance Management*.

Drach-Zahavy, A., & Somech, A. (2001). Understanding team innovation: The role of team processes and structures. *Group Dynamics: Theory, Research, and Practice*, *5*(2), 111.

F. Hair Jr, J., Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review*, *26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Fagerberg, J. (2004). *Innovation: A Guide to the Literature*. https://smartech.gatech.edu/handle/1853/43180

Gliddon, D. G., & Rothwell, W. J. (2018). *Innovation leadership*. Routledge.

International Air Traffic Association (IATA). (2018). *Annual Review*.

Kaminski, J. (2011). Diffusion of innovation theory. *Canadian Journal of Nursing Informatics*, *6*(2), 1–6.

Kline, S. J., & Rosenberg, N. (2010). An overview of innovation. *Studies on Science and the Innovation Process: Selected Works of Nathan Rosenberg*, 173–203.

Lohmann, G., & Pereira, B. A. (2019). Air transport innovations: A perspective article. *Tourism Review*.

Lundvall, B.-\AAke. (2013). Innovation studies: A Personal interpretation of 'The State of the Art.' *Innovation Studies: Evolution and Future Challenges*, *21*.

Mensah, J. K. (2015). A "coalesced framework" of talent management and employee performance: For further research and practice. *International Journal of Productivity and Performance Management*.

Narcisse, S., & Harcourt, M. (2008). Employee fairness perceptions of performance appraisal: A Saint Lucian case study. *The International Journal of Human Resource Management*, *19*(6), 1152–1169.

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed). Prentice Hall.

Thompson, L. L., & Choi, H.-S. (2006). *Creativity and innovation in organizational teams*. Psychology Press.

Uddin, M. J., Luva, R. H., & Hossian, S. M. M. (2013). Impact of organizational culture on employee performance and productivity: A case study of telecommunication sector in Bangladesh. *International Journal of Business and Management*, *8*(2), 63.

van Knippenberg, D. (2017). Team Innovation. *Annual Review of Organizational Psychology and Organizational Behavior*, *4*(1), 211–233. https://doi.org/10.1146/annurev-orgpsych-032516-113240

Van Offenbeek, M. A. G., & Koopman, P. (1996). Interaction and decision-making in project teams. In *Handbook of Work Group Psychology, Chapter 8* (pp. 159–187). Wiley.

West, M. A. (1990). *The social psychology of innovation in groups.*

West, M. A. (2002). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied Psychology*, *51*(3), 355–387.

Zhou, J., & Hoever, I. J. (2014). Research on workplace creativity: A review and redirection. *Annual Review of Organizational Psychology and Organizational Behavior*, *1*(1), 333–359.

Comparison of Classical and Online Experiments Concerning Personal Ambiguity Attitude

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Abstract: The paper concerns an issue of personal ambiguity attitude as a characteristic of decision-making is focused on the confrontation of an online and on-site form of experiments and comparing results among several different types of participants. During the years 2019, 2020, and January 2021, several series of experiments were performed. Most of them were organized in a classical manner on-site with organizers and participants in the same room. Latter, due to pandemic limitations, the series of lotteries were performed online throughout MS Teams software and questionnaire website, showing particular games' settings and saving participants' answers. Lotteries consisted of 14 questions concerning bets on results of drawing certain types of balls from an urn. Financial incentives were used for the most successful participants. The design of the experiment allowed to assess the personal attitude to ambiguity together with the measure of this attitude and contained also two variants of questions inspired by famous Ellsberg's experiments.

Keywords: ambiguity, personal attitude, online experiment, on-site experiment, decision-making.
JEL Classification: D01, G02, C91

1 Introduction

It appears to be a human nature of behavior and mode of decision-making that is mirrored in an idiomatic phrase “better the devil you know than the devil you don't”. This well-known functioning in situations of uncertainty and ignorance shows that the human decision-makers tend to choose a variant with somehow estimable risk rather than choosing a possibility with completely unknown risks. One hundred years ago John Maynard Keynes illustrated a practical connection of weight of arguments and probability on an example of drawing balls from an urn. In his thought experiment he has white and black balls in the urn and the probability of drawing a white ball was ½. But he considered two possible settings: 1) In first case the urn contains black and white balls in equal proportion. 2) Whereas in the second case the proportion of black and white balls is unknown. He concludes that having the same probability of drawing the white ball the first setting shows a greater weight of argument (see Keynes, 1921 and Knight, 1921), but the idea is older and its variant appears in his book already in 1909 and its roots stems to a Boole’s Laws of Thought, 1854).

In the fields of decision-making and more generally in economic theories underlying the estimation of subjective probabilities it appeared that besides the attitude to risk also this so called ambiguity aversion is an important characteristics of a human decision-maker. Classical probability theory fails in addressing states of ignorance and vagueness. It appeared that the Savage’s normative decision theory (see Savage, 1954) is insufficient and does not describe all facets of decision-maker’s behavior. Namely, it appears that the attitude to ambiguity (sometimes labeled also as attitude to uncertainty) is not neutral, but shows an aversion. There is a famous urn experiment augmenting the example of Keynes documenting this type of behavior (see Ellsberg, 1961). In the classical Ellsberg setting each of two urns contains 100 balls in the following way: 1) First urn contains 50 red and 50 black balls. 2) But the second urn contains an unknown mixture of red and black balls.

Meanwhile, the ambiguity attitude appeared to be an important characteristic of individual decision-maker and many implications in the field of economics were analyzed (see, e.g., Cole et al., 2013 or Nishimura & Ozaki, 2007).

Several different methodological approaches were used to address the ambiguity aversion phenomenon. Among others let us mention Halevy (2007). In this paper we will employ another approach to overcome shortcomings of decision-making based on classical probability and expected utility theory led Jiroušek & Kratochvíl (2020) to an introduction of notion personal expected value and belief function model incorporating an ambiguity aversion.

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2 Experiments

The series of experiments (within the acknowledged research project) began in on-site form (see lotteries #13 to #40 below). However, in the COVID-19 era at the very end of 2020 and in January 2021 an additional series of four lotteries was performed online using MS Teams software and questionnaire website, showing particular games' settings and saving participants' answers.

2.1 Particular games

All experiments were organized as a lottery and were composed from the following set of 14 games. (Game 13 was not used.)

Game 1:

Contents of an urn: balls of 6 colors (black, white, red, yellow, blue, green). Count of all balls and counts of balls of particular colors are unknown.

Question: If the drawn ball has the red color, you win 100 CZK. How much are you willing to pay to play the game?

Game 2:

Contents of an urn: balls of 6 colors (black, white, red, yellow, blue, green). Count of all balls and counts of balls of particular colors are unknown.

Question: Choose color (in a choice box). If the drawn ball has your color, you win 100 CZK. How much are you willing to pay to play the game?

Game 3:

Contents of an urn: balls of 6 colors (black, white, red, yellow, blue, green). There are 30 balls, 5 of each color.

Question: If the drawn ball has the red color, you win 100 CZK. How much are you willing to pay to play the game?

Game 4:

Contents of an urn: balls of 6 colors (black, white, red, yellow, blue, green). There are 30 balls, 5 of each color.

Question: Choose color. If the drawn ball has your color, you win 100 CZK. How much are you willing to pay to play the game?

Games 5 to 12:

Contents of an urn: balls of 6 colors (black, white, red, yellow, blue, green). There are 5 to 12 balls in an urn (same number as the number of game), just 1 red ball, counts of balls of other colors is unknown.

Question: Choose color. If the drawn ball has your color, you win 100 CZK. How much are you willing to pay to play the game?

Game 14 (a modification of Ellsberg's example):

Contents of an urn: balls of 3 colors (black, red, yellow). There are 15 balls, exactly 5 red balls, counts of balls of other colors is unknown.

Question: Choose color. If the drawn ball has your color, you win 100 CZK. How much are you willing to pay to play the game?

Game 15 (a modification of Ellsberg's example):

Contents of an urn: balls of 3 colors (black, red, yellow). There are 15 balls, exactly 5 red balls, counts of balls of other colors is unknown.

Question: Choose color. If the drawn ball has yellow or your color, you win 100 CZK. How much are you willing to pay to play the game?

- **All experiments**

During years 2019, 2020 and in the very beginning of 2021 a series of experiments were realized. In particular, the following lotteries containing players and their bets on Games 1 to 15 (with 13 missing) were organized. Let us briefly summarize the most important information:

Jindřichův Hradec II (30. 1. 2019, lottery #13):

The experiment was held at the Faculty of Management. Among the total of 14 participants 9 participants were students of Gymnázium in Jindřichův Hradec, the others were employees of Faculty.

Jindřichův Hradec III (19. 2. 2019, lottery #18):

The experiment was held at the Faculty of Management in Jindřichův Hradec. There were total of 17 participants, all of them were students of master degree at Faculty of Management.

Alšovice 2019 (7. 6. 2019, lottery #29):

The experiment was held at the traditional seminar Alšovice 2019 held in Krkonoše. There were total of 11 participants, all of them were scientists in related fields of mathematics (most of them from Institute of In-formation Theory and Automation, Czech Academy of Science).

Oslava (26. 10. 2019, lottery #31):

The experiment was held at the Faculty of management during the official celebration of 25 years of Faculty of management. There were total of 15 participants, 4 of them were students (Ph.D. or combined form), most of the remaining were alumni.

11. 11. 2019 (lottery #32):

The experiment was held at the Faculty of management during the lecture. There were total of 8 participating bachelor degree students.

12. 11. 2019 A (lottery #33):

The experiment was held at the Faculty of management during the lecture. There were total of 11 participating bachelor degree students.

12. 11. 2019 B (lottery #34):

The experiment was held at the Faculty of management during the lecture. There were total of 22 participating master degree students.

6. 12. 2019 (lottery #35):

The experiment was held at the Faculty of management during the lecture. There were total of 5 participating master degree students in combined study form.

Tábor (16. 2. 2020, lottery #36):

The experiment was held in Tábor. There were total of 14 participants – non-professional ice-hockey players most of them in middle age.

21. 2. 2020 A (lottery #37):

The experiment was held at the Faculty of management during the lecture. There were total of 25 participants, 24 bachelor degree students and one teacher.

21. 2. 2020 B (lottery #38):

The experiment was held at the Faculty of management during the lecture. There were total of 12 participating bachelor degree students in combined study form.

Alšovice 2020 (2. 6. 2020, lottery #40):

The experiment was held at the traditional seminar Alšovice 2020 in Onen Svět. There were total of 11 participants, 6 participated already in the first experiment Alšovice 2019 (lottery #29). All participants were scientists in related fields of mathematics (most of them from Institute of Information Theory and Automation, CAS).

Online experiments 1. – 4. (16. 12. 2020, 6. 1. 2021, 20. 1. 2021 and 27. 1. 2021, lotteries #42, #43, #44, #45):

Experiment were performed online with draw at Faculty of management. There were total of 40 participating students of faculty and 3 scientists who were excluded from the sample. The repeated on-line experiment is evaluated in detail in another paper of this author team, see Bažantová et al. (2021).

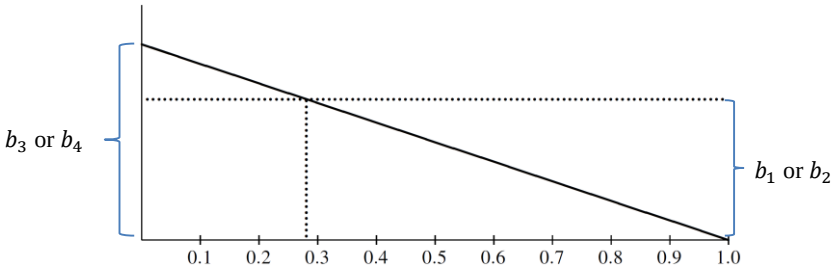
Personal coefficient of ambiguity

In accordance with the paper of Jiroušek & Kratochvíl (2020) the ambiguity aversion of an individual can be estimated from a pair of bets in the above games. Particularly, let us denote bets in Games 1 to 4 by a symbol b_i for $i \in \{1,2,3,4\}$. We can introduce two estimates of personal coefficient of relation to ambiguity based on two different pairs of games. For a principle of estimation refer to a Figure 1. Bets on drawing the red ball in Games 1 and 3 give an estimate α_G (see Equation 1) and bets on drawing the balls of chosen color in Games 2 and 4 provide an estimate α_F (see Equation 2) in the following way:

$$\alpha_G = \frac{b_3 - b_1}{b_3} \tag{1}$$

$$\alpha_F = \frac{b_4 - b_2}{b_4} \tag{2}$$

Figure 1 Estimation of α (personal ambiguity coefficient, on a horizontal axis) from bets in a pair of games.



Source: Own processing

The personal preferences and bets in Games 5 to 12. According to Jiroušek & Kratochvíl (2020) we can expect different choices depending on personal ambiguity coefficient. Person with negative α (ambiguity seeking) will most probably bet on ball other than red in all Games 5 to 12. Person with neutral attitude to ambiguity ($\alpha = 0$) will bet on red in Game 5 and on some other ball in Games 7 to 12, in Game 6 he can choose any color since his gain is equal in all cases. People with positive α (i.e. showing ambiguity aversion) will stop betting on red in some Game with higher number than 6.

3 Characteristics of on-site and on-line lotteries and some results

In the process of summarization, we will omit incomplete records, particularly players who did not bet a positive amount in Games 1 to 4.

Table 1 Sample characteristics of ambiguity coefficients on-site and on-line lotteries.

lottery #	# of participants	mean α_F	quartile of α_F			mean α_G	quartile of α_G		
			Q1	Q2	Q3		Q1	Q2	Q3
13	13	0.304	0.000	0.500	0.643	0.135	0.000	0.400	0.600
18	13	0.321	0.000	0.375	0.750	0.327	0.000	0.375	0.667
29	11	0.225	-0.182	0.300	0.724	0.408	0.000	0.375	0.812
31	20	0.071	0.000	0.333	0.500	-0.300	0.000	0.115	0.400
32	7	0.316	0.000	0.412	0.750	0.500	0.417	0.500	0.708
33	11	0.091	-0.100	0.333	0.558	0.455	0.221	0.333	0.725
34	26	-0.027	0.000	0.200	0.475	0.200	0.000	0.400	0.542
35	6	0.000	0.000	0.000	0.250	-0.782	0.094	0.488	0.650
36	15	-0.111	-0.125	0.000	0.100	-0.052	-0.167	0.000	0.550
37	23	0.123	0.000	0.000	0.464	0.316	0.000	0.400	0.550
38	9	0.304	0.000	0.400	0.500	0.033	0.000	0.200	0.667
40	8	0.502	0.300	0.558	0.700	0.106	0.000	0.296	0.460
on-s. mean	13.50	0.177	-0.009	0.284	0.534	0.112	0.047	0.324	0.611
42	17	0.079	0.000	0.375	0.500	0.263	0.200	0.467	0.667
43	24	0.226	0.000	0.275	0.667	0.298	0.160	0.438	0.700

44	28	0.269	0.186	0.317	0.500	0.178	0.000	0.273	0.508
45	16	0.253	0.000	0.183	0.398	0.382	0.310	0.368	0.496
on-l. mean	21.25	0.207	0.046	0.287	0.516	0.280	0.167	0.386	0.592

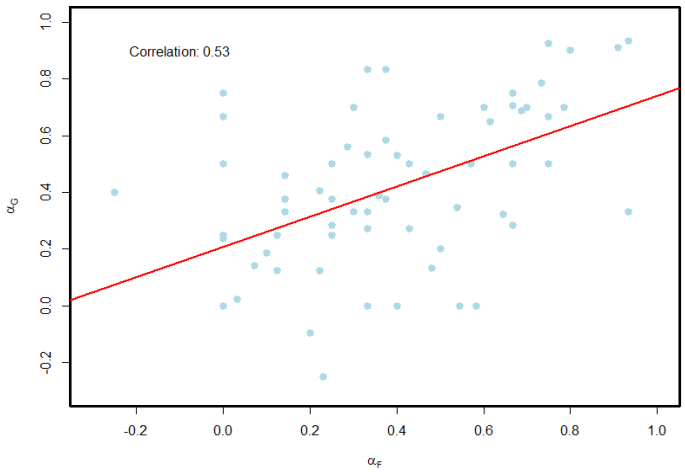
Source: Own processing

The main results:

The formal statistical approach (Students t-test for means on 5 percent significance level) shows what the values in Table 1 suggest:

1. The mean values of α_F and α_G do not significantly differ throughout the whole data set.
2. The mean values of α_F do not significantly differ in on-site and on-line experiments.
3. The mean values of α_G do not significantly differ in on-site and on-line experiments.
4. The mean values of α_F do not significantly differ in the case of scientist (#29 and #40) and other participants (the value of α_F is higher for the scientist group if we choose a 10 percent significance level).
5. The mean values of α_G do not significantly differ in the case of scientist (#29 and #40) and other participants.
6. **The mean value of α_F is significantly lower in the case of the first participation in experiment in comparison with the second and other participations (p-value=0.03).**
7. The mean values of α_G do not significantly differ in the case of the first participation in experiment and in the case of the second and other participations.
8. **The correlation plot of α_F and α_G coefficients (see Figure 2) shows that some participants provide inconsistent answers and in some case do not decide in a rational way.** The data show relatively high correlation which could be even higher after preselection of rationally behaving participants.

Figure 2 The Pearson correlation of α_F and α_G coefficients.



Source: Own processing

Table 2 Sample characteristics bets and resulting amounts of on-site and on-line lotteries.

lottery #	# of partic-ipants	mean bet	quartile of bet			mean result	quartile of result		
			Q1	Q2	Q3		Q1	Q2	Q3
13	13	75.9	32.5	58.5	105.0	59.9	-11.8	62.0	95.8
18	13	65.2	10.0	41.0	66.0	81.5	-9.0	59.0	155.0
29	11	63.0	25.5	42.0	87.0	-35.7	-60.0	-40.0	-20.5
31	20	129.0	4.5	30.0	204.0	-56.1	-88.0	-20.0	-2.0
32	7	68.8	10.2	35.0	116.0	56.2	-12.8	18.0	150.0
33	11	36.6	17.0	25.0	51.5	109.0	26.0	83.0	204.0
34	26	55.4	5.0	19.5	42.5	-19.0	-26.5	-7.5	-1.5
35	6	140.0	60.0	103.0	170.0	-79.6	-70.0	-60.0	-10.0
36	15	115.0	3.5	18.5	114.0	-36.0	-17.5	-2.5	15.0
37	23	78.0	5.0	16.0	40.0	-42.0	-30.0	-10.0	-3.0
38	9	50.0	10.8	20.0	90.0	33.3	-17.5	-10.5	94.2
40	8	225.0	40.0	120.0	302.0	212.0	126.0	200.0	286.0
on-s. mean	13.6	91.8	18.7	44.0	115.7	23.6	-15.9	22.6	77.8
42	17	104.0	60.0	80.5	152.0	-9.1	-67.8	-46.0	36.0
43	24	240.0	60.0	136.0	310.0	-60.2	-55.0	-15.0	64.0
44	28	273.0	77.0	190.0	410.0	-80.6	-90.0	-20.0	49.0
45	16	200.0	53.0	110.0	280.0	-62.6	-85.8	-52.5	36.8
on-l. mean	21.5	204.3	62.7	129.3	287.8	-53.1	-74.6	-33.4	46.4

Source: Own processing

The lottery #40 was excluded from this comparison since it used doubled amount in case of win. In Table 2, the comparison of mean bets and the resulting balance of individual participants shows that there is a significant difference in bets and resulting financial balance in on-site and on-line experiment. In case of on-line experiment higher bets appear (p-value<0.0001) together with negative financial balance of on-line experiments (p-value=0.003 showing lower mean gain in on-line experiments) which shows more tendency to risk in on-line case. This was caused by a different scheme of payment where in classical on-site experiment the participant need to use their own money and in online experiment participants used assigned points which were converted into the financial sum only after successful completion of experiment (see again Bažantová et al., 2021 for more detail). Another interesting fact is that the although the bets of students and non-students do not significantly differ, the overall balance was significantly lower in case of students (p-value=0.044, moreover, students have negative balance with mean -14 and non-students got in average 88). The bets tended to be higher in case of repeated participation in experiment (p-value=0.038) but it did not lead to statistically different financial balance.

Table 3 Sample characteristics of Games 5 to 12.

	Game 5	Game 6	Game 7	Game 8	Game 9	Game 10	Game 11	Game 12
proportion [%]	40.1	22.3	13.8	6.1	2.0	1.6	0.4	13.8
mean α	0.16	0.12	0.19	0.26	-0.66	-0.18	0.77	0.38

Source: Own processing

Table 3 documents besides the attitude to ambiguity probably also another facet of the limits of rationality assumption in case of lottery participants. We can observe that the choice of red ball appears the most frequently in Game 5 but still it is only in 40.1 percent of cases and moreover, there are 13.8 percent of participants who chose red ball in all 8 games. Moreover, it is not associated with the mean α coefficient of the participant (taken as average of alpha coefficients).

4 Conclusions

The presented paper summarized results of series of experiments concerning the decision-makers' attitude to ambiguity. To assess the attitude a set of questions was used providing a possibility do evaluate the personal ambiguity coefficient α (in two variants). The main results of experiments were analyzed from different facets and the results show significant differences in case of on-site (classical) experiments and in its on-line variant. The most likely cause of this result lies in different payment scheme in case of on-line experiments. Several aspects of the analysis show rather limited rationality

of behavior of some participants, but in case of repeated participation the coefficient of ambiguity and amount of bets significantly differs.

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References

Bažantová, S., Bína, V., Kratochvíl, V. & Šimůnková, K. (2021). Assessment of personal ambiguity attitude in a series of online experiments. In R. Hlavatý (Ed.), *Proceedings of 39th International Conference on Mathematical Methods in Economics* (pp. 30-35): Prague.

Cole, S., Giné, X., Tobacman, J., Topalova, P., Townsend, R., & Vickery, J. (2013). Barriers to household risk management: Evidence from India. *American Economic Journal: Applied Economics*, *5*(1), 104-35.

Ellsberg, D. (1961). Risk, ambiguity, and the Savage axioms. *The quarterly journal of economics*, 643-669.

Halevy, Y. (2007). Ellsberg revisited: An experimental study. *Econometrica*, *75*(2), 503-536.

Jiroušek, R., & Kratochvíl, V. (2020). On subjective expected value under ambiguity. *International Journal of Approximate Reasoning*, *127*, 70-82.

Keynes, J. M. (1921). *A treatise on probability*. London: Macmillan and Company, limited.

Knight, Frank H. (1921), *Risk, Uncertainty, and* Profit, Houghton Mifflin Company, Boston, MA.

Nishimura, K. G., & Ozaki, H. (2007). Irreversible investment and Knightian uncertainty. *Journal of Economic Theory*, 136(1), 668-694.

Savage, L. J. (1954). The Foundations of Statistics. New York: John Wiley & Sons Inc.

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