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FOREWORD

Dear ladies and gentlemen, dear doctoral students,

Let me sincerely welcome you all to Proceedings from international scientific conference of doctoral students and young scientists Scientia Iuventa 2024. The current year was the 19th opportunity for doctoral students and young scientists to present their research results at the conference Scientia Iuventa. The conference was organized by the Centre for Research and Development of Doctoral Students in cooperation with the Faculty of Economics of Matej Bel University in Banská Bystrica.

Scientia Iuventa 2024 reflected contemporary doctoral research in areas as Tourism, Business Economics and Management, Finance and Public Economics and Politics and not only here in Slovakia, but also abroad. The conference created space for multidisciplinarity and mutual inspiration and getting know new and unknown. Scientia Iuventa became a platform where young people reveal their talent, move their research forward by gained advices and also add their value added to the scientific knowledge. The output of the conference is the Proceedings of scientific papers from the international scientific conference. All papers published in this way were peer reviewed by anonymous referees.

Also I would like to thank the organizers of this conference for their responsible approach, work effort and successful organization of Scientia Iuventa 2024.

Dear participants of Scientia Iuventa, on behalf of the Scientific Committee as well as the Organizing Committee, let me thank you for choosing our conference to present your results and I want to wish you all the best and good success in your research, study as well as in all other ways.

prof. Ing. Zdenka Musová, PhD.
Guarantor of the conference

CONTENTS

HUNGARY'S ENERGY TRANSITION FOR A GREENER ELECTRICITY MIX, USING RENEWABLES AND NUCLEAR ENERGY

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ABSTRACT

Purpose:
The purpose of this study is to analyze the changes in the Hungarian electricity mix over the last 20 years and investigate the country's future possibilities.
Design/methodology:
In the study, mostly secondary research was used, based on the data publicly available from websites, related to the country's electricity sector.
Findings:
Hungary's electricity mix changed a lot in the last 20 years. While nuclear energy remained significant in the mix, the use of fossil resources significantly decreased, and renewables strengthened their positions.
Research/practical implications:
The current electricity mix is well-known to everyone, however, in a couple of years, it will be necessary to phase out the currently working blocks of the Paks Nuclear Power Plant, which will bring uncertainties for the future and could further increase the country's energy dependency.
Originality/value:
The value of this paper is to connect the current situation and trends with the future possibilities of the Hungarian electricity generation sector.

Keywords: energy mix, electricity mix, energy strategy, renewable energy sources

JEL Classification: Q2, Q4, Q5

1. Introduction

To meet the energy needs of the different sectors of the economy, countries use all types of energy sources. Although the share of these energy sources in the energy mix can vary

considerably, the majority of the countries are using mostly fossil fuels (oil, natural gas, and coal), which is responsible for around 80% of their electricity mix.

While fossil fuels are easy to obtain and use, from an economic point of view it is not a wise decision to solely rely on them. It takes millions of years and specific geological conditions for them to form, so given current trends, they will become scarce within a few decades, making it inevitable that the energy needs of the countries will have to be met by other means.

At the same time, we shouldn't forget about the ecological consequences of using such materials. By burning fossil fuels, energy can be produced rapidly, but during the process, CO_2 and other greenhouse gases are emitted into the atmosphere, which are mainly responsible for global warming.

As a result, researchers predict that by the end of the 21st century, the average temperature of the Earth could increase by up to 3-5°C, which would have serious consequences for life on the planet. (Föld Napja Alapítvány, 2024)

2. Theoretical background

The electricity mix refers to a narrower range within a country's energy mix, which strictly indicates what resources are used, and in what distribution for the country's electricity generation while ignoring all other areas that are included in the energy mix (e.g. transport).

Looking at the data for France in 2022, we see that the share of nuclear energy in the energy mix is 31.6%, while the share of nuclear energy in the electricity mix is 63.3%, so the differences can be rather significant. (Planete Energies, 2023) Analyzing the data for Hungary shows the same contrast between the two indicators. (Our World in Data, 2024a)

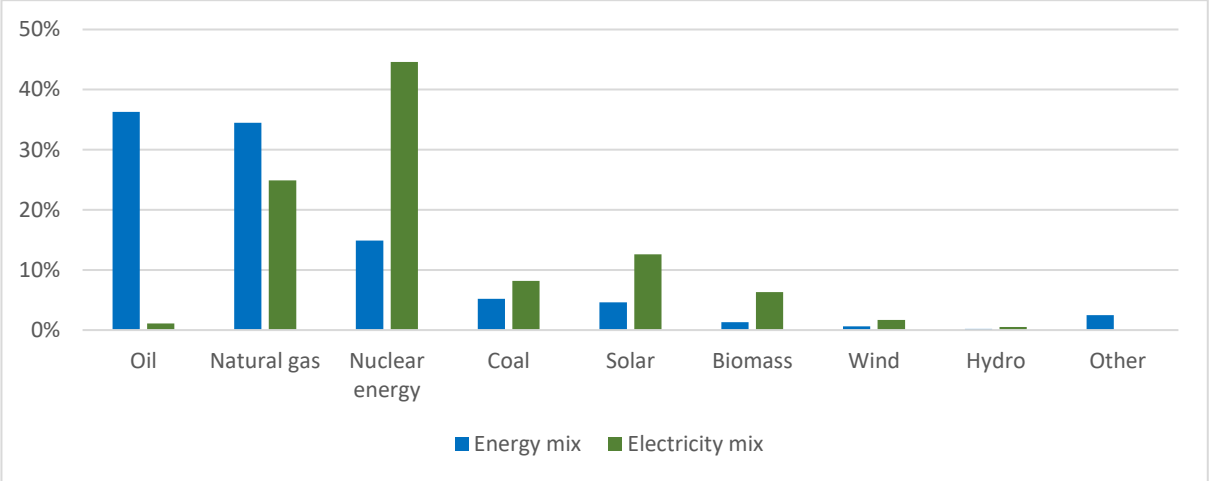

Figure 1: Energy and electricity mix of Hungary (2022)
Source: own editing based on Our World in Data (2024b)

Regarding Hungary, as shown in Figure 1, the biggest anomaly is for oil, where the difference is more than 35% between the values of the energy mix and the electricity mix (36,3% and 1,1%). This can be explained by the fact, that regarding the electricity mix there are more environmentally friendly substitutes for oil (solar, wind, hydro energy, but even natural gas), while in the transport or the plastics producing industry, it is a much bigger technological challenge. (Nun, 2021) The figure shows a significant difference in nuclear energy share too, as it is much higher in the country's electricity mix (44,6%), compared to its energy mix (14,9%), but the perception of this energy carrier is diverse within the EU countries, so it is not a real alternative for everyone, to reduce the ratio of the fossil fuels.

Hungary's Energy Strategy was defined last time in 2012 to set energy and climate policy directions until 2030, which would create a balance between economic development, energy security, and environmental sustainability while taking into consideration the EU's long-term energy ambitions and the country's geopolitical aspects at the same time.

Accordingly, the study highlights 5 key areas, where structural changes are needed, in order to improve the country's competitiveness and energy security while relieving the burden on the environment. These are the following:

- introducing comprehensive measures across the energy sector to promote energy efficiency,
- maximizing the use of renewable, low-carbon resources in electricity generation and promoting the uptake of new technologies,

- the electrification of the transport sector, which is based mainly on the reliable nuclear energy,
- the development of a bipolar agriculture (Agriculture and food companies should be able to switch flexibly between food production and biomass production for energy purposes, which can be beneficial not only from an energy point of view but can also give an economical chance for improvement to those areas, where farming wouldn't be financially viable given the current circumstances
- connection to European energy structures (Nemzeti Energiastratégia, 2011)

As a result of the above-mentioned objectives, significant changes can be expected in Hungary's electricity sector, and depending on the effectiveness of the projects in each area, the results can vary greatly, which can be seen in Figure 2.

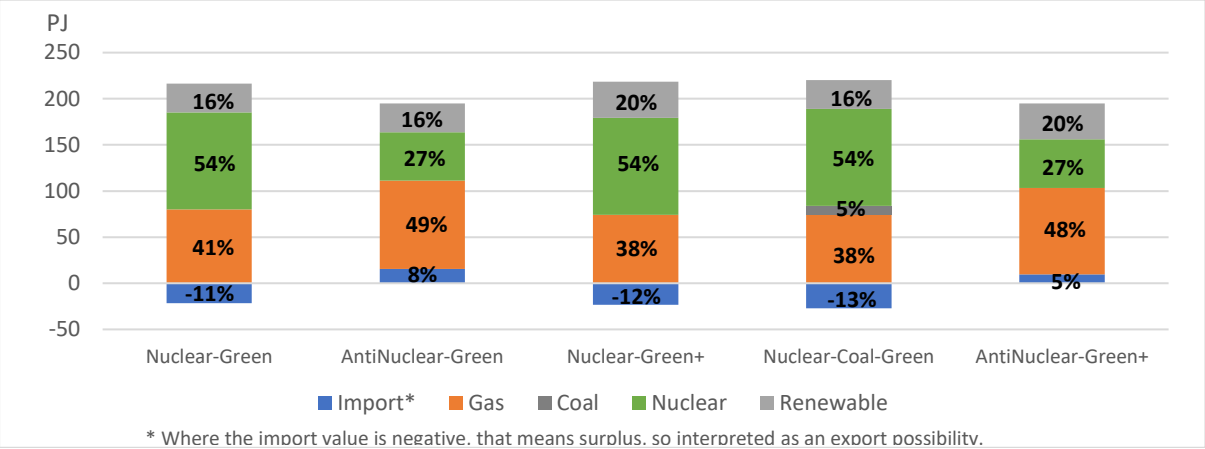

Figure 2: Possible electricity-mix of Hungary in 2030 by different scenarios
Source: own editing based on National Energy Strategy (2011)

Out of these scenarios, the government selected the "Nuclear-Coal-Green" as the most desirable for the future. In this scenario, the country's energy mix would be based on 3 main pillars:

- on nuclear energy,
- on maintaining the current coal-based energy production,
- and on the constantly increasing renewable energy production.

While it may be surprising from an environmental point of view to keep coal (one of the most harmful fossil fuels) in the electricity mix, from an economic point of view, the experts justified their proposal by the following factors:

- in the event of an energy crisis (natural gas price explosion or nuclear power plant malfunction), coal/lignite is the only rapidly mobilizable fossil fuel, which is available in the country's territory in a large quantity (also it is relatively easy to mine)
- the country does not want to lose the know-how and practical experience that the experts have accumulated over the decades on the subject, which could have a great impact on research and development in the future (with the improvement of carbon capture and clean coal technologies)

Another argument in favor of this scenario is that domestic production could fully meet economic needs and the country would no longer need to import energy, which would reduce the country's energy dependency.

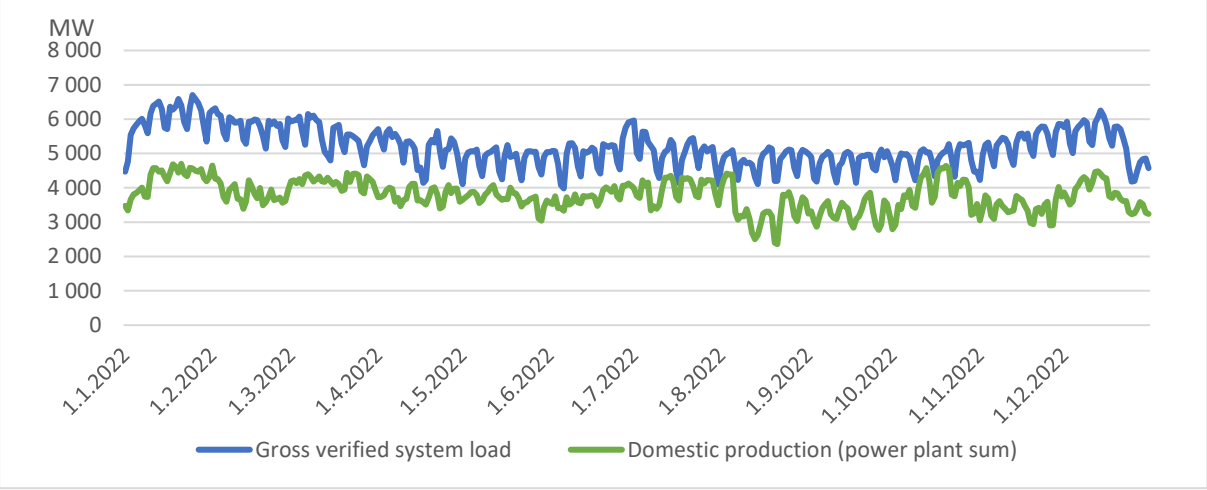

Figure 3: Domestic electricity generation and share in the electricity mix (2022)
Source: own editing based on Mavir (2024)

Unfortunately, since the publication of the National Energy Strategy back in 2011 there hasn't been a significant improvement in this regard. Energy dependency is still a serious issue for the country, as it can be seen on Figure 3. Let's analyze the daily average data for 2022. We can see that almost without exception Hungary has been relying on import energy every day, ranging from 7% to 44%, which was supplied by the neighboring countries, namely Slovakia, Austria and Romania. (Papp, 2023; Somogyi, 2022) Looking at the distribution within the given

year, we can see that the summer months were the main periods when the country had less need for foreign energy (basically lower demand and proportionally higher share of energy from renewables), while the trend changes during the winter months, resulting in an increased import ratio.

In the above-mentioned scenario (Nuclear-Coal-Green), imports would be substituted and even 13% of the production could be exported to international markets (Nemzeti Energiastratégia, 2011).

3. Methods

In this study, a combination of secondary data analysis and comparative evaluation methods were used to examine Hungary's energy transition and its evolving electricity mix. The key datasets were extracted from reputable organizations such as MAVIR, KSH, and official governmental sites. Data spanning the past two decades were analyzed to identify structural changes in Hungary's electricity mix, including shifts in energy sources and their shares in electricity generation.

The data collection involved extracting quantitative information on Hungary's historical and current electricity mix, focusing on primary energy sources such as nuclear, coal, natural gas, solar, and biomass. Statistical figures were processed to explore trends, seasonality, and interdependencies between variables such as carbon intensity, import reliance, and the contribution of renewables.

Scenario analysis was applied to evaluate the implications of Hungary's "Nuclear-Coal-Green" strategy, leveraging projections from the National Energy Strategy and IPCC guidelines to estimate future carbon intensity under varying scenarios.

To ensure analytical rigor, the study also incorporated insights from academic literature, government publications, and technical reports. Results were visualized using graphs and charts to facilitate interpretation and highlight the impact of policy interventions and technological advancements on Hungary's electricity mix.

This methodological framework provides reliability, and enabling future researchers to build upon the findings and explore deeper interdependencies between energy strategies, economic performance, and environmental sustainability.

4. Results and discussion

In Hungary, the share of nuclear energy in the electricity mix has remarkably increased over the last 20 years, from 38.6% (in 2002) to 44.6% (in 2022).

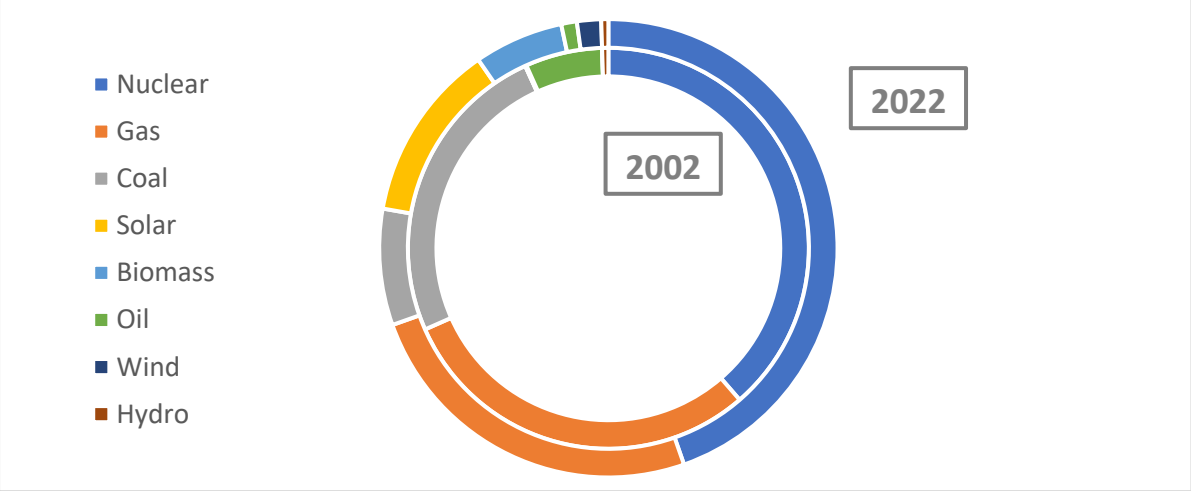

Figure 4: Structural changes in the Hungarian electricity-mix between 2002 and 2022
Source: own editing based on Our World in Data (2023b)

Furthermore, there is a positive change in coal use, where consumption has decreased from 24.8% to 8.2% over the reviewed period, which is close to the 5% target outlined in the Nuclear-Coal-Green scenario. At the same time, solar energy (12.6%) and biomass (6.3%) have seen dynamic growth, while oil has steadily lost ground (from 6.2% to 1.1%).

4.1. Nuclear energy

Nuclear energy plays an important role in the Hungarian electricity generation, accounting for about 44.6% of the electricity mix in 2022.

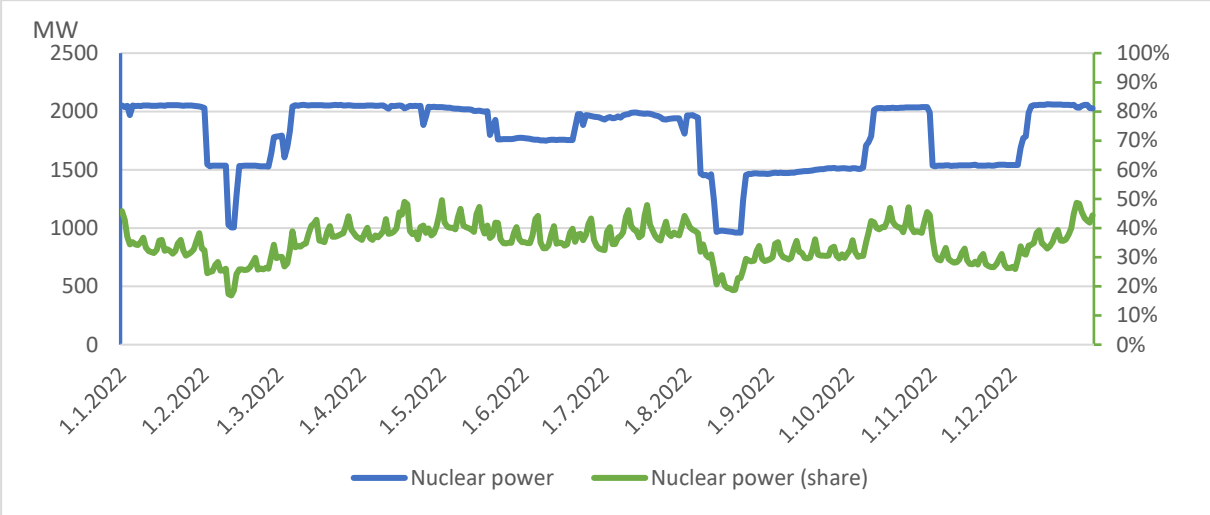

Figure 5: Share of nuclear energy in domestic electricity generation (2022)
Source: own editing based on Mavir (2024)

This type of energy is entirely produced at the Paks Nuclear Power Plant, where currently a total of 4 500 MW units are available. Unfortunately, the power plant was built several decades ago, so Hungary must prepare for the time when these blocks won't be available for energy generation.

The first block was built in 1982, so even taking into consideration that the government used its option to extend the operating lifetime by 20 years, the licenses for the 4 units will expire between 2032 and 2037. To maintain a steady supply, decision-makers started to explore the theoretical possibilities for a nuclear power plant expansion in 2009, which would involve the construction of 2 new units with a combined capacity of 2,000 MW, to be built next to the existing nuclear power plant. This new investment would temporarily increase the weight of nuclear power in the energy mix to 50%, but this would only be significant for a few years, as all the old 500 MW units will be phased out from 2037. According to the latest available information, the licensing procedure for the new units was completed on the 18th of August 2023 and the project has entered the construction phase (Paks 2 Zrt. 2024). From an environmental point of view, Imran et al. (2023) conclude that the use of nuclear power reduces the overall carbon dioxide emissions of a country, but if an unforeseen disaster were to occur (e.g. Fukushima), the consequences could be catastrophic. This paper is not intended to further analyze the pros and cons of using nuclear power, but for the future, it could be a valid scenario

in the case of Hungary, since the National Energy Strategy does not rule out the possibility of building additional nuclear power plants in the country.

4.2. Brown coal and lignite

In the case of Hungary's geopolitical characteristics, coal is the only fossil fuel that is available in relatively large quantities (extractable under current conditions) in the country. Although coal combustion is currently one of the most CO_2-emitting process, there is a lot of technological research on how to significantly reduce or eliminate carbon dioxide emissions during this process. Since the topic is very popular among scholars, there is a possibility that this material will relive its golden ages in the future, thanks to the various CCS technologies (Leeson et al. 2017; Al Baroudi et al. 2021; Hua et al. 2023) Believing in such scenario Hungary is currently not keen to completely phase out this material from its electricity mix, in order to keep the know-how.

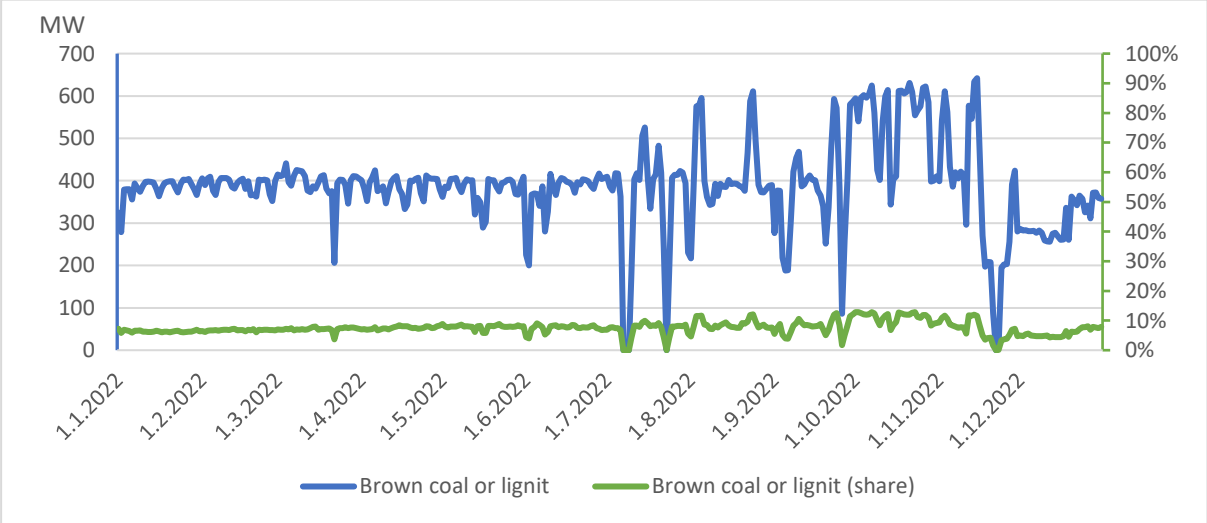

Figure 6: Share of coal-lignite power plants in domestic electricity production (2022)
Source: own editing based on Mavir (2024)

While keeping the country's options open regarding coal mining and combustion, we can see that the usage shows a decreasing trend between 2002 and 2022 in alignment with EU and national directives. In 2022, coal combustion was responsible for a daily average of 8,2% of the total electricity generation.

4.3. Natural gas

Based on the data for 2022, natural gas is the second largest energy carrier in the Hungarian electricity mix, with 24.9%. Although the combustion of natural gas releases a lot of carbon

dioxide into the air overall, it is one of the least polluting fossil fuels (U.S. Energy Information Administration, 2022).

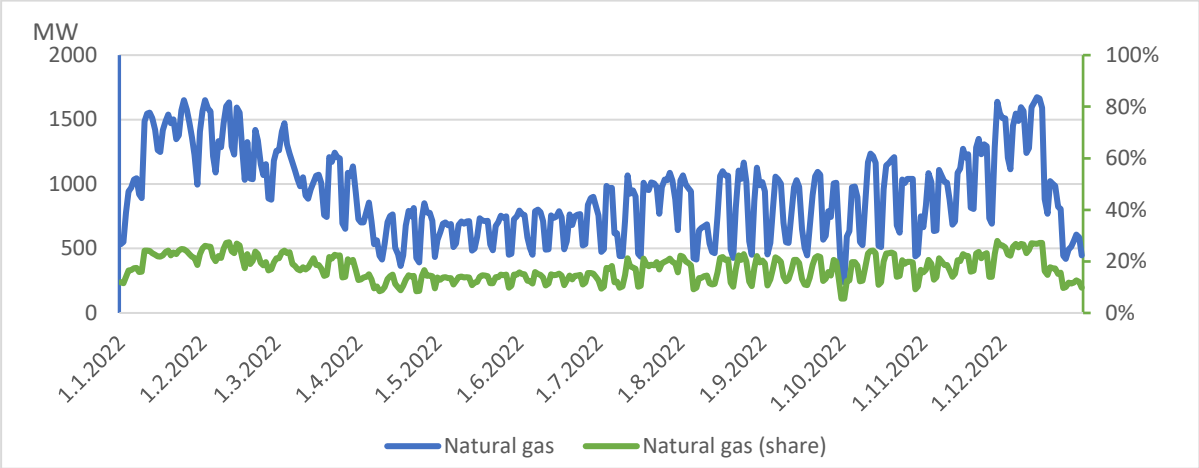

Figure 7: Share of natural gas in domestic electricity generation (2022)
Source: own editing based on Mavir (2024)

Based on Figure 7, the use of natural gas in the electricity mix is highly seasonal. In the winter months, the country relies on this resource in a much higher ratio than in the summer months due to its characteristics. (Hungary mostly utilizes solar energy from renewables, which can generate a much lower amount of electricity during the winter season, so to supplement the higher energy demand in these months, mostly natural gas is used.)

On the negative side, the share of natural gas reserves in the country is low and production is decreasing year by year. In recent years several major deposits have indeed been found, but their extraction is currently not economically feasible (Makó), in compliance with the legal requirements (FGSZ, 2024). As a result, the country is dependent on gas imports, most of which it can meet from Russia (43,6% in 2020), so in the current geopolitical situation (Russian-Ukrainian war) it is quite a challenge to mitigate the supply risks.

On the positive side, Hungary has four underground gas storage facilities with a capacity of 4.43 billion m^3, which allows it to prepare for the winter period and to stock up a significant part of the expected consumption in advance. (Magyar Földgáztároló Zrt. 2023)

4.4. Solar and wind energy

Over the past 20 years, the European Union has announced a number of programs to promote renewable energy sources, such as Europe 2020, the European Green Deal, and REPowerEU. Accordingly, Hungary has also put more emphasis on the expansion of renewable

energy sources (through various tenders and subsidies), which has led to an explosion in solar energy production, which now accounts for almost 13% of the electricity mix. (MEKH, 2021; Major, 2021). The latest program, called Napenergia Plusz (Solar Energy Plus), was published in early October 2023, with a budget of 75 billion HUF to support applicants for the installation of small-scale household power plants, including not only solar panels but also energy storage. (Világgazdaság, 2023)

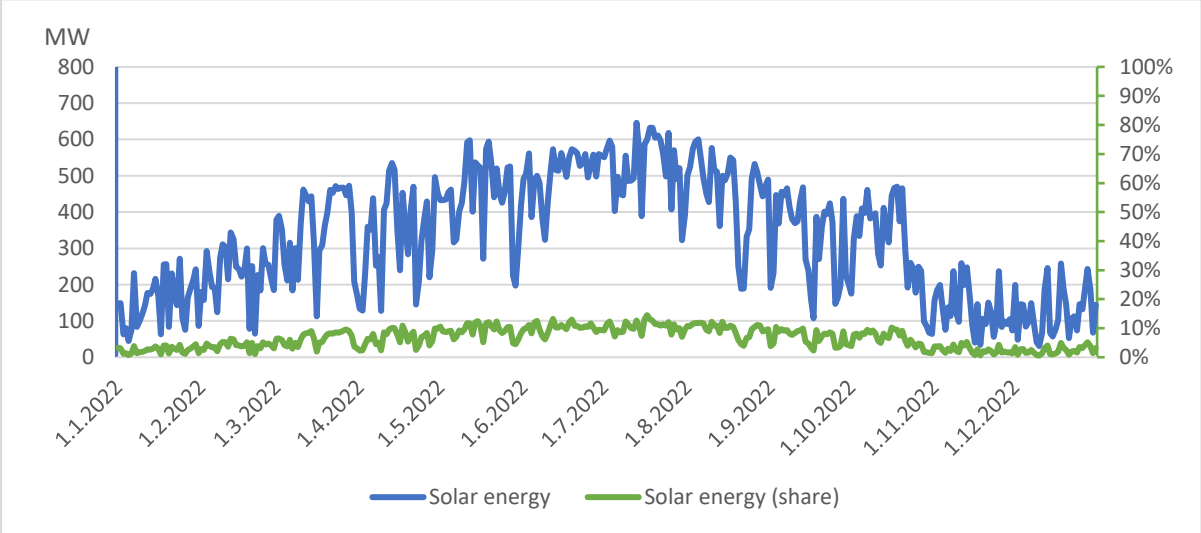

Figure 8: Share of solar energy in domestic electricity generation (2022)
Source: own editing based on Mavir (2024)

Figure 8. shows that there is also a strong seasonality in solar energy production, not just in terms of the produced quantity but also in its share in the electricity mix. This trend comes from geopolitical characteristics, as the number of sunny hours in Hungary is much higher throughout the summer months than in the winter months.

While the country had a decent improvement regarding the solar energy production in the last decade, there is still room for advance regarding wind energy (currently 1,7% of the electricity mix). This poor result is mainly thanks to the fact that until 2023 there has been a regulation in order that made it impossible to install wind farms in large parts of the country (no installation was allowed within 12 km of any settlement). Fortunately, the Hungarian government announced in March 2023 that there will be significant legislative changes on the subject, which they hope will promote the uptake of wind power. (Major, 2021; Bogdán and Babus 2023)

This idea seems reasonable based on Campos et al. (2023), who highlighted, that the wind-solar ratio in the electricity sector should be 0,9 to ensure that the system can easily handle fluctuations and overgeneration.

4.5. Biomass

Analyzing the data for 2022 it is clear, that energy production is currently very low (6,3%) from this type of resource considering the country's potential. Since biomass refers to organic matter which could be a byproduct from forestry or agriculture, Hungary has a high chance to boost its energy production in the future from this type of material. (Nemzeti Energiastratégia, 2011) However, it should not be forgotten that the environmental impacts of this energy source need to be considered in a much broader context than other renewable energy sources (impacts on land use, wildlife, or water management). (Magyarország Energiapolitikája 2007-2020)

4.6. Changes in CO_2 emission

In alignment with the decreasing usage of fossil fuels in the country's electricity mix, the carbon intensity of the sector has also undergone significant changes over the last 2 decades.

Hungary's power sector has experienced a generally declining trend in carbon intensity since the early 2000s. By 2023, emissions from the sector had dropped to approximately 205 grams of carbon dioxide per kilowatt-hour (gCO_2/KWh) of electricity generated, which is the lowest level recorded since 2000. This means that the emission is about 56% less now than the peak level observed in 2003.

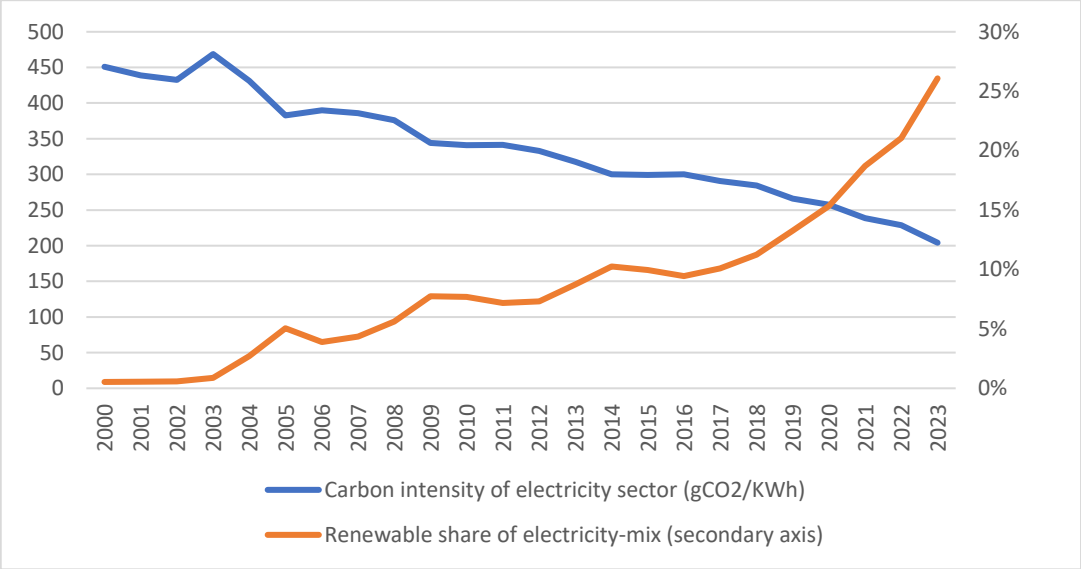

Figure 9: Carbon intensity of the power sector in Hungary from 2000 to 2023 compared with the renewable energy share of the electricity mix (2022)
Source: own editing based on Statista (2024) and KSH (2024a)

Based on the assumption that Hungary will aim for the above-mentioned Nuclear-Coal-Green scenario with 38% gas share and 5% coal share in its electricity mix, there is not much room to improve in carbon intensity.

Making a basic calculation, using the method presented by IPCC (2006) the country's Weighted Emission Factor would be 218,5 gCO_2/KWh[1] in 2030, which of course could be further decreased in case of shifting the natural gas share in favor of renewables.

4.7. CO_2 emission and economic growth

While reducing a country's greenhouse gas emissions is an important thing, governments – especially in developing countries – overall prioritize economic growth over environmental protection objectives. (Bihari, 2021) For this purpose, it is also important to analyze the country's economic indicators.

In the case of Hungary, as can be seen from Figure 10., a clear trend cannot be identified between the changes of GDP/Capita and the Carbon intensity of the electricity sector.

[1] Emission Factor for coal 950 gCO_2/KWh, for natural gas 450 gCO_2/KWh, for renewables and nuclear energy (during operational phase) 0%
Weighted Emission Factor = (0.05x950) + (0,38x450) + (0,16x0) + (0,54x0) = 218,5 gCO_2/KWh

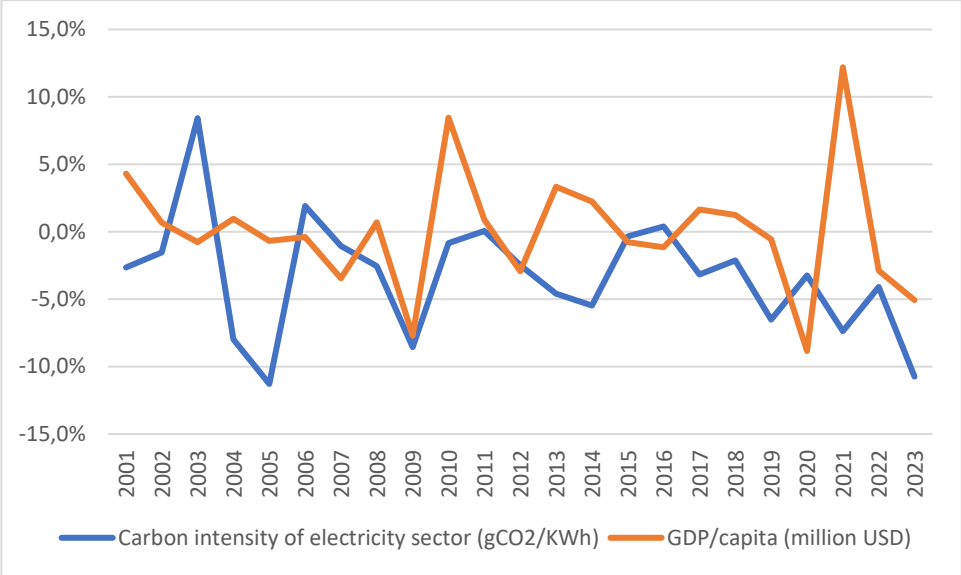

Figure 10: Changes in carbon intensity of the power sector and changes in GDP/Capita in Hungary between 2001-2023
Source: own editing based on Statista (2024) and KSH (2024b)

Reviewing the available data from the 21st century, there were 13 years, where the increase in GDP/Capita paired with a decrease in carbon intensity, however in 10 years, the relation between the two datasets pointed in the same direction.

From this perspective, we can come to two conclusions:

- A clear link cannot be identified between environmental awareness in the electricity sector and economic growth (GDP/Capita)
- Economic performance is a complex topic, which is the result of multiple factors and governmental actions, therefore it cannot be said, that environmental awareness alone harms a country's economy.

5. Conclusion

The analysis of Hungary's electricity mix over the past two decades highlights significant changes driven by the government, focusing on a balanced and secure energy strategy. Policymakers have prioritized diversification, with renewable energy, nuclear power, and natural gas serving as the three main pillars of the energy mix to ensure energy security and sustainability. Notably, a 2023 solar panel and energy storage tender, allocating 75 billion HUF in non-refundable grants - covering 65% of project costs - demonstrates a concrete commitment

to expanding solar capacity. Similarly, regulatory reforms in wind energy aim to support its gradual integration into the mix, because in this case, the country is far behind other European countries.

Nuclear energy also plays a pivotal role, reflecting the country's reliance on this low-carbon source. Unfortunately, the currently operating nuclear power plant units will be phased out between 2032 and 2037, and building new units is time and money-consuming, so there is still a big uncertainty related to nuclear energy generation for the future.

Meanwhile, natural gas remains essential for the country's electricity mix, even though the domestic reserves are low and constant import is needed from this type of resource, which seems to be quite challenging in the current geopolitical situation.

While this strategy aligns with the country's specific needs and conditions, it leaves limited room for further reductions in CO_2 emissions due to the continued use of fossil fuels, which account for around 40% of the energy mix. To meet net-zero goals, Hungary must adopt more ambitious measures to reduce fossil fuel dependency and accelerate renewable energy development. Striking the right balance between sustainability, energy security, and economic growth will be crucial in the next phases of Hungary's energy transition.

Future research could expand on these findings by incorporating quantitative modeling to simulate the potential impacts of various policy scenarios on Hungary's energy mix, while exploring the socio-economic impacts of the energy transition, including public acceptance of renewable energy sources and nuclear energy, could provide a more holistic understanding of the topic. At the same time, comparative studies with other countries in the Central and Eastern European region could shed light on shared challenges and opportunities, enhancing regional energy collaboration and sustainability.

References

Al Baroudi, H., Awoyomi, A., Patchigolla, K., Jonnalagadda, K., Anthony E. J., (2021): A review of large-scale CO2 shipping and marine emissions management for carbon capture, utilisation and storage, Applied Energy, Volume 287, https://www.sciencedirect.com/science/article/pii/S0306261921000684 Downloaded: 2024.03.20.

Bihari, P., (2021): China's energy policy in alignment with the Paris Agreement, In: Nataša, URBANČÍKOVÁ Building Smart Communities for the Future: SMART solutions for energy, Kosice, Slovakia, Technical University of Kosice, pp. 4-10.

Bogdán, A., Babus, G., (2023): A szélerőmű kapacitás növekedése várható Magyarországon https://www2.deloitte.com/hu/hu/pages/jog/articles/a-szeleromu-kapacitas-novekedese-varhato-magyarorszagon.html Downloaded: 2024.03.21.

Campos, J., Csontos, Cs., Munkácsy, B., (2023): Electricity scenarios for Hungary: Possible role of wind and solar resources in the energy transition https://www.sciencedirect.com/science/article/pii/S0360544223013658 Downloaded: 2024.03.22.

Európai Bizottság (2010): Európa 2020: Az intelligens, fenntartható és inkluzív növekedés stratégiája https://ec.europa.eu/eu2020/pdf/1_HU_ACT_part1_v1.pdf Downloaded: 2024.03.19.

Európai Bizottság (2019): Európai zöld megállapodás https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_hu Downloaded: 2024.03.17.

Európai Tanács (2024): REPowerEU: energiapolitika az uniós országok helyreállítási és rezilienciaépítési terveiben,https://www.consilium.europa.eu/hu/policies/eu-recovery-plan/repowereu/ Downloaded: 2024.03.18.

FGSZ (2024): Statisztikai adatok https://fgsz.hu/a-foldgazrol/a-foldgaz-szerepe/statisztikai-adatok Downloaded: 2024.03.21.

Föld Napja Alapítvány (2024): Éghajlatváltozás VS Klímaválság http://fna.hu/vilagfigyelo/eghajlatvaltozas Downloaded: 2024.03.30.

Hua, W., Sha, Y., Zhang, X., Cao, H., (2023): Research progress of carbon capture and storage (CCS) technology based on the shipping industry, Ocean Engineering, Volume 281, https://www.sciencedirect.com/science/article/pii/S0029801823013136#abs0010 Downloaded: 2024.03.24.

Imran, M., Zaman, K., Nassani, A. A., Dinca, G., Khan, H. R., Haffar, M., (2023): Does nuclear energy reduce carbon emissions despite using fuels and chemicals? Transition to clean energy and finance for green solutions, Geoscience Frontiers, https://www.sciencedirect.com/science/article/pii/S1674987123000750 Downloaded: 2024.03.23.

IPCC (2006): 2006 IPCC Guidelines for National Greenhouse Gas Inventories https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html Downloaded: 2024.11.28.

KSH (2024a): Gross electricity production [gigawatt hours] https://www.ksh.hu/stadat_files/ene/en/ene0009.html Downloaded: 2024.11.28.

KSH (2024b): Az egy főre jutó bruttó hazai termék (GDP) értéke és volumenindexe https://www.ksh.hu/stadat_files/gdp/hu/gdp0005.html Downloaded: 2024.11.30.

Leeson, D., Mac Dowell, N., Shah, N., Petit, C., Fennell, P. S., (2017): A Techno-economic analysis and systematic review of carbon capture and storage (CCS) applied to the iron and steel, cement, oil refining and pulp and paper industries, as well as other high purity sources, International Journal of Greenhouse Gas Control, Vol. 61, p. 71-84, https://www.sciencedirect.com/science/article/pii/S175058361730289X Downloaded: 2024.03.23.

Leggett, J. (2008): A fele elfogyott: Olaj, gáz, forró levegő és a globális energiaválság, Typotex Kiadó, Budapest

Magyar Földgáztároló Zrt. (2023): Gáztárolók https://mfgt.hu/hu-HU/Tevekenysegunk/Gaztarolok Downloaded: 2024.03.21.

Magyarország Energiapolitikája 2007-2020 (2007) http://www.pestmegye.hu/images/2014/agazati_strategiak/Magyarorszag_Energiapolitikaja_2008_2020.pdf Downloaded: 2024.03.16.

Major, A. (2021): A világon példátlan szabályokkal lehetetleníti el a szélenergiát Magyarország https://www.portfolio.hu/gazdasag/20210423/a-vilagon-peldatlan-szabalyokkal-lehetetleniti-el-a-szelenergiat-magyarorszag-479054 Downloaded: 2024.03.22.

Major, A. (2022): Napenergia: óriási mérföldkőnél Magyarország, tovább gyorsulhat a növekedés https://www.portfolio.hu/uzlet/20220412/napenergia-oriasi-merfoldkonel-magyarorszag-tovabb-gyorsulhat-a-novekedes-539079 Downloaded: 2024.03.20.

Mavir (2024): Energia MIX - Erőművi termelés primer források szerinti megoszlása és az import-export szaldó - Bruttó üzemirányítási mérések alapján https://www.mavir.hu/web/mavir/energia-mix-eromuvi-termeles-primer-forrasok-szerinti-megoszlasa-es-az-import-export-szaldo-brutto-uzemiranyitasi-meresek-alapjan Downloaded: 2024.03.18.

MEKH (2021): Bruttó villamosenergia-termelés megújuló kategóriájának a részletezése https://mekh.hu/brutto-villamosenergia-termeles-megujulo-kategoriajanak-a-reszletezese Downloaded: 2024.03.17.

Nemzeti Energiastratégia (2011) https://2010-2014.kormany.hu/download/e/19/40000/Energiastrategia.pdf Downloaded: 2024.03.17.

Nun, M. (2021): Mi a kőolaj? Hogyan befolyásolja a világot? https://xforest.hu/koolaj/ Downloaded: 2024.03.18.

Our World in Data (2024a): France: Energy Country Profile https://ourworldindata.org/energy/country/france Downloaded: 2024.03.16.

Our World in Data (2024b): Hungary: Energy Country Profile https://ourworldindata.org/energy/country/hungary Downloaded: 2024.03.16.

Papp, L. (2023): Így termelt áramot Magyarország 2022-ben https://villanyautosok.hu/2023/02/18/igy-termelt-aramot-magyarorszag-2022-ben/ Downloaded: 2024.03.16.

Paks 2 Zrt. (2024): A projekt története https://www.paks2.hu/web/guest/a-projekt-tortenete Downloaded: 2024.03.18.

Planete Energies (2023): What is the Energy Mix https://www.planete-energies.com/en/media/article/what-energy-mix Downloaded: 2024.03.16.

Somogyi, O. (2022): Biztonsági kockázat a túl sok importáram https://magyarnemzet.hu/gazdasag/2022/01/biztonsagi-kockazat-a-tul-sok-importaram Downloaded:2024.03.20.

Statista (2024): Carbon intensity of the power sector in Hungary from 2000 to 2023 https://www.statista.com/statistics/1290234/carbon-intensity-power-sector-hungary/ Downloaded: 2024.11.28.

U.S Energy Information Administration (2022): Natural gas explained https://www.eia.gov/energyexplained/natural-gas/natural-gas-and-the-environment.php Downloaded:2024.03.23.

Világgazdaság (2023): Indul a Napenergia Plusz program https://www.vg.hu/vilaggazdasag-magyar-gazdasag/2023/10/indul-a-napenergia-plusz-program Downloaded: 2024.03.24.

EXPLORING AI TRENDS ON REDDIT WITH R: A SENTIMENT ANALYSIS APPROACH

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ABSTRACT

Purpose:
This study proposes a novel approach to marketing research by employing sentiment analysis of Reddit comments to assess public perception and adoption rates of new technologies. Utilizing R's "syuzhet" and "SentimentAnalysis" packages, the research serves as a proof of concept for leveraging social media discourse in marketing strategies.
Design/methodology:
We collect and analyze Reddit comments on new AI tools, applying sentiment analysis through R's "syuzhet" and "SentimentAnalysis" and some additional packages. This approach enables a comprehensive sentiment assessment, incorporating various sentiment dictionaries and custom terms selection for nuanced analysis.
Findings:
The utilization of R statistical software for sentiment analysis has proven to be an effective method for extracting and interpreting public opinions on new technologies from Reddit forums. By integrating R statistics with packages such as "syuzhet" and "SentimentAnalysis", our study was able to conduct a comprehensive sentiment analysis that not only quantified the sentiment of comments but also provided deeper insights into the emotional nuances expressed by the online community. This strategy reveals R's proficiency in dealing with complex data structures and executing advanced analytical procedures.
Research/practical implications:
The study underscores the practicality of sentiment analysis in capturing real-time public opinion on emerging technologies. It suggests a scalable method for marketers to monitor brand perception and guide product development aligned with consumer sentiment.
Originality/value:
By demonstrating the effective use of sentiment analysis using R statistics on Reddit comments for marketing research, this study contributes a toolset for understanding public attitudes towards new technologies, offering a competitive edge in market strategy development.

Keywords: Marketing research, Sentiment Analysis, Reddit, Technology Adoption, R

JEL Classification: M31, C55, D83

1. Introduction

In this study, we explore the potential of sentiment analysis on Reddit comments as a marketing research tool. Utilizing R's sentiment analysis packages, we provide a proof of concept that demonstrates how social media discourse can be analyzed to understand public opinion on emerging technologies.

2. Literature review/theoretical background

Sentiment analysis is the process of gathering and analyzing people's opinions, thoughts, and impressions regarding various topics, products, subjects, and services. (M. Wankhade et al., 2022) Sentiment analysis intentions to decide the attitudes, appraisals and moods of the user with respect to some of the reviews or complete contextual isolations of a document. (Edison, M., Aloysius, A. 2016) The basic task of sentiment analysis is to classify the polarity in different levels like Document level, Sentence level and Aspect level or entity level. The sentiment or opinion expressed emotions are classified in different classes as positive, negative and neutral. The analysis of these textual contents for sentiments is a gold mine for marketing experts as well as for research in humanities, thus automatic sentiment analysis is a popular area of applied artificial intelligence. (Hangya, 2017) Opinion mining and sentiment analysis in marketing communications, also known as OMSAMC (Sánchez-Núñez, 2020), is a technique used to determine whether consumers are satisfied or dissatisfied with a service or product. This analysis helps identify the strengths and weaknesses of consumer experiences. In the realm of marketing research, it is utilized to measure brand awareness, reputation, and popularity, either at a specific moment or over a prolonged period. Additionally, it assists in tracking how consumers receive new products or features. Figure 1 categorizes sentiment analysis techniques into Lexicon Based, Machine Learning, Hybrid, and Other Approaches. Lexicon methods split into Dictionary and Corpus Based, while Machine Learning includes classifiers like Decision Trees and various neural networks. Hybrid combines features of the first two, and Other encompasses Transfer Learning and Aspect Based approaches. Verma, P., et al. (2019) demonstrate the efficacy of the R programming language in sentiment analysis, particularly for categorizing public opinion on Twitter regarding Indian government projects into distinct emotional states, thereby informing policy-making processes.

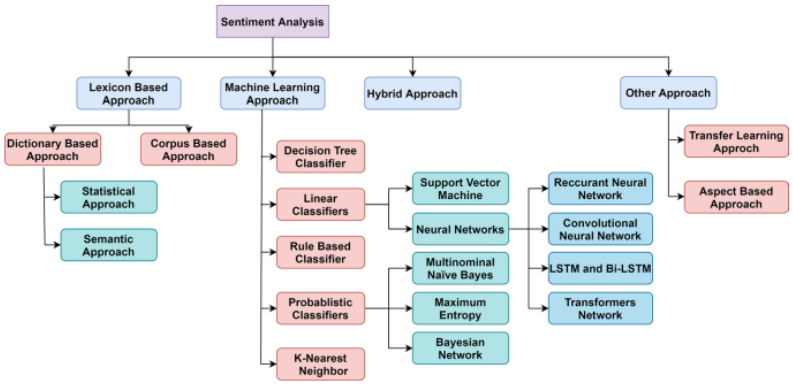

Figure 1 Sentiment Analysis approaches
Source: M. Wankhade et al. (2022)

Sentiment analysis enables businesses to understand and react to customer opinions by analyzing text for emotions, aiding in product improvement and customer satisfaction. (Wankhade et al., 2022) Big Data serves as a crucial component in analytics, particularly focusing on text and web data analysis, collectively known as Sentiment Analysis (SA), which measures people's feelings, behaviors, emotions, appraisals, and attitudes as expressed through texts, images, and emoticons on Social Media Networks. (Edison, M., Aloysius, A., 2017). In the context of sentiment analysis, the study by Ruan (2022) provides a comprehensive overview of public perceptions regarding electric vehicles (EVs) by analyzing approximately 3.4 million Reddit posts from January 2011 to December 2020. This extensive dataset enables the exploration of various topics discussed within different Reddit communities, offering insights into the shifts in sentiment towards EVs over the decade. Figure 2 displays the trend in the number of submissions and comments on Reddit related to electric vehicles (EVs) from 2011 to 2020, showing a notable increase over time, particularly in recent years. Figure 3 tracks the sentiment analysis scores of EV-related comments on Reddit during the same period, using VADER and AFFIN scoring systems, and indicates fluctuating sentiment trends with a general upward trend in positivity.

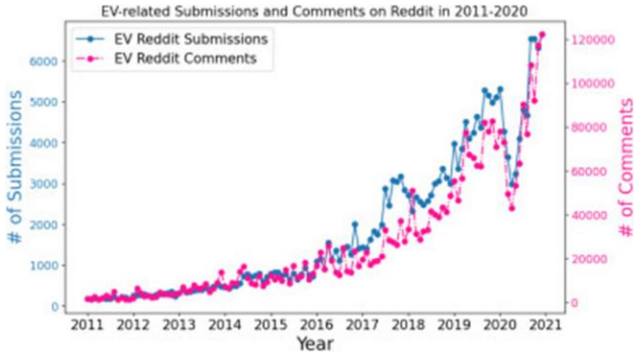

Figure 2 Number of submissions and comments on EV
Source: Ruan (2022)

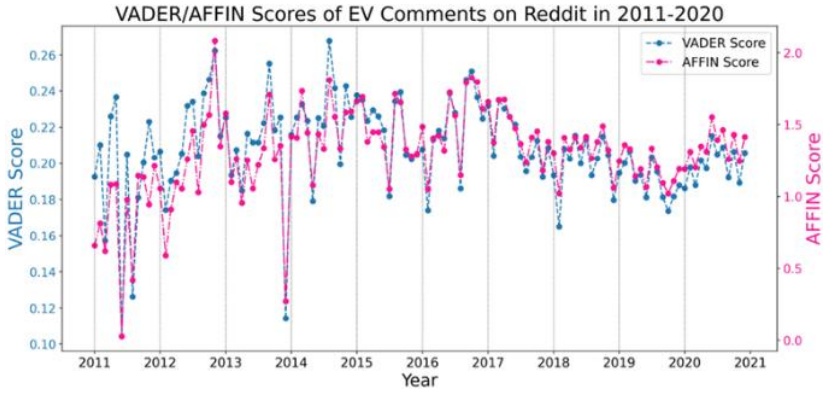

Figure 3 Sentiment analysis score over time
Source: Ruan (2022)

Such analysis is crucial for understanding how public opinion has evolved and varied across diverse groups, including fringe and politically oriented communities. This understanding could play a pivotal role in strategizing to boost EV adoption and reduce greenhouse gas emissions, addressing the key objective of grasping the broad spectrum of public interests and perceptions related to EVs.

Figure 4 Word clouds for topic modeling results (Number of topics = 20)
Sources Ruan (2022)

The word clouds (Figure 4) reveal 20 diverse topics from Reddit posts about electric vehicles (EVs), showing a broad range of user interests that exceed those identified in previous studies. Topics range from consumer concerns about EV prices and brands (e.g., Topics 0, 5, 18), to technical discussions by technophiles on battery and motor technologies (Topics 1, 4, 14). Investors analyze EV stock prices and market performance (Topics 15, 16), while political users focus on EV-related policies and elections (Topics 12, 9). Environmentalists discuss the impact of EVs on climate change and renewable energy sources (Topics 19, 6).

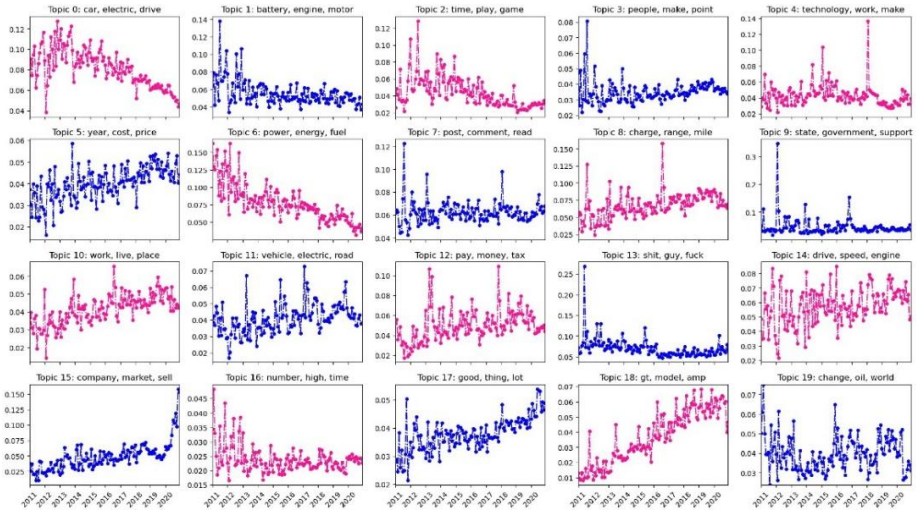

Figure 5 Topic popularity variation trends during 2011–2020
Source: Ruan (2022)

Figure 5 illustrates the changing popularity of 20 topics related to electric vehicles (EVs) from 2011 to 2020. The monthly topic weights, represented by the top three keywords, show varying trends. Notably, Topic 18 (alternative EV brands like Ford and Bolt) and Topic 15 (EV stock performance) gained increasing public interest. In particular, Topic 15 surged in popularity in 2020 due to the strong performance of the EV industry in the stock market. Conversely, interest in other renewable energies (Topic 6) declined. The decline in popularity for alternative EV brands in 2020 may be attributed to mobility restrictions during the COVID pandemic and Tesla's dominating stock performance, drawing attention away from other brands. These trends are confirmed through Mann-Kendall tests, ensuring consistency with the observed patterns. (Ryan, 2022)

3. Methods

To effectively analyze sentiment in Reddit comments (Reddit, 2024) on new AI tools, our methodology employed R Studio (R CORE TEAM, 2023), integrating it with specialized packages to capture and assess the data comprehensively. Initially, we set up our environment in R Studio and installed essential packages such as RedditExtractoR (Rivera, 2023), Syuzhet (Jockers, 2015), SentimentAnalysis (Proellochs, Feuerriegel, 2023), and ggplot2 (Wickham, 2016) for data visualization. The data collection process began by utilizing the RedditExtractoR package, which enabled us to extract posts and comments from the subreddit \ChatGPT, specifically sorted by "new." This step ensured that our database was filled with the latest discussions for analysis. For the sentiment analysis, we applied SentimentAnalysis packages. These tools allowed us to incorporate various sentiment dictionaries enhancing the granularity of our sentiment evaluation. The NRC Word-Emotion Association Lexicon (Mohammad, 2024) was used to classify words according to their associations with eight basic emotions—anger, fear, anticipation, trust, surprise, sadness, joy, and disgust—as well as two overarching sentiments, positive and negative. These emotions are based on Plutchik's model of the eight basic emotions (Mohammad, 2021). In the NRC Word-Emotion Emotion Lexicon, a given word can be associated with one emotion, multiple emotions, or no emotion at all. Similarly, a word can be classified as having positive, negative, both, or neither type of sentiment. Following the sentiment analysis, we used ggplot2 to create visual representations of the data,

facilitating a clearer understanding of the sentiments expressed in the comments. The final stage involved interpreting the results and compiling a comprehensive report on the findings.

4. Results and discussion

Our study leveraged the capabilities of R statistical software for sentiment analysis, focusing on the extraction and interpretation of public opinions from Reddit forums. The RedditExtractoR package proved instrumental in identifying relevant subreddits, threads, comments, rankings, and replies. For our lexicon-based sentiment analysis, we utilized the Syuzhet package, which scores sentiments on an interval from -1 to 1, and applied Saif Mohammad's NRC Word-Emotion Emotion lexicon to detect specific emotions. Additionally, the SentimentAnalysis package offered sentiment scoring within the same interval, harnessing the power of various dictionaries including the Harvard-IV, Henry's Financial, and Loughran-McDonald Financial dictionaries from external sources.

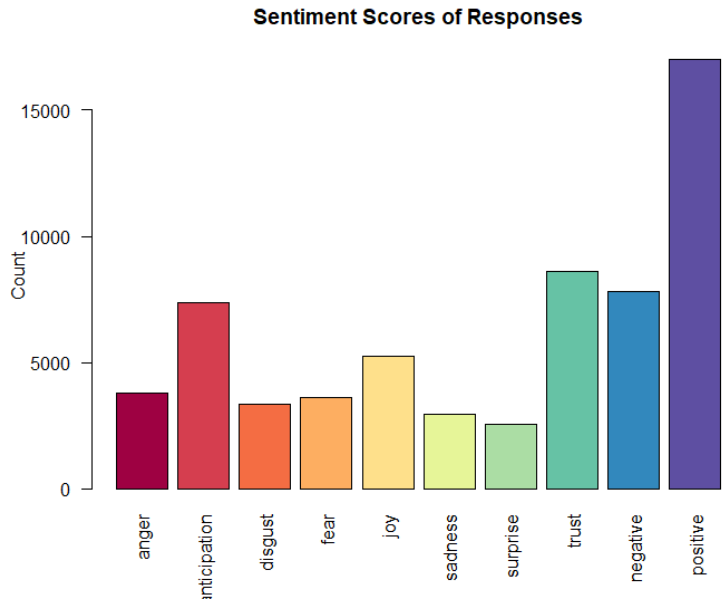

Figure 6 Word count of emotions in dataset
Source: own elaboration

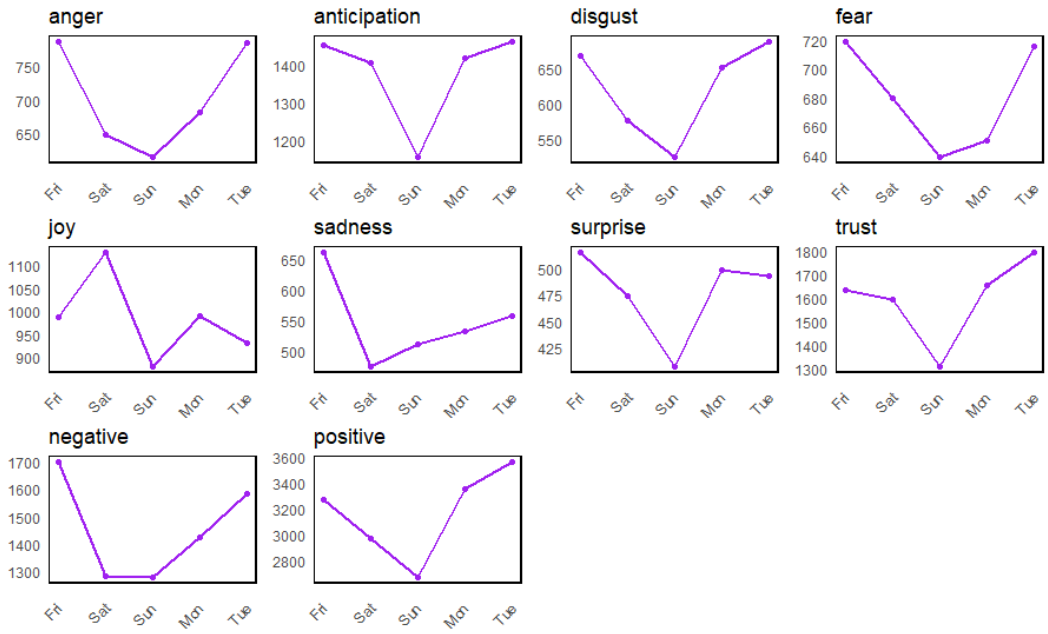

Figure 7 Emotional score over time
Source: own elaboration

In Figure 6, the word counts of various emotions across the complete dataset are displayed, quantifying the prevalence of each identified emotional expression within the analyzed comments and its valence. Figure 7 illustrates the temporal evolution of these emotions, capturing the dynamic changes in emotional scores, including positive and negative sentiment, over time.

The analysis reveals that positive sentiment dominates overall, even though this is not immediately apparent when examining the individual emotion categories. As detailed in the methodology section, the sentiment analysis was conducted using R with the Syuzhet package and the NRC Word-Emotion Lexicon (Mohammad, 2024). In this lexicon, anticipation is predominantly associated with positive valence, containing 842 words in total—449 classified as positive, 143 as negative, 34 as both, and 216 as neutral. This could indicate that anticipation often reflects feelings of hope or excitement, contributing to the prevalence of positive sentiment. Similarly, while words in the surprise category of lexicon can convey both positive and negative valence, the sentiment distribution is more balanced in this category, with a greater proportion marked as positive. This uneven distribution within ambivalent categories likely contributes to the overall dominance of positive sentiment, despite the presence of emotions

traditionally linked to negativity, such as anger or sadness. This analysis underscores the complexity of sentiment polarity when aggregated across categories, highlighting the nuanced nature of emotional classification within the dataset. Future studies could explore context-aware models to address this ambiguity and more accurately distinguish between ambivalent and explicitly positive or negative emotions.

Our analysis encountered several limitations. Firstly, the RedditExtractoR's reliance on the Reddit API introduced constraints, particularly in its inability to extract submissions between specific dates. The Reddit API limits data retrieval to 1000 posts per request, thus only allowing access to the 1000 most recent or most popular submissions from a subreddit. This limitation is significant when attempting to analyze topics with a broader historical context or those related to smaller-scale technologies or specific features. Another challenge arose with the lexicon approach. This method can be problematic when analyzing AI-generated posts, such as those created by ChatGPT for user review. Such content may contain nuances that traditional lexicon methods struggle accurately. Approximately 7% of the dataset was contributed by an automoderator, reflecting the inclusion of repetitive or non-user-generated content. The prevalence of replies echoing previous comments further complicated the sentiment analysis, necessitating meticulous data cleaning. To mitigate these issues and enhance the analysis, it's imperative to continue the development of more sophisticated models. These models must be adept at handling the nuances of AI-generated content and overcoming the limitations imposed by API constraints. Implementing more advanced methodologies will contribute to a more robust and insightful sentiment analysis, providing a clearer picture of public opinion dynamics on Reddit. Furthermore, the analysis also revealed a notable drop in the volume of comments during weekends, which suggests a corresponding decrease in the variety of expressed emotions. Future studies will need to account for this weekend effect to ensure a more accurate representation of sentiment across different time periods.

5. Conclusion

The adoption of R statistical software for sentiment analysis offers a methodologically sound approach for the extraction and interpretation of public opinion on novel technologies from Reddit. By utilizing packages like "syuzhet" and "SentimentAnalysis," the study

conducted a detailed sentiment assessment, enabling the quantification of comments' sentiment and the exploration of subtle emotional expressions within the online narratives. This technique affirms the capability of R to systematically process complex data and perform nuanced analytic tasks.

References

Edison, M., & Aloysius, A. (2016). Concepts and Methods of Sentiment Analysis on Big Data. International Journal of Innovative Research in Science, Engineering and Technology, 5(9).

Edison, M., & Aloysius, A. (2017). Lexicon based Acronyms and Emoticons Classification of Sentiment Analysis (SA) on Big Data. International Journal of Database Theory and Application, 10(7). https://doi.org/10.14257/ijdta.2017.10.7.04

Hangya, V., & Farkas, R. (2017). A comparative empirical study on social media sentiment analysis over various genres and languages. Artificial Intelligence Review, 47(4). https://doi.org/10.1007/s10462-016-9489-3

Jockers ML. (2015). Syuzhet: Extract Sentiment and Plot Arcs from Text. https://github.com/mjockers/syuzhet.

Jockers, M. L. (2023). Syuzhet: Extracting sentiment and emotional content from text. https://cran.r-project.org/web/packages/syuzhet/vignettes/syuzhet-vignette.html

Mohammad, S. M. (2021). Sentiment analysis: Automatically detecting valence, emotions, and other affectual states from text. In Emotion measurement (pp. 323-379). Woodhead Publishing.

Mohammad, S. M. (2024). NRC Emotion Lexicon. https://saifmohammad.com/WebPages/NRC-Emotion-Lexicon.htm

Proellochs N., & Feuerriegel S. (2023). SentimentAnalysis: Dictionary-Based Sentiment Analysis_. R package version 1.3-5. https://CRAN.R-project.org/package=SentimentAnalysis.

R Core Team. (2023). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Reddit. (2024). r/ChatGPT. https://www.reddit.com/ChatGPT

Rivera I. (2023). RedditExtractoR: Reddit Data Extraction Toolkit. R package version 3.0.9. https://CRAN.R-project.org/package=RedditExtractoR.

Ruan, T., & Lv, Q. (2022). Public perception of electric vehicles on reddit over the past decade. Communications in Transportation Research, 2, 100070. https://doi.org/10.1016/j.commtr.2022.100070

Sánchez-Núñez, P., De Las Heras-Pedrosa, C., & Peláez, J. I. (2020). Opinion mining and sentiment analysis in marketing communications: A science mapping analysis in web of science (1998-2018). Social Sciences, 9(3). https://doi.org/10.3390/socsci9030023

Verma, P., Khanday, A. M. U. D., Rabani, S. T., Mir, M. H., & Jamwal, S. (2019). Twitter sentiment analysis on Indian government project using R. International Journal of Recent Technology and Engineering, 8(3), 8338–8341. https://doi.org/10.35940/ijrte.C6612.098319

Wankhade, M., Rao, A. C. S., & Kulkarni, C. (2022). A survey on sentiment analysis methods, applications, and challenges. Artificial Intelligence Review, 55(7). https://doi.org/10.1007/s10462-022-10144-1

Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York.

DETERMINANTS OF FDI IN EUROPEAN COUNTRIES

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ABSTRACT

Purpose:
In dynamically changing conditions of the business environment influenced by innovations such as artificial intelligence, machine learning and other achievements of Industry 4.0 or as well as geopolitical changes and the effects of the pandemic, there is a question: How these changes affect capital flows between countries, specifically foreign direct investments (FDI) flows? The paper examined the role of macroeconomic determinants on FDI flows in the member states of the European Union.
Design/methodology:
Cluster analysis is method, that examined the distribution of the similarity of countries. This analysis provides a division of European economies based on the similarity of selected macroeconomic determinants. Using the correlation matrix, we can see the relationships of individual determinants with each other. The data were collected from the official websites of the World Bank, UNCTAD and the OECD database. According to Slovakia's data, the data were collected from the National Bank of Slovakia and the Slovak Investment and Trade Development Agency (SARIO).
Findings:
The main finding of this article is the division of European countries into groups based on the similarity of determinants. Through the cluster analysis, the distribution of 26 EU member countries was obtained. Cluster analysis divided countries into several clusters. One of them contain countries that joined the EU in 2004 and later. These countries have a higher degree of trade openness. Another cluster is made up of countries that joined the EU before 2004. These countries are more developed and have a higher population. Some countries are different, such as Malta, due to their high trade openness.
Research/practical implications:
This study can be helpful for future studies focused on the analyzing FDI flows with regard to the current situation where digitalization and technical progress in science and research affect the influx of FDI flows. It contains the basic differences of individual European countries. Future researches can be focused on determinants – which determinant has the greatest impact on FDI inflows in today's digitized world. It is questionable how much countries can increase FDI inflows through increased investment in science and research.
Originality/value:
Nowadays, when artificial intelligence and technological progress have caused a change in production, the labor market, but also the current overall economic situation, countries had to make changes in production and invest in new industries. Each country invests foreign direct investment in different industries. Besides the macroeconomic perspective on European

countries, we also monitored the situation in Slovakia and its future outlook. Thus, this study is enriched with a microeconomic perspective on this timely issue.

Keywords: foreign direct investment, research and development expenditure, cluster analysis

JEL Classification: F21, O30

1. Introduction

For some authors, the interest in researching foreign direct investments (FDI) is mainly due to their positive impact on the host country. FDI in the countries has been increasing for twenty years and currently the FDI flows are higher than it was in the past. The FDI inflow into countries is influenced by several macroeconomic determinants. The main motivation of investors is profit (Stawicka, 2013), and therefore investors are looking for a suitable country to invest. Traditional macroeconomic determinants include GDP, unemployment rate, inflation, political environment, natural resources and education of the population. The current situation caused by digitization and technological progress forces countries to increase their competitiveness and attract FDI with other than traditional macroeconomic determinants. (Najabat Ali et. al., 2023)

This study follows foreign direct investments and their determinants in European countries. Since the differences in European countries are visible, the main goal is the examination of diversity using cluster analysis.

2. Literature review/theoretical background

Ferenčíková, Michník, and Šesták (1997) concurred that the inflow of foreign direct investment (FDI) aids in economic growth, highlighting its importance especially in developing countries. FDI is recognized as a crucial form of business with the primary goal of profit-making. This capital influx not only increases the employment rate and the qualification of the workforce but also fosters the creation of new jobs and enhances managerial skills among others.

Historically, FDI primarily flowed from developed to less developed countries. Caccia and Pavlova (2018) noted that such investments introduce new and modern production methods, thereby reducing unemployment. Hossain et al. (2019) added that the introduction of new

technologies improves the workforce in developing nations. Mateev and Tsekov (2014) identified macroeconomic stability as a critical factor for investors, emphasizing that less developed countries should strive for this along with a stable political and institutional environment.

Stawicka (2013) categorized the motives behind choosing a country for capital transfer into cost motives, which include factors like wages and natural resources, and mixed motives, such as the level of corruption and established controls, as well as profit motives which focus on the evaluation of the investment.

Carstensen and Toubal (2004), along with Stoian and Filipaios (2007), argued that factors such as the level of corruption, credit risk, and quality of institutions significantly impact FDI in Europe, where the institutional and political environment is meticulously monitored. Mateev and Tsekov (2014) reiterated that traditional macroeconomic determinants like unemployment rate, inflation, and GDP per capita significantly influence FDI inflow into EU countries, with Stawicka (2014) adding that Central and Eastern European countries attract foreign investors due to geographical advantages and lower labor costs.

Najabat Ali et al. (2023) highlighted that multinational companies face intense market competition, leading them to innovate to increase their market share. Brahim and Dupuch (2016) suggested that while natural resources were once a key attractor for FDI, the focus has now shifted towards research, development, and innovation. Vega and Neto (2013) explored how the composition of foreign capital entering a country is a vital determinant of economic growth, with countries receiving more FDI achieving higher growth levels. Lastly, Najabat Ali et al. (2023) examined the spillovers of FDI, particularly how technological innovations influenced by FDI and research and development spending can significantly benefit the host economy's technology sector.

3. Methods

This study is focused on European countries. The aim of the study is to examine FDI inflow, macroeconomic determinants and R&D expenditure. This is the reason why cluster analysis was chosen.

Trebuňa and Halčinová (2010) describe cluster analysis as a methodological approach that groups studied objects - such as EU member countries - based on their similarities or dissimilarities. This process results in clusters that consist of countries with similar outcomes in determinants or flows of foreign direct investment (FDI). Countries grouped into different clusters exhibit distinct values, and the variations between clusters are more pronounced than the differences between countries within the same cluster.

If we want to use this method, the data can´t be correlated. Values in the correlation matrix that are close to the number "1" indicate that there is a high correlation between these determinants. The correlation matrix between variables does not show a high correlation. This is why it is appropriate to use cluster analysis. (Kakalejčík and Bucko, 2018)

Table 1 Matrix colleration

	FDI	GDP	IR	UR	EO	CT	RD
FDI	1,00000	-0,00559	0,14166	-0,09631	0,50304	-0,05288	-0,27390
GDP	-0,00559	1,00000	-0,40902	-0,08409	0,13129	0,09437	0,54458
IR	0,14166	-0,40901	1,00000	-0,31887	0,09409	-0,59572	-0,29607
UR	-0,09637	-0,08409	-0,31887	1,00000	-0,41387	0,19180	-0,09813
EO	0,50304	0,13129	0,09409	-0,41387	1,00000	0,02418	-0,33254
CT	-0,05288	0,09437	-0,59571	0,19180	0,02418	1,00000	0,15200
RD	-0,27390	0,54458	-0,29607	-0,09813	-0,33254	0,15200	1,00000

Source: own elaboration, R Studio

Cluster analysis cannot contain extreme values or incomplete data. All observations have to be complete. The authors recommended rescaling data. Thanks to this, we avoid data distortion. (Kakalejčík and Bucko, 2018)

Through distance measure, association coefficient, correlation coefficient or similarity measure, we can examine the similarity between objects. The distance measure is the most widely used. In this study, we chose the Euclidean distance. We consider "n" objects and each object is characterized by "k" characters. "n" means 27 European countries and "k" means determinants - there are 7 determinants in this study. (Trebuňa and Halčinová, 2010)

Formula:

$$d_{ij} = \sqrt{\sum_{k=1}^{n} (X_{ik} - X_{jk})^2}$$

where, X_ik represents the value of the k-th variable for the i-th object,
X_jk represents the value of the k-th variable for the j-th object.

A hierarchical agglomerative clustering procedure was used in this study. This process gradually connects objects - from the most similar to the most different. Ward's method was also used - this method produces clusters that are similar in size. The measure of homogeneity is the within-cluster sum of squares that deviate from the mean of the ESS cluster (error sums from squares).

The analysis was tested in the R Studio program, where we used several necessary packages: *NbClust, psych, cluster,* etc. Based on the similarity of the objects, the program defined the necessary number of clusters.

Based on the studies mentioned in the literature review, traditional macroeconomic variables (GDP per capita, inflation rate, unemployment rate) and political determinants (corporate income tax) were selected. Some recent studies (Najabat Ali, et. al, 2023) mention that in the current situation, where innovation, technological progress and AI are changing and facilitating production, science, research and innovation are becoming an important determinant. R&D expenditure will be also used.

Table 2 Variables

Variable	**Designation**	**Unit of measurement**	**Source**
Foreign direct investment, net inflow	FDI	Percentage of GDP	IMF
HDP per capita	GDP	GDP per person	IMF
Inflation rate	IR	Percentage	World Bank
Unemployment rate	UR	Percentage	World Bank
Trade openness	EO	Percentage of GDP	World Bank
Corporate taxes	CT	Percentage of GDP	OECD
Research and development expenditure	RD	Percentage of GDP	World Bank

Source: own elaboration

4. Results and discussion

The European Central Bank claims that trade openness is related to FDI inflows. It is connected by multinational companies that create subsidiaries on the territory of other countries. The literature reports a positive correlation between FDI inflows and trade openness. (Carril-Caccia, Pavlova, 2018) This was also shown by the correlation matrix in this study with a value of 0.5.

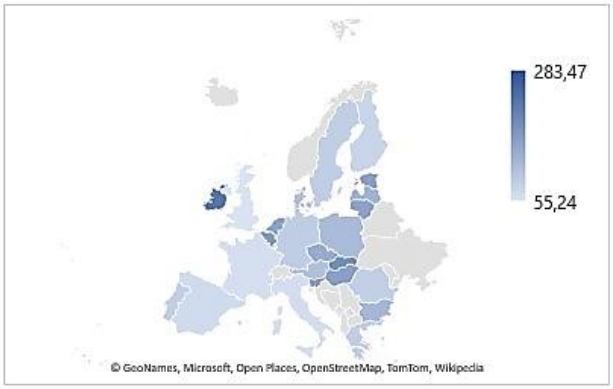

Figure 1 Trade openness in 2021 in Europe
Source: Own elaboration, World Bank (2023)

The studied European countries have different levels of trade openness. The diversity of the countries is visible, but they are still connected within the integration grouping. Over the past 20 years, the trade openness has increased. Smaller European countries usually achieve a higher level of trade openness – Belgium, Estonia, Slovenia. More developed countries achieve a low level of trade openness. Each of these countries focuses on exporting different products, but they are more independent compared to more open countries.

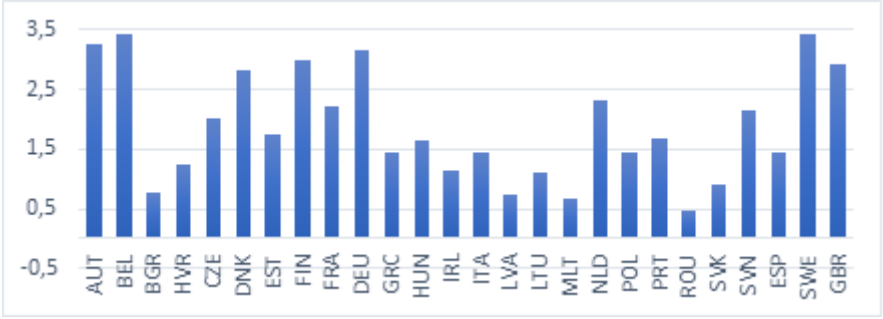

Figure 2 R&D expenditure in 2021(%GDP)
Source: own elaboration, World Bank (2023)

In recent years, investments in research and development have grown faster than economic output. In 2017 and 2018, R&D expenditure grew very intensively. Before the pandemic, R&D grew by 8.5%, while world GDP grew by 2.4%. (The Global Innovation Index, 2020)

Belgium (3.43%) and Sweden (3.42%) are countries that achieve the highest value of R&D expenditure (%GDP). Romania is the country with the lowest value (0.47%). The government, aims to increase R&D expenditure to 1% through the creation of a Ministry of Research. (2023 Country report, European Commission) Countries that also reach low values: Malta (0.67%) or Latvia (0.74%).

Unfavorable conditions during the coronavirus pandemic caused a reduction in some types of investment. This crisis was different from other macroeconomics - some sectors saw an increase in science and research. These were mostly applications that helped track home delivery, electronic bicycles and scooters, etc. (14th Edition, Global Innovation Index, 2021)

A new study published in early 2023 examined the impact of FDI and R&D expenditure in the development process of countries. The results showed that the impact of R&D on development is more significant than FDI itself. The authors claim that a higher value of R&D expenditure leads to less dependence on FDI in development. This relationship also applies vice versa. Countries should focus on investing in science and research as a way of supporting development. (Dwumpfour et al., 2023)

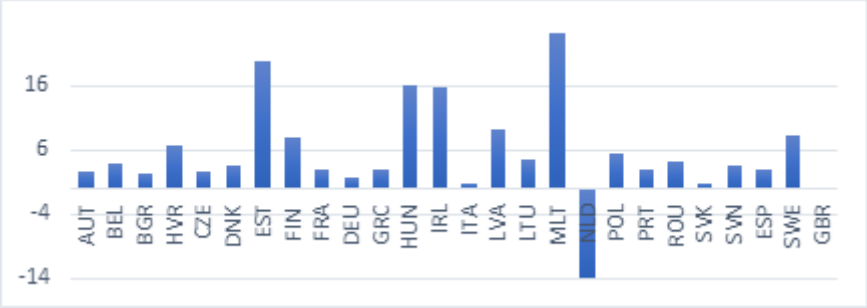

Figure 3 Net inflow FDI in 2021 (%GDP)
Source: own elaboration, IMF (2023)

The amount of capital flowing to European countries is different, because the countries in the integration group are heterogeneous. They differ in size, wealth of natural resources, skilled labor force, population size, political environment, etc.

Some of the studied countries have FDI inflow higher than 10% of their GDP. Malta and the Netherlands are the investment centers of Europe. These countries are intermediaries in the FDI flows of the Eurozone, and a large part of FDI goes to other countries. The FDI of these countries is more volatile and a small part of these flows remains in the country. (ECB, 2023) FDI inflows have been negative in the Netherlands for several years. In 2021, there were approximately 25,100 multinational companies in the Netherlands. (UNCTAD, 2023)

A better view of FDI in these countries will show us several insights: (Sources: UNCTAD, 2023; National Banks)

1. FDI inflow in smaller economies is primarily from Germany and from Netherlands - these countries are a significant investor in smaller economies (Slovakia, Hungary, Romania, Poland, Czech Republic, ...).
2. Important investors in smaller economies also include neighboring countries. For example, in Slovakia it is Austria and the Czech Republic, in Latvia it is Estonia and Lithuania, etc.
3. The USA is an important investor in advanced economies belonging to Netherlands, Germany, Austria, Belgium, United Kingdom.
4. The United Kingdom is not among the significant investors of smaller countries, but a large amount of FDI from GBR goes to the countries of more developed countries – Netherlands, Denmark, Sweden, France, Italy, Germany, ...
5. Sweden is significant investor of the Baltic countries: Lithuania, Latvia, Estonia.

Slovakia is a suitable country for foreign investors mainly due to its highly qualified workforce and affordable costs. In Slovakia, investments are successfully placed in regions with high employment, which, however, deepens the differences between regions. Slovakia achieves a value of 0.92 (%GDP) in R&D expenditure. Over the past 10 years, the government has allocated more money to science every year. In 2012 it was €585 million and in 2021 investments in science and research were €918 million. (SARIO, 2024)

In Slovakia, most investments go to technical sciences (56%). Slovakia focuses on technical skills – the automotive industry is one of the most important, followed by electrical engineering and mechanical engineering. The second sector with the highest value is medical and

pharmaceutical sciences (22%), and the least investment goes to agricultural sciences and humanities at 4% of the total expenditure on science and research. (SARIO, 2024)

Slovakia is leader in car production per capita (184 cars per 1000 inhabitants in 2020). SARIO (2024) states that the main goal of investment incentives in Slovakia is to attract new interesting and beneficial projects to regions with higher unemployment. The highest unemployment in Slovakia is primarily in eastern Slovakia. There is an effort to attract investment projects with higher added value. Volvo started construction in the Košice region. Thanks to this investment, the employment rate will increase, a bicycle path will be built to facilitate travel, and new apartments will be built in the vicinity.

Cluster analysis was carried out for the year 2021 for 26 European countries. 25 EU member states were included in the analysis - except for Cyprus (due to lack of data) and Luxembourg (due to extreme values). The United Kingdom was also included in the analysis, as it was part of the EU for many years and is among the more developed countries, such as France and Germany included in the analysis.

Figure 4 Clusters
Source: own elaboration, R Studio

Cluster analysis classified the studied countries into the following clusters:

1. Cluster 1 is made up of countries that joined the EU in 2004 during the largest enlargement of the EU and later. These countries are selected of Central, Northern and Southern Europe. GDP per capita is lower in these countries than in other clusters. These countries are smaller and have lower population and they are more dependent on others. Trade openness in these countries is higher than 100%.

2. Cluster 2 is made up of countries whose values differ from the rest of the monitored countries. Malta and Ireland achieve high trade openness and the share of FDI is much higher. Trade openness in these countries is 229% (IRL) and 283% (MLT). Malta has the highest

corporate tax (35%) and Ireland has the highest GDP per capita compared to other countries (101,983.64).

3. Cluster 3 consists of countries that joined the EU earlier. These are the countries whose GDP per capita is higher compare to others. The United Kingdom has the lowest GDP per capita in this cluster (46,421.61). Trade openness is not higher than 100% and these countries achieve relatively high values of R&D expenditure - near 3%.

4. Cluster 4 also consists of developed European countries that achieve low trade openness - from 60% to 90%. They are more independent countries belonging to Western Europe. The exception is Greece, which ranks among Southern Europe.

Within the EU, the geographical location of countries and their potential is important. The key motivation was the development of the market, and therefore a large part of FDI was directed to the larger countries of later EU members – Poland, Czech Republic, Hungary. The automotive industry has the largest share in production, followed by engineering, metal industry, chemical sector. (Veugelers, 2013)

5. Conclusion

This study examines the similarity of European countries based on determinants. FDI flows in the European Union are constantly flowing and innovation is becoming an important factor in FDI inflows. That is why it is important to address this issue. The selected sample includes 26 EU member countries and one former EU member - the United Kingdom.

The results indicate the division of countries into several basic groups:

1. Countries that joined the EU in 2004 and later. These countries have a higher value of trade openness and are more dependent on more developed countries. A large part of FDI in these countries is made up of the Netherlands and Germany.

2. Countries that joined the EU earlier than in 2004. These are the so-called "original EU members" and some later members. These are advanced economies that make up a large part of FDI flows in Europe.

3. Countries with different values of determinants. This group includes Malta and Ireland. They achieve different values in GDP per capita, trade openness or FDI inflow.

The new business environment, where digitization and technological progress change the conditions, countries must adapt. Efforts to attract FDI to countries vary from various factors. Countries must adapt to maintain their position in global competitiveness.

References

Acaravci, A., & Ozturk, I. (2012). Foreign direct investment, export and economic growth: Empirical evidence from new EU countries. *Institute for Economic Forecasting*. https://ideas.repec.org/a/rjr/romjef/vy2012i2p52-67.html

Brahim, M., & Dupuch, M. (2016). Foreign direct investments in Europe: Are the East-West differences still so noticeable? *The European Journal of Comparative Economics*. https://ejce.liuc.it/18242979201601/182429792016130102.pdf

Caccia, F., & Pavlova, E. (2018). Foreign direct investment and its drivers: A global and EU perspective. *ECB Economic Bulletin*. https://www.ecb.europa.eu/pub/economicbulletin/articles/2018/html/ecb.ebart201804_01.en.html

Carstensen, K., & Toubal, F. (2004). Foreign direct investment in Central and Eastern European countries: A dynamic panel analysis. *Journal of Comparative Economics, 32*(1), 3-22. https://econpapers.repec.org/paper/halcesptp/hal-00311585.htm

Dutta, S., Reynoso, R., Lanvin, B., & et. al. (2021). The Global Innovation Index, 2020. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020-chapter1.pdf

Dwumfour, R. A., Pan, L., & Harris, M. N. (2023). FDI and development redux: Is R&D a substitute for FDIs? *MPRA Paper No. 116117*. https://mpra.ub.uni-muenchen.de/116117/

European Central Bank. (2023). The EU's open strategic autonomy from a central banking perspective. https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op311~5065ff588c.en.pdf

European Commission. (2023). Country report – Romania. *Institutional Paper 247*. https://economy-finance.ec.europa.eu/system/files/2023-06/ip247_en.pdf

Ferenčíková, S., Michník, Ľ., & Šesták, J. (1997). *Priame zahraničné investície: Vnútorné a medzinárodné súvislosti*. Sprint.

Hossain, M., & spol. (2019). Effects of export and technology on economic growth: Selected emerging Asian economies. *Economic Research-Ekonomska Istraživanja, 32*(1). https://www.tandfonline.com/doi/full/10.1080/1331677X.2019.1650656

Kakalejčík, L., & Bucko, J. (2018). Mobile shoppers: Ako nakupujú majitelia smartfónov. Technická univerzita v Košiciach.

Mateev, M., & Tsekov, I. (2014). Are there any top FDI performers among EU-15 and CEE countries? A comparative panel data analysis. *Financial Theory and Practice, 38*(3), 337-374. https://www.researchgate.net/publication/271005422

Najabat, A., & spol. (2023). Does FDI foster technological innovations? Empirical evidence from BRICS economies. *PLoS ONE*. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0282498

Neto, D., & Veiga, F. (2013). Financial globalization, convergence and growth: The role of foreign direct investment. *Journal of International Money and Finance, 37*, 161-186. https://www.sciencedirect.com/science/article/abs/pii/S0261560613000430

SARIO. (2024). Automotive sector. https://www.sario.sk/sites/default/files/sario-automotive-sector-in-slovakia-2024-02-20.pdf

SARIO. (2024). R&D & Innovation Sector in Slovakia. https://www.sario.sk/sites/default/files/sario-research-and-development-2024-02-21.pdf

Stawicka, M. (2014). Determinants of foreign direct investment inflows in Central and Eastern European countries. *Quarterly Journal Oeconomia Copernicana*. https://www.ceeol.com/search/article-detail?id=122983

Stoian, C., & Filipaios, F. (2007). Foreign direct investment and aid: Engines for growth in transition economies? https://www.researchgate.net/publication/42603654

Trebuňa, P., & Halčinová, J. (2010). Princípy zhlukovej analýzy. *Trends and Innovative Approaches in Business Processes*. https://www.sjf.tuke.sk/umpadi/taipvpp/2010/index.files/clanky%20PDF/TREBUNA_HALCINOVA.pdf

United Nations Conference on Trade and Development. (2023). *World Investment Report, 2023*. https://unctad.org/system/files/official-document/wir2023_en.pdf

Veugelers, R., & Cincera, M. (2013). Young leading innovators and the EU's R&D intensity gap. *Economics of Innovation and New Technology, 22*(2), 177-198. https://www.tandfonline.com/doi/abs/10.1080/10438599.2012.731166

World Intellectual Property Organization. (2021). *Global Innovation Index, 14th Edition*. https://www.wipo.int/publications/en/details.jsp?id=4560

KEY DETERMINANTS OF NON-PERFORMING LOANS: EVIDENCE FROM EUROPEAN UNION COUNTRIES

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ABSTRACT

Purpose:
The non-performing loans ratio (NPLR) is a key measure for assessing the quality of bank´s loan portfolios. Information about the quality of a bank´s loans is a significant topic, sparking interest among the public as users of banking services, potential investors, bank management, financial markets, banking supervisors, and regulators concerned with financial system stability. The main aim of this study is to examine the development of NPLR and, using a panel fixed effects model, identify the key determinants significantly impacting it in EU countries, taking into account country-level data (macroeconomic and bank-specific) for the period 2008 - 2021.
Design/methodology:
We analyzed non-performing loans in EU countries from 2008 to 2021 using aggregated data from individual countries. To examine the relationship between macroeconomic and bank-specific determinants and NPLR, we employed a fixed-effect model chosen based on various tests (F-test, Lagrange Multiplier test, and Hausman test). In selecting individual variables to include in the model, we drew inspiration from multiple studies (Kjosevski and Petkovski (2021), Ari et al. (2021), Messai and Jouini (2013), etc.). Subsequently, we tested the theoretical and statistical model assumptions: significance of effects, cross-sectional dependence, serial correlation, heteroskedasticity, and stationarity. After considering these assumptions, we estimated the variance-covariance matrix to evaluate the results.
Findings:
In the European Union, non-performing loans (NPL) currently stand at around 1.8% of total gross loans, with varying rates among countries. Greece and Cyprus show the highest NPL levels, exceeding 20% of total loans, while Nordic countries, except Latvia and Lithuania, remain below 1%. Southern European countries generally have slightly higher NPL levels than their Central European and Nordic counterparts. Based on the panel regression results, we identify GDP growth, inflation, unemployment, interest rates, bank capital to assets ratio, and loan-to-deposit ratio as key determinants affecting NPL development in these countries.
Research/practical implications:
When comparing our findings to other studies, we identified a dynamic bias in our model caused by the fact that NPL cannot be immediately written off and persist on a bank´s balance sheets for several years. Due to this, we cannot consider our results relevant. Therefore, conducting the Generalized Method of Moments (GMM) estimation is advisable to assess their practical implications, which provides us with the opportunity for further research. Further research could also benefit from including new variables, such as exchange rates, stock prices, and bank concentration, as their influence has been statistically significant in existing studies.

Originality/value:
During sample selection, we aimed to include as many EU countries as possible and cover an extensive period. However, our efforts were constrained by data availability. Despite this limitation, our examined sample represented a relatively large subset of countries compared to other studies focusing on only a few countries. We utilised aggregated data from individual countries to mitigate the risk of insufficient representation. Aggregated data can be considered more suitable as they provide us with a comprehensive view of the entire banking system of each respective country.

Keywords: non-performing loans, macroeconomic determinants, bank-specific determinants, panel regression

JEL Classification: C33, G21

1. Introduction

The issue of non-performing loans (NPL) is an important topic in terms of the financial stability of the banking system. After the global financial crisis in 2008, EU countries experienced a rapid increase in the level of NPL, which was then worsened by subsequent debt crisis. Considering the interconnection between the quality of bank loans and the economic cycle, the increase in NPL following the crisis isn´t entirely unexpected. However, these financial crises demonstrated that NPL could increase to a level significant enough to pose a real problem for bank´s business activities and their financial stability (Ari et al., 2021). Despite the recent decrease in the level of NPL, banks still face the risk of loan defaults because people are losing their jobs and companies are encountering financial difficulties almost every day.

The interest of individual banks is to maintain an adequate level of capital to cover losses caused by potential loan defaults. Generally, the higher risk of default on individual loans, the more capital a bank needs to hold to cover them (ECB, 2023). Therefore, a high level of NPL requires coverage with a large amount of capital. This capital could be used by banks to improve their efficiency, performance, and condition at lower levels of NPL. In the European Union, NPLR currently stand at around 1.8%, with varying rates among countries (World bank, 2023). As a result, the question arises as to what factors contribute to the variation among individual countries and which determinants influence the development of NPLR.

The structure of the paper is organized as follows: After the Introduction, Section 2 provides the reader with the theoretical knowledge necessary to understand the issue of NPL. Theoretical insights primarily focus on the determinants of NPL, which are divided into macroeconomic

and bank-specific determinants. Section 3 describes the sample and the empirical methodology. Section 4 presents the results of the analysis, and Section 5 offers concluding remarks and possible topics for further research.

2. Literature review/theoretical background

There is no uniform definition or universally recognized standard for the term "NPL". However, there are specific criteria used by the international financial institutions for identifying NPL. According to the definition of the ECB, a loan becomes non-performing if there are indications that the borrower is likely to default on the loan or if more than 90 days have passed without the borrower fulfilling the agreed payment (ECB, 2017). The fact that the quality of loans is closely linked to the economic cycle is well-known and not surprising. Following the outbreak of the global financial crisis in 2008, there was a significant increase in the level of NPLR in individual countries. Although almost all countries around the world faced rapid growth in NPLR after the crisis, the growth varied among different groups of countries and within countries within the same group (Ari et al., 2021). For example, in OECD high-income countries, the NPLR increased from 2.5% in 2007 to 3.7% in 2010. In Central Europe, Southeast Europe, and the Baltic states, the NPLR change from 2.1% in 2006 to 15% in 2014 (Kjosevski and Petkovski, 2021).

Therefore, the question arises: what causes the differences in the growth of NPLR among countries? In other words, which determinants influence the level of NPLR? To identify the key determinants most authors used the panel regression. The determinants of NPLR can be categorized into macroeconomic and bank-specific determinants. Among the most frequently examined macroeconomic determinants are GDP growth, inflation, unemployment, general government debt, and interest rates (Tölö and Virén (2021), Kjosevski and Petkovski (2021), Radivojevič et al. (2019), Beck et al. (2015), Messai and Jouini (2013), etc.). The expected impact of this variables is presented in Table 1.

Table 1 Expected relationship between macroeconomic determinants and NPLR

Macroeconomic determinants	Expected sign	Closer characterization of the relationship between variables
GDP growth	(-)	The period of expansion is characterized by GDP growth, during which there is also an increase in overall income levels and a reduction in financial stress. It is rational to assume that the population will have fewer difficulties repaying loans due to higher income levels, and therefore, the NPLR will decrease during this period. Conversely, during a recession, this assumption is reversed (Kjosevski and Petkovski (2021), Beck et al. (2015), Messai and Jouini (2013), and Klein (2013)).
government debt	(+)	During the recession, there is an increase in the NPLR and also an increase in government debt because the government typically needs to borrow a significant amount of financial resources during this period. Thus, it is assumed that there is a positive relationship between these variables (Kjosevski and Petkovski (2021), and Makri et al. (2014)).
interest rates	(+)	The positive correlation between interest rates and NPLR can be explained by the decrease in borrowers' ability to fulfill their obligations (Messai and Jouini, 2013).
inflation	(+/-)	The relationship between inflation and NPLR isn't as straightforward as with previous determinants. A negative correlation has been demonstrated in the study by Vogiazas and Nikolaidu (2011). Conversely, Gunsel (2012) and Donatah et al. (2014) indicate a positive relationship.
unemployment	(+)	A positive relationship indicates that an increase in unemployment weakens borrowers' ability to repair their loans, leading to an increase in NPLR (Makri et al. (2014), Mesai and Jouini (2013), and Bofondi and Ropele (2011)).

Source: own elaboration

The development of NPLR is also significantly influenced by bank-specific determinants. Bank profitability is closely related to their risk behavior. Highly profitable banks have less incentive to engage in high-risk activities; therefore, it is assumed that there will be a lower NPLR. Conversely, less profitable banks may be tempted to resort to less reliable and risky placements to increase their profitability and meet regulatory requirements, leading to an increase in the NPLR. Therefore, a negative relationship between bank profitability and NPLR is expected (Kjosevski and Petkovski (2021), Makri at al. (2014), and Boudriga et al. (2009)).

3. Methods

We analysed the macroeconomic and bank-specific determinants of NPLR in EU countries over the period 2008 – 2021. To obtain the data for NPLR, we utilized the World bank database, which provides data for almost all EU countries from 2008. An exception was Croatia, for which only one NPLR data point in 2021 was available. From the similar reason Cyprus was also excluded from the sample. As a result, the final sample consists of 25 EU countries.

To examine the relationship between determinants and NPLR, we use panel regression, which combines time series analysis with regression components simultaneously (Baltagi, 2005). We employed a fixed-effects model chosen based on various tests (F-test, Lagrange Multiplier test, and Hausman test). Subsequently, we tested the theoretical and statistical model assumptions: significance of effects (F-test), cross-sectional dependence (Pesaran CD test), serial correlation (Breusch-Godfrey/Wooldridge test), heteroskedasticity (Breusch-Pagan test), and stationarity (Augmented Dickey-Fuller test). After considering these assumptions, we estimated the variance-covariance matrix to evaluate the results, as recommended by Zeileis (2004). The specific panel regression model we use looks as follows:

$$NPLR_{i,t} = \beta_i M_{i,t} + \beta_i B_{i,t} + \varepsilon_{i,t} \quad (1)$$

where NPLR represents the ratio of NPL to total loans, M denotes the vector of macroeconomic variables, and B is the vector of bank-specific variables. The index i corresponds to the examined country in the sample, and the index t denotes the year, with ε representing the error term. The variables were selected based on the previous studies

(Kjosevski and Petkovski (2021), Ari et al. (2021), Messai and Jouini (2013), etc.). Table 2 provides the definition of variables and source of data.

Table 2 Variables included in the model

Variables Type	Symbol	Variables	Source
Dependent variable	NPLR	Bank nonperforming loans to total gross loans (%)	World Bank (2022)
Macroeconomic variables	GDPG	GDP growth (annual %)	World Bank (2022)
	INF	Inflation, consumer price (annual %)	World Bank (2022)
	UN	Unemployment, total (% of total labor force)	World Bank (2022)
	PD	General government gross dept (% of GDP)	IMF (October 2022)
	IR	Interest rates (annual, EMU convergence criterion bond yields)	Eurostat (2023)
Bank-specific variables	ROA	Return on assets (%, after tax)	World Bank (2022)
	ROE	Return on equity (%, after tax)	World Bank (2022)
	CAP	Bank capital to assets ratio (%)	World Bank (2022)
	NIM	Net interest margin (%)	World Bank (2022)
	LDR	Loan-to-deposit ratio (%)	World Bank (2022)

Source: Own elaboration

One of the assumptions of a linear regression model is the absence of multicollinearity among the explanatory variables. Therefore, we constructed a correlation matrix and used a threshold level of 0.80 to identify multicollinearity issues, as recommended by Kennedy (2008). Based on the results of the correlation matrix, we identified a very strong positive correlation between the variables ROA and ROE. As a result, we cannot include these variables in the same model simultaneously. Consequently, we work with two versions of the model. The first version of the model includes the variable ROA, and the second version includes the variable ROE.

4. Results and discussion

Before analyzing the key determinants of NPLR, we decided to visualize and analyze NPLR across EU countries (Figure 1).

Figure 1 Average level of NPLR in EU countries
Source: Own elaboration, World bank (2022)

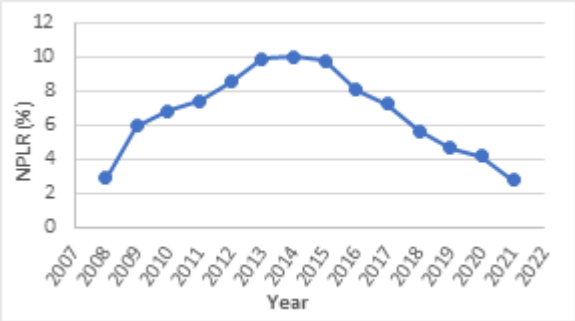

Figure 2 Development of NPLR in EU
Source: Own elaboration, World bank (2022)

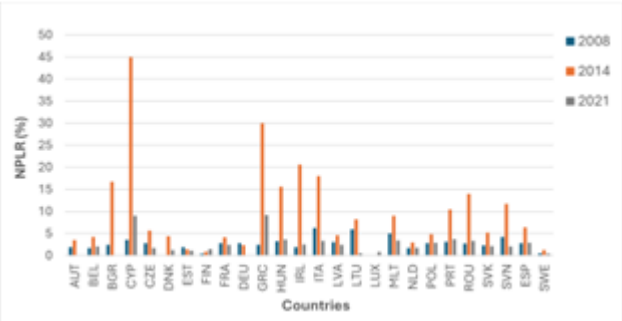

Figure 3 Development of NPLR across EU countries
Source: Own elaboration, World bank (2022)

As we can see, Greece and Cyprus show the highest NPLR exceeding 20%, while Nordic countries, except Latvia and Lithuania, remain below 1%. Southern European countries generally have slightly higher NPLR than their Central European and Nordic counterparts. The display of the average level of NPLR can somewhat distort the real situation in a country, therefore we display the development of NPLR in EU countries within specific years. First, we plotted the development of NPLR across EU from 2008 to 2021, where the level of NPLR in each year is represented by the average level of NPLR across individual EU countries. Subsequently, we plotted the development of NPLR for individual countries in the years 2008,

2014 and 2021. We chose these specific years to capture both the NPLR at beginning and end of the observed period, as well as in 2014 when the average NPLR in the EU was highest.

As shown in Figure 2, after the global financial crisis in 2008, EU countries experienced an increase in the NPLR, which was exacerbated by subsequent debt crisis in the Eurozone triggered by Greece's poor financial situation. In 2014, the NPLR reached its peak, comprising approximately 10%. As demonstrated in Figure 3, the increase was not uniform across all countries. The highest increase can be observed in Cyprus, which experienced an increase of over 40% compared to 2008. The reason was the Cypriot banking crisis that erupted in 2013. Cyprus fell into a banking crisis due to its attempt to help Greece, its largest trading partner. Contributing to the outbreak of the Cypriot crisis was also the situation during the period from 2005 to 2010 when bank loans increased by 24% annually. The high level of NPLR was thus a consequence of the rapid growth of loans and the low profitability of Cypriot banks (Bezek, 2014). Countries such as Bulgaria, Greece, Hungary, Ireland, and Italy also saw a relatively high increase, with their NPLR reaching over 15%. In the following years, we can observe a slight improvement in NPLR. This improvement was attributed to comprehensive packages of measures aimed at reducing the level of NPLR in accordance with the ECOFIN Action Plan adopted by the European Commission in October 2017 (European Council, 2017). Despite the NPLR indicator decreasing by only around 1% annually, successful reductions in NPLR were achieved by the end of the observed period. The lowest NPLR can be observed in three Nordic countries: Sweden (0.42%), Lithuania (0.51%), and Luxembourg (0.79%). Sweden was perceived as a reliable debtor by investors due to its low government debt, which ultimately led to its being assigned a high credit rating. The high credit rating helped Sweden manage financial crises without any major difficulties (Zošiaková, 2014).

For a closer assessment of differences in the development of NPLR within individual countries, we estimated a fixed-effects model. The results of the model estimation, including the coefficients of the independent variables and the corresponding p-values, are presented in Table 3.

Table 3 Fixed-effects model estimation

	Model 1		Model 2	
	β	**p-value**	**β**	**p-value**
GDPG	0,1478	<0,001 ***	0,1536	<0,001 ***
INF	-0,4305	0,0011 **	-0,4151	0,0013 **
UN	0,9076	0,0008 ***	0,9256	0,0013 **
PD	0,0583	0,1421	0,0557	0,0923 .
IR	-0,5591	0,0502 .	-0,6716	0,0541 .
ROA	-0,2690	0,7110	-	-
ROE	-	-	-0,0533	0,2179
CAP	0,0320	0,0814 .	0,0304	0,0990 .
NIM	1,6300	0,1432	1,8716	0,1190
LDR	0,0635	0,0168 *	0,0655	0,0085 **
No. obs.	n = 25 t = 14		n = 25 t = 14	
R^2	0,5368		0,5423	
p-value	<0,001		<0,001	

Signif. codes: *** 0.001; ** 0.01; * 0.05; . 0.1
Source: Own elaboration, RStudio

Our results indicate that in the case of both models, they can be considered statistically significant based on their p-values, which are lower than the significance level (0,05). The results of the estimation for both models are very similar in terms of the sign and statistical significance of variables entering the model. In both models, six explanatory variables proved to be statistically significant, namely GDP growth (GDPG), inflation (INF), unemployment (UN), interest rates (IR), bank capital to assets ratio (CAP) and loan-to-deposit ratio (LDR). Among the variables GDPG, UN, CAP, and LDR, we observe a positive relationship with the explanatory variable NPLR. The positive relationship between UN and NPLR is also supported by the results of Messai and Jouini (2013). However, these authors, along with Kjosevski and Petkovski (2021), point out a negative correlation in the case of the GDP, which contradicts our findings. Radivojevič et al. (2019) also support the significant impact of GDP in their study,

but the impacts of UN, IR, and INF did not prove to be statistically significant. On the contrary, in our results, the impact of these variables proved to be statistically significant. Based on our results, we observe a negative correlation between the explanatory variable NPLR and both INF and IR, which contradict the results of Messai and Jouini (2013) and Kjosevski and Petkovski (2021). Kjosevski and Petkovski (2021) also point out a negative correlation between bank profitability and NPLR. We assessed bank profitability within our analysis using multiple variables, among which only the variables ROA and ROE confirmed this negative correlation. However, the variables ROA and ROE did not prove to be statistically significant within the results of our analysis.

5. Conclusion

After the global financial crises, there was an increase in the NPLR in almost all EU countries, which was subsequently deepened further due to the debt crisis. The highest increase can be observed in Cyprus, where the NPLR reached 45%, and Greece, where it reached 30%. These financial crises demonstrated that the NPLR can reach sufficiently high levels to become a significant threat to the business activities of banks and their financial stability. While addressing the issue of the high level of NPLR primarily rests with the affected banks and domestic authorities of the respective country, within a monetary union where the economies of member countries are interconnected and can generate spillover effect, it is also in the interest of the European Union to tackle the issue.

The conducted analysis also highlights the interconnection between the development of the NPLR and the economic cycle, which are closely related to macroeconomic (GDP growth, inflation, unemployment, interest rates) as well as bank-specific determinants (bank capital to assets ratio, and loan-to-deposit ratio). However, our results, specifically the sign of the relationship between the NPLR and some variables, differed compared to other studies. We attribute the difference to the fact that the mentioned studies applied the Generalized Method of Moments (GMM), while in our study, we only apply a static fixed-effects model. The use of GMM is justified by the fact that NPLR cannot be immediately written off and may persist on banks' balance sheets for several years. Therefore, conducting GMM provides us with the opportunity for further research. Further research could also benefit from including new

variables, such as exchange rates, stock prices, and bank concentration, as their influence has been statistically significant in existing studies.

References

Ari, A., Chen, S., & Ratnovski, L. (2021). The dynamics of non-performing loans during banking crises: A new database with post-COVID-19 implications. Journal of Banking & Finance, 133, 106140.

Baltagi, B. H. (2005). Econometric analysis of panel data (3rd ed.). John Wiley and Sons.

Beck, R., Jakubik, P., & Piloiu, A. (2015). Key determinants of non-performing loans: New evidence from a global sample. Open Economies Review, 26(3), 525-550.

Bezek, P. (2014). Kríza bankového sektoru na Cypre [Bachelor's thesis]. Vysoká škola ekonomická v Praze.

Bofondi, M., & Ropele, T. (2011). Macroeconomic determinants of bad loans: Evidence from Italian banks. Bank of Italy Occasional Paper, 89.

Boudriga, A., Boulila, N., & Jellouli, S. (2009). Does bank supervision impact nonperforming loans: Cross-country determinants using aggregate data?

Donath, L., Cerna, V. M., & Oprea, I. M. (2014). Macroeconomic determinants of bad loans in Baltic countries and Romania. SEA: Practical Application of Science, 2(4).

European Central Bank. (2017). Guidance to banks on non-performing loans. Retrieved from https://www.bankingsupervision.europa.eu/ecb/pub/pdf/guidance_on_npl.en.pdf?b2b48eefa9972f0ca983c8b164b859ac

European Central Bank. (2023). ECB keeps capital requirements steady in 2023, as banks remain resilient. Retrieved from https://www.bankingsupervision.europa.eu/press/pr/date/2023/html/ssm.pr230208~8971619db2.en.html

European Council. (2017). Banking: Council sets out action plan for non-performing loans. Retrieved from https://www.consilium.europa.eu/en/press/press-releases/2017/07/11/banking-action-plan-non-performing-loans/

Gunsel, N. (2012). Micro and macro determinants of bank fragility in North Cyprus economy. African Journal of Business Management, 6(4), 1323.

Kennedy, P. (2008). A guide to econometrics. John Wiley & Sons.

Kjosevski, J., & Petkovski, M. (2021). Macroeconomic and bank-specific determinants of non-performing loans: The case of Baltic states. Empirica, 48(4), 1009-1028.

Klein, N. (2013). Non-performing loans in CESEE: Determinants and impact on macroeconomic performance. International Monetary Fund.

Makri, V., Tsagkanos, A., & Bellas, A. (2014). Determinants of non-performing loans: The case of Eurozone. Panoeconomicus, 61(2), 193-206.

Messai, A. S., & Jouini, F. (2013). Micro and macro determinants of non-performing loans. International Journal of Economics and Financial Issues, 3(4), 852-860.

Radivojević, N., et al. (2019). Econometric model of non-performing loans determinants. Physica A: Statistical Mechanics and its Applications, 520, 481-488.

Tölö, E., & Virén, M. (2021). How much do non-performing loans hinder loan growth in Europe? European Economic Review, 136, 103773.

Vogiazas, S. D., & Nikolaidou, E. (2011). Investigating the determinants of nonperforming loans in the Romanian banking system: An empirical study with reference to the Greek crisis. Economics Research International, 2011.

World Bank. (2022). World development indicators. Retrieved from https://databank.worldbank.org/source/world-development-indicators

Zeileis, A. (2004). Econometric computing with HC and HAC covariance matrix estimators.

Zošiaková, R. (2014). Hospodárska politika škandinávskych krajín v období hospodárskej krízy počiatku 21. storočia [Bachelor's thesis]. Masaryková univerzita v Brne.Rogers, E. M. (2002). Diffusion of preventive innovations. Addictive Behaviors, 27(6), 989–993. https://doi.org/10.1016/s0306-4603(02)00300-3

DEVELOPMENT OF A FINANCIAL MANAGEMENT STRATEGY FOR AUTONOMOUS MOBILITY-AS-A-SERVICE

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ABSTRACT

Purpose:
Within the European Union, passenger cars and motorcycles are responsible for almost two thirds of all greenhouse gas emissions. However, an average car in Germany gets used only three percent of the day. Individual mobility therefore needs to change massively. The purpose of the paper is to develop and analyze a financial management strategy for a business model that combines autonomous driving with car sharing, namely autonomous mobility-as-a-service. It focuses on Special Purpose Vehicle Financing or SPV for short. The aim is to maximize usage rates and minimize costs, with the ultimate goal of creating a sustainable and efficient individual mobility solution.
Design/methodology:
The paper will first examine the basic idea of the business model in detail, followed by the definition of key terms such as mobility, autonomous driving, and Mobility-as-a-Service (MaaS). The main method used for the research is a critical analysis of the existing literature on financial management, specifically in the context of mobility-as-a-service and autonomous driving in order to develop a feasible financial management strategy.
Findings:
The paper will present findings on the potential benefits of the proposed business model and financing, including reduced personnel costs, increased economies of scale, and the potential for higher profitability compared to traditional car sharing models. It will also discuss the challenges and limitations associated with the implementation of the business model, such as regulatory frameworks and the need for technological advancements in autonomous driving.
Research/practical implications:
The paper will identify the potential outcomes and implications for practice, such as the impact on the mobility industry, the potential for reduced environmental pollution, and the potential for increased accessibility to mobility services. It will also suggest future research directions, including the exploration of alternative financing models and the evaluation of the business model in different market contexts.
Originality/value:
The paper will highlight the main added value, which is the development of a novel financial management strategy for a business model that combines autonomous driving with car sharing. It will also discuss the potential for this business model to address some of the challenges associated with current mobility concepts, such as high vehicle density and associated costs.

Keywords: autonomous Mobility-as-a-Service, Special Purpose Vehicle financing, business model development

JEL Classification: M13, M40

1. Introduction

Mobility is constantly changing and therefore offers more and more opportunities for new business models. One example of this is the Berlin start-up Vay. Not yet active in the market, the company has already collected 128 million Euros from investors (Brors & Holzki, 2021). The business model focuses on remote driving in combination with car sharing. Here, drivers from a central location of the company control the vehicles to the respective customers who have booked a trip via smartphone. As soon as the vehicle appears to the customer, they can use it like their own vehicle and then release it again. Then a teledriver from Vay takes over the vehicle and drives it to the next customer. The pressure on mobility to have to change results from a multitude of factors. The proportion of households owning a car is tending to rise. In Germany alone, only 17% of 18 to 64 year olds do not have a car permanently available (*Autobesitz in Deutschland 2023*, 2024). This also increases the problems associated with high vehicle density, such as increased environmental pollution, high space utilization and traffic jams (Wang et al., 2021, p. 1034). Added to this are the associated costs, which, in addition to the direct usage costs, such as fuel consumption and insurance, are particularly characterized by the loss of value (Al Otary et al., 2022, p. 2). And although the costs of a passenger car are immense and, in particular, require a high initial investment, they are only used on average 30 kilometres and 45 minutes a day. In other words, the usage rate is just three percent of the day (Mobilität in Deutschland – MiD – Ergebnisbericht, 2019, p. 4). Carsharing offers seem to represent the ideal solution in theory, as they enable a significantly higher usage rate. In reality, however, the associated costs are so high that in 94% of cases it would be more worthwhile to have your own vehicle (Eisenmann & Kuhnimhof, 2019, p. 18). In addition, there is the loss of comfort for a restricted area of use and the fact that there must always be local availability. The above-mentioned start-up Vay tries to reduce this loss of comfort as much as possible. To what extent the costs will turn out to be opportune compared to your own vehicle remains to be seen.

An optimal solution, with which the usage rates can be maximized and the costs can be kept comparatively low, would be the combination of autonomous driving with car sharing. Instead of teledrivers taking control of the vehicles, this is done by the vehicle's on-board computer. The personnel requirements could be reduced to a minimum and the loss of comfort for end customers would also be minimal. The aim of this essay is to develop and analyse a possible financial management strategy.

In the first section, the basic idea of the business model is examined in more detail. Following this, key terms are defined more precisely in order to create a basis for the same understanding. This is followed by the development and analysis of a proposal for financial management. The results are then further examined with regards to their advantages and disadvantages. At the end there is a critical appreciation and limitation of the work and the conclusion.

2. Theoretical foundations

In order to have a basis of the same understanding, the theoretical basics are defined in the first chapter and an insight into the market is given. First, the desired business model is explained schematically and then described in more detail. The key terms "mobility", "autonomous driving" and "Mobility-as-a-Service" are then defined. This is followed by an insight into the market for private transport in Germany. Car sharing, as a similar and already existing business model, will then be analyzed in more detail. In particular, a look is taken at the profitability of the existing services. At the end there is a brief outlook on autonomous driving as a whole.

2.1 The underlying idea of the business model

As briefly explained in the introduction, a business model in the area of mobility-as-a-service is to be developed in combination with autonomous driving. The ideal is that end customers can use an app to call a car if necessary. This car then drives up to the respective customer and can be used. The customer has the options of whether he then wants to drive to his destination himself or whether he wants to be transported using autonomous driving. The car can then be released again and driven to the next customer. Monthly capping could be

introduced to increase usability. This is used, among other things, in local public transport in London. Customers present their credit card when boarding the train. The system then checks on a weekly and monthly basis which rate would be the cheapest ex post for the customer (Bondemark et al., 2021, p. 2731). He always gets the cheapest option, depending on his usage behavior.

This should solve several problems of current mobility concepts at the same time. With autonomous driving, personnel costs can be minimized and economies of scale are much easier to achieve. The marginal costs of further growth thus consist primarily of the acquisition costs of the vehicles and only to a minimal extent of investments in infrastructure and human capital. The latter is primarily used for maintenance, infrastructure management and customer service.

2.2 Definition of main terms "Mobility", "Autonomous driving" and "Mobility-as-a-Service"

In order to create a basis for the same understanding, the essential terms for the essay are defined below.

Although the term mobility is widely used in everyday language, there is no clear definition. Kristoffersen and Ljungberg wrote in 1999, "Mobility is one of those words that are virtually impossible to define in a meaningful way. You either come up with a definition that excludes obvious instances, or your definition is to too vague; it fails to shed light on important aspects. At the same time we all have a feeling of what it means." (Kristoffersen & Ljungberg, 1999, p. 271). Generally speaking, the word comes from the Latin "mobilis", which in turn means "to be mobile" (Sprenger, 2021, p. 9). On closer inspection, however, there are now innumerable definitions. In an attempt to create an overview, Hörold already included seven different definitions (Hörold, 2016, p. 30). Krannich's definition is most effective for this work. He describes mobility as a temporary physical overcoming of space (Krannich, 2010, p. 31).

With autonomous driving, a computer takes over the control of the vehicle, ideally a driver is no longer necessary. This creates a wide range of positive effects, such as increased safety, less wear and tear on the roads and lower energy consumption for driving itself (Peng et al., 2021, p. 329). A distinction is made between six different levels of autonomous driving. At level zero, the driver takes full control, no system intervenes. Assistance systems, such as cruise

control or a parking assistant, are assigned to the next higher level. The driver still has to carry out all central actions, such as steering and braking, independently. Level three includes distance-keeping assistants, in which the vehicle brakes and accelerates by itself and always maintains the same distance from the vehicle in front. When the assistant is switched on, the driver no longer has to act actively, but always has to be ready to intervene. In the penultimate level, the vehicle takes on all tasks associated with driving an automobile. The driver does not have to monitor the system, but can intervene at any time and overrule the system. At this level, the system can transfer control back to the driver in certain situations. If the driver does not react, the vehicle parks independently in a suitable position. Only in the last stage is the control back to the driver no longer an option on the system side. Fully autonomous driving is only spoken of at level five. A vehicle that fulfils level five can cover any route with the associated speeds without the need for a person to be the driver (Herrmann et al., 2018, pp. 47–51). The highest degree of autonomous driving places considerable demands on hardware and software and must be comprehensively regulated both ethically and legally. The advances in hardware over the past few years, in line with Moore's Law, also enable increasingly complex calculations using software (Edwards, 2021, p. 12). Artificial intelligence is therefore considered a key component for autonomous driving (Gupta et al., 2021, pp. 12429–12431). This is primarily due to the fact that a large number of factors must be taken into account at the same time in order to be able to make a sufficient decision (Abbas et al., 2021, pp. 12921–12922). In order for this business model to be fully feasible, autonomous driving according to level five is necessary.

The concept of Mobility-as-a-Service, or MaaS for short, generally speaking describes a service that enables end customers to satisfy their mobility needs without having to own their own vehicle. In other words, end customers can use different mobility concepts with a usage-dependent fee. This also includes, for example, taxis and buses. MaaS is therefore seen as a key component for reducing emissions and negative externalities (Hensher et al., 2020, p. 2). Instead of a high initial investment, in most cases a subscription is offered, for which end customers can use the mobility offer. Instead of sunk costs, the consumer has marginal costs for the usage. In this context, cultural change is also of great importance, as ownership of a car still has a high ideological value (Wong & Hensher, 2021, p. 1838). Mobility-on-Demand is

used synonymously with Mobility-as-a-Service, both terms refer to the same area (Kuhnimhof & Eisenmann, 2023). In this paper, autonomous Mobility-as-a-Service or Mobility-on-Demand refers to individual mobility using passenger cars. Mass transportation or taxis are not part of the business model to be developed.

2.3 Essential contents of financial management

Financial management is one of the most important tasks of a company. Profitability is a basic requirement for companies to be able to survive in the market in the long term. In Germany, the three direct reasons for insolvency are inability to pay, imminent insolvency and overindebtedness (Staab, 2015, pp. 153–157). They are to be avoided at all costs. While corporate finance is generally understood to mean capital resources, liquidity, investments, income and expenses and more, financial management deals with the administration of these (Sharma, 2021, p. 2). Since the term is very broad and general, there are multiple definitions for it. For example, Mathur defines financial management as management of the so-called m-levels of men, materials, money, marketing and machines (Mathur, 2015, p. 4). A frequently quoted definition is that according to Kuchhal “Financial Management deals with procurement of funds and their effective utilization in the business.” (Kuchhal, 1993, pp. 1–2; Sharma, 2021, p. 4). Given the scope, this focused definition is also relevant to this work. There are different approaches in financial management. The classic approach focuses on the so-called "golden balance sheet rule", which considers the matching maturities of the financing. It states that long-term assets should also be refinanced using capital available to the company over the long term. For example, real estate should ideally be refinanced from equity and long-term debt as well as mezzanine capital. This is a point in time consideration, which is why dynamic considerations are becoming increasingly popular. The dynamic considerations include the cash flow-based analysis, in which the focus is on the liquidity available to the company (Binder & Högsdal, 2016, pp. 47–50).

3. Application and analysis of a possible financial management strategy on the business model

In the case of very young companies and start-ups in particular, the focus is on dynamic approaches with regard to financial management. One way of raising capital would be to look for venture capitalists and business angels. These are financiers who support companies in the very early stages with capital and usually also know-how. Since investments in such early company phases are associated with massive risks, it is also a comparatively expensive and time-consuming form of raising capital (Wünsche, 2016). An alternative would be financing using a special purpose vehicle, or SPV for short. An SPV is a company that is only formed for a specific purpose and cannot make any substantive decisions. For this reason, there are always a large number of parties that are connected to an SPV (Soleimani & Shadab, 2020, pp. 1–2). With SPV financing, a distinction is made between full, limited and non-recourse financing. In the case of full-recourse financing, the sponsors, i.e. the operators, are fully liable for the respective project. This form of SPV financing is rare, since risk mitigation is a key motivation for SPV financing. In the case of limited-recourse, the sponsor's liability for selected risks is limited. In the case of non-recourse financing, the entire risk is borne by the SPV. Since, in the case of non-recourse financing, it is not possible to fall back on past values or alternative assets of the company, for example, future cash flows must be used (Sainati et al., 2019, p. 114). Transferred to the business model, the structure could look as follows.

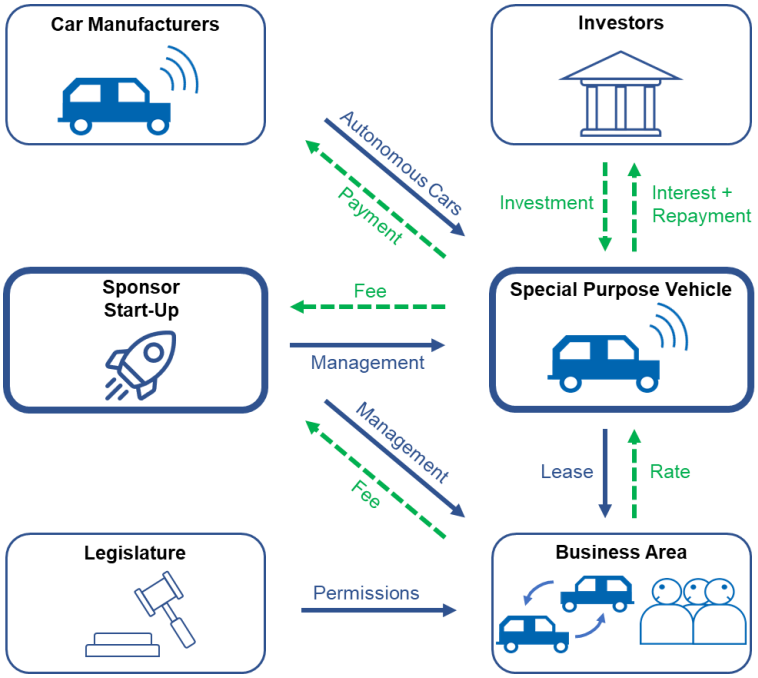

Figure 1 Proposal for a Special Purpose Vehicle Financing structure
Source: Own representation

One option would be to set up an SPV for each business area in which it aspires to be active. For example, one SPV could be set up for the German city of Hamburg and another for the capital city of Berlin. Investors would then have the opportunity to better assess and price the risks. Car sharing already shows that profit margins in Germany are very heterogeneous. Only three out of 13 German cities have positive profit margins for car sharing (Stolle et al., 2019, p. 12). The SPV collects funds from investors for a specific business area and pays them interest and, after a certain ramp-up phase, repayment. These funds are then used to purchase autonomous vehicles from the manufacturers. These vehicles thus represent the assets of the SPV and are then used in the business area. The SPV itself and the vehicles are then liable for the credit funds, in the case of the latter usually by way of chattel mortgage (Derleder, 2017). The company to be founded, i.e. the startup and the sponsor, takes over the management of the business area and the SPV and receives a management fee for this. Funds are raised by investors, the technological infrastructure is created in the form of an app, marketing is carried out and so on. The legislature is also of central importance, since the appropriate legal framework must be in place for the business model to operate. This structure could be extended

to the most diverse and also international business areas. Another SPV can then be set up for each additional store, funds and vehicles can be procured and then transferred to operations.

An SPV structure brings with it a multitude of legal and organizational advantages. From the sponsor's point of view, this is primarily risk sharing. In the case of non-recourse financing, the business risks are limited exclusively to the SPV. In the event of failure, the main company, i.e. the sponsor, is not at risk as a whole. SPVs also allow assets and funds to be easily collected and pooled, using a variety of funding sources. The SPV as such can be operationally active and conclude legal transactions. Overall, with the help of the SPV structure, several markets can be opened up within a short period of time. Instead of a market having to be fully developed and managed profitably before funds can be collected for further expansion, SPV financing focuses exclusively on future cash flows and thus on the respective market (Sainati et al., 2020). An SPV structure also reduces information asymmetries, and the sponsor has fewer incentives for moral hazards (Soleimani & Shadab, 2020).

While risk mitigation is a clear advantage for the sponsor, it is a disadvantage for investors. This can limit the ability to attract investors. In addition, setting up and managing an SPV involves considerable costs. However, studies come to different conclusions as to whether the transaction costs are higher overall than with classic financing (Sainati et al., 2017, p. 63). In addition, the earnings potential of this construct is limited for the sponsor. While the company fully participates in profits with classic financing, this is usually only the case to a limited extent with an SPV structure. Overall, the performance of SPVs has so far been very heterogeneous, which in this case is gaining importance due to the very different market potential (Szarek & Pachciarek, 2020, p. 460).

4. Conclusion

Given the scope of this work, a financial management strategy was developed using a qualitative literature review. As included in the text, there are a variety of definitions that are defined in different ways. With regard to the statements made, the following quote from Bateman also applies: „When a company is too early stage to make any of the normal valuation methods work […], then it normally goes back to a gut feeling.“ (Bateman, 2019, p. 19). Mobility is constantly changing, both in terms of new mobility services and new technologies

such as autonomous driving. Although there are already services that are moving in the direction of a completely autonomous mobility-as-a-service, these are limited in their service due to technical and legal limitations. A promising business model is starting with Vay, which in terms of performance comes very close to the focused business model. Expanded to include autonomous driving, a large number of negative externalities of today's mobility could be eliminated.

There are a variety of definitions for financial management, which differ in particular in terms of how narrowly they are defined. While some definitions subsume almost the entire management of the company under it, other definitions only refer to the raising of capital. The latter in particular is generally accepted and often cited. There are different options for raising capital to found a company with such a capital-intensive business model. One option that would enable rapid expansion in addition to risk mitigation would be the structure of a special purpose vehicle. A new SPV could be founded for each business area or market. However, the associated costs and the limited earnings potential would be disadvantageous. It is also questionable to what extent investors would be willing to invest in such an innovative and untested business model anyway. Subsequent investigations should therefore focus in particular on which source of capital would be the most sensible and attractive. Relevant here would be, for example, the classic capital market, credit institutions or citizen participation and Blockchain-based sources of finance. In addition to the SPV structure, there are also other options for financial management, which should also be examined in further studies to determine their suitability. Overall, however, the advantages of SPV financing are particularly relevant when pursuing a rapidly growing corporate strategy.

References

Abbas, W., Khan, M. F., Taj, M., & Mahmood, A. (2021). Statistically correlated multi-task learning for autonomous driving. *Neural Computing and Applications*, *33*(19), 12921–12938. https://doi.org/10.1007/s00521-021-05941-8

Al Otary, L., Abou-Zeid, M., & Kaysi, I. (2022). Modeling car ownership and use in a developing country context with informal public transportation. Transportation, 49(1), 1–36. https://doi.org/10.1007/s11116-020-10161-5

Autobesitz in Deutschland 2023. (2024). Statista. https://de.statista.com/prognosen/999770/deutschland-besitz-eines-pkw

Bateman, D. (2019). The Investment Handbook: The Essential Funding Guide for Entrepreneurs. Legend Press.

Binder, C., & Högsdal, N. (2016). Kennzahlen zur Liquidität. Controlling & Management Review, 60(6), 46–51. https://doi.org/10.1007/s12176-016-0096-6

Bondemark, A., Andersson, H., Wretstrand, A., & Brundell-Freij, K. (2021). Is it expensive to be poor? Public transport in Sweden. Transportation, 48(5), 2709–2734. https://doi.org/10.1007/s11116-020-10145-5

Brors, P., & Holzki, L. (2021). Vay: Start-up für ferngesteuerte Taxis sammelt 84 Millionen ein. https://www.handelsblatt.com/technik/it-internet/autonomes-fahren-start-up-vay-84-millionen-euro-fuer-ferngesteuerte-autos-im-strassenverkehr/27886726.html

Derleder, P. (2017). § 32 Sicherungsübereignung. In P. Derleder, K.-O. Knops, & H. G. Bamberger (Eds.), Deutsches und europäisches Bank- und Kapitalmarktrecht (pp. 1491–1520). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-52807-5_32

Edwards, C. (2021). Moore's Law: What comes next? Communications of the ACM, 64(2), 12–14. https://doi.org/10.1145/3440992

Eisenmann, C., & Kuhnimhof, T. (2019). Für Vielfahrer oft konkurrenzlos günstig: Pkw-Nutzung in Deutschland.

Federal Ministry of Transport and Digital Infrastructure (Ed.). (2019). Mobilität in Deutschland – MiD – Ergebnisbericht (pp. 1–136). Federal Ministry of Transport and Digital Infrastructure. https://bmdv.bund.de/SharedDocs/DE/Anlage/G/mid-ergebnisbericht.pdf?__blob=publicationFile

Gupta, M., Upadhyay, V., Kumar, P., & Al-Turjman, F. (2021). Implementation of autonomous driving using Ensemble-M in simulated environment. Soft Computing, 25(18), 12429–12438. https://doi.org/10.1007/s00500-021-05954-4

Hensher, D., Ho, C., Mulley, C., Nelson, J., Smith, G., & Wong, Y. (2020). Understanding Mobility as a Service (MaaS): Past, Present and Future.

Herrmann, A., Brenner, W., & Stadler, R. (2018). Autonomous Driving: How the Driverless Revolution Will Change the World. Emerald Publishing Limited. https://doi.org/10.1108/9781787148338

Hörold, S. (2016). Instrumentarium zur Qualitätsevaluation von Mobilitätsinformation. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-15458-5

Krannich, D. (2010). Mobile System Design: Herausforderungen, Anforderungen und Lösungsansätze für Design, Implementierung und Usability-Testing Mobiler Systeme (1. Aufl). Books on Demand.

Kristoffersen, S., & Ljungberg, F. (1999). Mobile Use of IT. https://www.semanticscholar.org/paper/Mobile-Use-of-IT-Kristoffersen-b/9714804c3259cdc339c6b29a9c3b06a38aebe31b

Kuchhal, S. C. (1993). Financial Management. CHAITANYA Publishing House.

Kuhnimhof, T., & Eisenmann, C. (2023). Mobility-on-demand pricing versus private vehicle TCO: How cost structures hinder the dethroning of the car. Transportation, 50(2), 707–731. https://doi.org/10.1007/s11116-021-10258-5

Mathur, S. B. (2015). FINANCIAL MANAGEMENT Theory and Practice. Laxmi Publications Pvt. Ltd.

Peng, B., Sun, Q., Li, S. E., Kum, D., Yin, Y., Wei, J., & Gu, T. (2021). End-to-End Autonomous Driving Through Dueling Double Deep Q-Network. Automotive Innovation, 4(3), 328–337. https://doi.org/10.1007/s42154-021-00151-3

Sainati, T., Brookes, N., & Locatelli, G. (2017). Special Purpose Entities in Megaprojects: Empty Boxes or Real Companies? Project Management Journal, 48(2), 55–73. https://doi.org/10.1177/875697281704800205

Sainati, T., Locatelli, G., & Smith, N. (2019). Project financing in nuclear new build, why not? The legal and regulatory barriers. Energy Policy, 129, 111–119. https://doi.org/10.1016/j.enpol.2019.01.068

Sainati, T., Locatelli, G., Smith, N., Brookes, N., & Olver, G. (2020). Types and functions of special purpose vehicles in infrastructure megaprojects. International Journal of Project Management, 38(5), 243–255. https://doi.org/10.1016/j.ijproman.2020.05.002

Sharma, A. (2021). Financial Management (for MBA Students). LaxmiPublications Pvt Limited.

Soleimani, M., & Shadab, M. (2020). Roles and functions of special purpose vehicles (SPV); a comparison between Islamic and conventional finance. Journal of Emerging Economies and Islamic Research, 8(1), 1. https://doi.org/10.24191/jeeir.v8i1.6219

Sprenger, F. (2021). Autonome Automobilität: Eine medien- und kulturwissenschaftliche Einführung. In F. Sprenger (Ed.), Autonome Autos (pp. 9–82). transcript Verlag. https://doi.org/10.1515/9783839450246-001

Staab, J. (2015). Die 7 häufigsten Insolvenzgründe erkennen und vermeiden: Wie KMU nachhaltig erfolgreich bleiben. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-06425-9

Stolle, W. O., Steinmann, W., Rodewyk, V., Gil, A. R., & Peine, A. (2019). The Demystification of Car Sharing – An in-depth analysis of customer perspective, underlying economics, and secondary effects. https://www.de.kearney.com/documents/1117166/0/Car+Sharing.pdf/3bff4a9a-1279-b26f-3b23-8183f14979ce?t=1565363325427

Szarek, M., & Pachciarek, H. (2020). Application of stakeholder analysis in university-owned special purpose vehicle. Scientific Papers of Silesian University of Technology. Organization and Management Series, 2020(145), 459–469. https://doi.org/10.29119/1641-3466.2020.145.34

Wang, J., Dane, G. Z., & Timmermans, H. J. P. (2021). Carsharing-facilitating neighbourhood choice: A mixed logit model. Journal of Housing and the Built Environment, 36(3), 1033–1054. https://doi.org/10.1007/s10901-020-09791-z

Wong, Y. Z., & Hensher, D. A. (2021). Delivering mobility as a service (MaaS) through a broker/aggregator business model. Transportation, 48(4), 1837–1863. https://doi.org/10.1007/s11116-020-10113-z

Wünsche, M. (2016). Finanzwirtschaft der Bilanzbuchhalter IHK: Mit Übungsklausuren für die Prüfung. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-10073-5

IMPROVEMENT OF HR RECRUITING PROCESSES BY ESTABLISHING A UTILITY AND GAME THEORY BASED MODEL

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ABSTRACT

Purpose:
The field of human resources management places significant emphasis on the application of behavioural science. The behaviour of employers, employees and jobseekers can, to a certain extent, be described, explained and predicted using game theory models. In conjunction with utility theory models, it is feasible to devise strategies for utility-optimising behaviour in specific decision-making and negotiation scenarios, such as the recruitment process. By employing a mathematical model integrating game- and utility-theory elements, the objective is to formalise the intricate, multi-stage recruitment process for enhanced comprehension and to develop strategies for HR decision-makers to facilitate targeted decision-making.
Design/methodology:
This research presents a model for the selection of candidates for a vacancy, developed on the basis of the application of matrix games. Two potential candidates are considered as players, who may adopt disparate strategies to secure the position and thereby obtain the greatest possible personal benefit. The professional and soft skills of the candidates are evaluated according to a set of criteria, with a rating scale ranging from 1 to 10. The decision-maker is an HR manager, who is tasked with the responsibility of hiring personnel within their company. The decision-maker compares the two candidates, selecting the most suitable one according to their utility function and evaluation, taking into account the skills deemed most important for the company.
Findings:
This approach enables the formalization of the procedure for the hiring of candidates for specific job positions within a company. For all three parties involved, recommendations for optimizing benefits – or at the very least, minimizing losses – can be provided. It is also important to consider the role of psychological issues and the individual attitudes of the HR manager with regard to potential candidates. Thus, if the utility function and the structure of benefits for the payoff matrix were to change, the optimal solutions for mixed strategies would also be subject to alteration.
Research/practical implications:
The model has the potential to enhance the recruitment process in two distinct ways: The process can yield superior, more precise outcomes for the company, as the potential risks and

additional expenses associated with job candidates can be mitigated. Conversely, the candidates may be better prepared for the recruitment process, thereby increasing their probability of securing the position – or alternatively, adjusting their efforts to enhance their standing in the subsequent recruitment round. A potential subsequent step would be the incorporation of the model into a recruitment software solution, thereby establishing a uniform process.

Originality/value:

The workforce represents the largest expenditure for any company, yet it is also one of the most significant drivers of organizational success. If a company is able to gain a decisive advantage over its competitors in the composition of its workforce, this will increase the probability of economic success. The improvement of the selection process and the reduction of the risk of erroneous decisions represent an essential building block for this, for which the model presented here can make a significant contribution and provide an impetus.

Keywords: Game Theory, Utility Theory, Human Resource Management, Recruitment

JEL Classification: C70, M51

1. Introduction

It is of paramount importance for any company to identify and select the most suitable employees in order to gain a competitive advantage. The selection of an inappropriate candidate or the rejection of the most suitable one can result in additional expenditure and may even lead to the failure of the entire organisation (Genping, 2022). It is therefore imperative that every company has an effective and successful recruitment process in place to identify and select the most suitable candidates. This process encompasses the planning of personnel work, the recruitment of applicants, and the selection of the most suitable candidates. As a company expands, the recruitment and selection process assume even greater importance, particularly when new employees evince a willingness to learn, flexibility, and a capacity for teamwork (Chaudhary, Nirala, 2014). The following paper presents a mathematical model based on game theory for the selection of applicants, which can be implemented in any company. The objective of the model is to conduct a comprehensive assessment of candidates in accordance with pre-defined criteria and their relative importance, evaluate their professional and personal competencies, and align their qualifications with the specific requirements of the company. The model takes into account the rational behaviour of candidates, their strategies for optimising their chances of success, and the results of competition between candidates. The model is based on matrix games within the framework of game theory, with elements of utility theory and the

hierarchy method incorporated. In order to develop the model, experts from the field were consulted in order to evaluate and conduct a comparative analysis of the qualitative characteristics of the candidates.

2. Literature review/theoretical background

The significance of efficacious recruitment and selection processes for organisations is a topic that has been extensively explored in academic literature (Armstrong, Taylor, 2017; Dessler, 2020, etc.). S. Gaikwad and V. Vaishnav analysed the recruitment process, which includes assessing job requirements, sourcing, screening and selecting candidates, and hiring and integrating the new employee into the team (Gaikwad, Vaishnav, 2022). The challenge of an effective recruitment process is to identify the best candidate for a vacancy at the right time through an organisation-specific sourcing mechanism (Carless, 2002; Nikolaou, Oostrom, 2015; Armstrong, Taylor, 2017; Dessler, 2020). It is a methodical process for hiring smart people who can contribute to the company's expansion. The recruitment process usually aims to find the most motivated and qualified candidates with the required professional skills (Schmidt et al., 1992; Kristof, 1996; Rafaeli, 1999; Chaudhary, Nirala, 2014; Genping, 2022). However, many companies also consider soft skills, which relate to an employee's working style and attitude (Chapman et al., 1999, 2003). At the same time, it is essential to evaluate the applicant as a whole, using the criteria and their weightings. In addition, there is the problem of selecting a successful candidate, as several potential candidates will submit their applications and participate in the selection process. Applicants will assess their chances of being selected and, taking into account rational behaviour, may apply different strategies to improve their skills accordingly (Chapman et al., 1999, 2003). It is essential to select those candidates who have the right skills and the right values and attitudes to fit into the culture of the organisation. Effective recruitment and selection will create a larger pool of candidates with the right skills, increasing the potential talent pool to meet the organisation's growth objectives (Genping, 2022).

The dynamic and complex nature of the recruitment and selection process means that HR managers often overlook key aspects. Different requirements and selection plans need to be developed depending on the needs, positions and organisations. Several factors come into play,

including the candidate's qualifications, the organisation's location, industry and culture. Neglecting these factors could have negative consequences (Genping, 2022).

Qualitative studies play an important role in understanding the challenges of recruitment and selection. Questionnaires, surveys and expert opinions are the main sources of information and data. The data collected is then analysed using descriptive statistics or other statistical methods (Schmidt, Hunter, 1992, 1998; Nikolaou, Oostrom, 2015; Welasari et al, 2023). The prevalence of these approaches is due to the widespread use of psychological and sociological methods in the assessment and motivation of human resources.

F. L. Schmidt and J. E. Hunter's article evaluates and summarises the results of 85 years of personnel psychology research on the validity of measures of 19 selection procedures used in recruitment, training and development tasks. The results are based on a meta-analytic analysis and consider the determinants of the practical usefulness of selection procedures (Schmidt, Hunter, 1998).

Over the years, recruitment processes have increasingly incorporated Artificial Intelligence (AI) methods (Jatoba et al., 2023). Researchers are exploring the potential of using AI in recruitment to improve the accuracy and speed of selecting candidates from a large pool of applicants, while reducing recruitment costs (Gupta et al., 2018). AI is used in recruitment to find the best candidates for open positions in an organisation (Nawaz, 2019), resulting in more efficient processes and better accuracy of candidate data. The capacity of AI to process vast amounts of data represents a significant advantage in the context of recruitment. This enables the identification of candidates who not only possess the requisite skills and experience to fulfil the demands of the role, but also align with the values and culture of the organisation (Odili e.a., 2024). Valued at USD 661.56 million in 2023, the AI recruitment market is expected to witness significant growth, with the market size estimated to reach USD 1119.80 million by 2030, registering a robust Compound Annual Growth Rate (CAGR) of 6.8% over the forecast period (MMR, 2024). However, there is a risk that the use of AI might result in talent acquisition outcomes becoming dehumanised, lacking the emotional intelligence and cultural evaluation currently provided only by human specialists. This indicates that, as AI solutions become more and more sophisticated, integrated collaboration between recruiters and AI is optimal for optimised recruitment, rather than replacing humans entirely (Tasheva, Karpovich, 2024).

Game theory is an exciting approach to analysing competition between two or more potential candidates (Samuelson, 2016). Game theory helps decision makers determine how to choose between different courses of action in response to a competitor's predicted course of action (Chakrabarty, Kanaujiya, 2023). It shows how participants behave in a game and what their optimal moves are, given two players in a game. Game theory has become increasingly relevant in today's competitive landscape where it is difficult for any organisation to differentiate itself from the competition (Chaudhary, Nirala, 2014).

3. Methods

The model presented considers two possible candidates, A and B, as actors who can pursue different strategies. Each candidate's professional and social competencies, or "hard and soft factors", are rated on a scale of 1 to 10 according to various criteria. The decision-maker is the HR manager in charge of recruitment, who compares the two candidates and selects the one who will bring the greatest benefit to the company, based on his or her utility function in relation to the position to be filled. The model makes it possible to formalise the recruitment process without neglecting the psychological aspects and the HR manager's individual attitude towards potential candidates. The model can be adapted to any company and its elements can be implemented in the company's recruitment software, allowing for a more effective organisation and documentation of the process. The company analyses the potential of each candidate for the position to be filled and the benefits they can bring, while minimising the risks and additional costs associated with new candidates. In conclusion, the development of a detailed candidate selection mechanism based on an appropriate mathematical model and algorithm is essential in order to find an optimal solution to the recruitment process, and this model can help companies achieve this.

4. Results and discussion

First of all, nine important skills and characteristics are presented, which are important for the assessment of a candidate for a specific job position in the company. The set of required skills has been developed on the recommendation of HR experts:

x_1 – professional skills and experience (PSE)
x_2 – cognitive and analytical skills (CAS)

x_3 – personal characteristics and skills (PERS)
x_4 – responsibility, time management skills (RTS)
x_5 – leadership (LDP)
x_6 – skills in IT using (ITS)
x_7 – health condition and ability to keep health lifestyle (HC)
x_8 – communication skills (CS)
x_9 – language skills (LGS)

The skills are evaluated on a scale from 1 to 10 and the different tests can be used for the evaluation. Then the utility function of the HR manager is introduced. There are two approaches: to consider the theoretical utility function with certain values of parameters or to use the empirical utility function with estimated parameters.

In our approach, we proposed to represent the utility function as a function of several variables or $U = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9)$. We have used a typical utility function with some important mathematical features, so our function is given below:

$$U = x_1^{\alpha_1} \cdot x_2^{\alpha_2} \cdot x_3^{\alpha_3} \cdot x_4^{\alpha_4} \cdot x_5^{\alpha_5} \cdot x_6^{\alpha_6} \cdot x_7^{\alpha_7} \cdot x_8^{\alpha_8} \cdot x_9^{\alpha_9},$$

where α_1= 0,2925; α_2= 0,1952; α_3= 0,1664; α_4= 0,1601; α_5= 0,0713; α_6= 0,0406; α_7= 0,0303; α_8= 0,0222; α_9= 0,0209.

We see that the first place of importance belongs to professional skills and experience (α_1= 0,2925); next 2nd place is for cognitive and analytical skills (α_2= 0,1952), then the 3rd and 4th places are close to each other and belong to personal skills and responsibility & time management skills, where α_3= 0,1664 and α_4= 0,1601 respectively. Leadership has the fifth position with α_5= 0,0713. The other three last positions belong to skills in IT, health and language skills, where α_7= 0,0303; α_8= 0,0222; α_9= 0,0209.

Then the possible strategies for 2 players were created. Their description is given in Table 1. We have suggested that the possible costs of actions are related to prices in Eastern Europe. The figures in Table 1 may be different for other countries.

Table 1 Description of the strategies for 2 players – candidates for job position

Strategy	Actions	Costs (EUR)	Improvement of skills
S_1	Doing nothing	0,-	0
S_2	Taking additional professional courses or trainings with certificate	300,-	PSE + 3
S_3	using ability for self-teaching, reading additional books, watching videos with professional recommendations, etc.	100,-	CS + 5
S_4	Taking language courses with certificate	200,-	LGS + 4
S_5	Self-improvement, reading books focused on psychological issues	50,-	PERS + 3
S_6	Taking courses on management and leadership	150,-	RTS + 2; LDP + 1
S_7	Taking courses or advice how to improve self-presentation	70,-	PERS + 1; HC + 1; CS +1

Source: own elaboration

Consider two possible candidates with characteristics, some of which are not significantly different. The characteristics of two candidates, Candidate A and Candidate B, are shown in Table 2.

Table 2 The characteristics of candidate A and candidate B and calculation of utility for HR manager

Parameters α_i	0,2925	0,1952	0,1664	0,1601	0,0713	0,0406	0,0303	0,0222	0,0209	$\sum_{i=1}^{9} \alpha_i = 1$
Skills and characteristics	PSE	CAS	PERS	RTS	LDP	ITS	HC	CS	LGS	Utility
Candidate A	1	1	9	4	1	8	10	5	7	2,2666
Candidate B	1	1	7	4	7	2	4	9	8	2,3326

Source: own elaboration

Then it is necessary to calculate the elements in the matrices of personal characteristics and utility function for candidate A and candidate B, if they will use strategies S_1, S_2 , …. S_7 from Table 1. The characteristics of the candidate A and candidate B are presented in the tables 3 and 4 respectively.

Table 3 The characteristics and values of utility function calculated for candidate A

Candidate A	PSE	CAS	PERS	RTS	LDP	ITS	HC	CS	LGS	Utility
A1	1	1	9	4	1	8	10	5	7	2,2666
A2	4	1	9	4	1	8	10	5	7	3,2645
A3	1	1	9	4	1	8	10	10	7	2,2100
A4	1	1	9	4	1	8	10	5	10	2,1762
A5	1	1	10	4	1	8	10	5	7	2,2147
A6	1	1	9	6	2	8	10	5	7	2,4399
A7	1	1	10	4	1	8	10	6	7	2,2237

Source: own elaboration

Table 4 The characteristics and values of utility function calculated for candidate B

Candidate B	PSE	CAS	PERS	RTS	LDP	ITS	HC	CS	LGS	Utility
B1	1	1	7	4	7	2	4	9	8	2,3326
B2	4	1	7	4	7	2	4	9	8	2,8231
B3	1	1	7	4	7	2	4	10	8	1,8864
B4	1	1	7	4	7	2	4	9	10	1,8820
B5	1	1	10	4	7	2	4	9	8	2,6885
B6	1	1	7	6	8	2	4	9	8	2,0274
B7	1	1	8	4	7	2	5	10	8	2,1705

Source: own elaboration

The HR manager's decision depends on the results of the comparative analysis for the values of the utility function in the case of candidate A and candidate B. The choice Q is defined as a function:

$$Q = f(U_1, U_2) = \begin{cases} 1, & if\ U_1 \geq U_2 \\ 0, & if\ U_1 < U_2 \end{cases}$$

If Q is equal to 1, it means that candidate A was selected for the job, otherwise candidate B is the winner. The results of the HR manager's decisions are shown in Table 5.

Table 5 The results of the selection by HR manager between candidate A and candidate B

	B1	B2	B3	B4	B5	B6	B7
A1	B	B	A	A	B	A	A
A2	A	A	A	A	A	A	A
A3	B	B	A	A	B	A	A
A4	B	B	A	A	B	A	A
A5	B	B	A	A	B	A	A
A6	A	B	A	A	B	A	A
A7	A	B	A	A	B	A	A

Source: own elaboration

Then the elements in the payoff matrix for 2 players were calculated. We used the proposals that the payoff results will depend on the individual salary with additional bonuses for some higher skills. Also, the results of the payoffs depended on the comparative analysis of the salaries for possible candidate A and candidate B. The HR manager chose the minimum of the costs for the payment for the winner or the candidate who was selected. We also took into account the results of the costs incurred by the candidates. Thus, the final payoffs are equal to the payoffs defined by the employer and the HR manager minus the costs of improving the skills taken by the candidates. The elements of the payoff matrix are shown in Table 6.

Table 6 The payoff matrix for the game

	B1	B2	B3	B4	B5	B6	B7
A1	0	0	1305	1305	0	1305	1305
A2	1035	1080	1037,5	1055	1042,5	1070	1042,5
A3	-100	-100	1235	1235	-100	1235	1235
A4	-200	-200	1135	1135	-200	1135	1135
A5	-50	-50	1257,5	1257,5	-50	1257,5	1257,5
A6	1185	-150	1187,5	1190	-150	1190	1190
A7	1240	-70	1240	1240	-70	1240	1240

Source: own elaboration

The positive elements mean the benefit or gain obtained by the candidate; the negative elements mean the losses incurred by the candidate if he/she spent some money on improving his/her skills but was not selected for the job position. Thus, we have the typical matrix game with 2 players and payoff matrix $P = (p_{i,j})$ and the problem is to define the optimum strategy for player 1 (candidate A), if the other player, player 2 (candidate B), can take each strategy from set S_1, S_2 , …. S_7. As the elements of the payoff matrix should be positive, thus after adding 201 to each element in the initial matrix, we get new payoff matrix (see Table 7):

Table 7. The modified payoff matrix for the game

	B1	B2	B3	B4	B5	B6	B7
A1	201	201	1506	1506	201	1506	1506
A2	1236	1281	1238,5	1256	1243,5	1271	1243,5
A3	101	101	1436	1436	101	1436	1436
A4	1	1	1336	1336	1	1336	1336
A5	151	151	1458,5	1458,5	151	1458,5	1458,5
A6	1386	51	1388,5	1391	51	1391	1391
A7	1441	131	1441	1441	131	1441	1441

Source: own elaboration

Now we can define values for $\max_i \min_j p_{i,j}$=1236 and $\min_j \max_i p_{i,j}$=1243,5. Let $V_* = 1236$ and $V^* = 1243{,}5$. So, the saddle point in pure strategies is not defined. But we can see that $V_* < V^*$, but these values are relatively close each other. This means that if there is a solution, the probability for some strategies will be very close to 1.

In the general case, we are dealing with a mixed strategy game, and it is necessary to define the probabilities for the optimal set of selected strategies for player 1 and player 2. The approach how we can define the optimal mixed strategies by means of linear programming and search for solutions of primal and dual problems is described in many books on operation research or game theory (Samuelson, 2016). The results of solving the two-player matrix game with mixed strategies are shown in Table 8.

Table 8. The results of the solution of matrix game with two players in mixed strategy

Candidate	Candidate A						
Strategy	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7
Probability p_i	0	0,9938	0	0	0	0	0,0062
Candidate	Candidate B						
Strategy	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7
Probability q_i	0	0	1	0	0	0	0

Source: own elaboration

To solve the primal and dual linear programming problems we used the Solver in Excel. We can see that in this case the recommendation for player 1 is to choose strategy 2 (probability is approximately 1) or to improve his professional skills and experience. The recommendation for player 2, if player 1 chooses strategy 2, is to choose strategy 3, where his losses in terms of benefits not gained will be minimal.

5. Conclusion

The process of selecting candidates for vacancies is complex and requires both qualitative and quantitative approaches. Candidates need to assess their chances of being selected and may employ various strategies to improve their skills and enhance their prospects. Similarly, companies analyse each candidate's potential for the open position and evaluate the benefits of hiring them, while aiming to minimise the potential risks and additional costs associated with new hires.

This approach with application of game theory can be developed for cases of different companies and characteristics of companies and different job positions should be considered. Such an approach allows to formalise the procedure of recruitment of candidates to different positions in the company, however, the role of psychological issues and individual attitudes of

the HR manager to possible candidates is important. Thus, if the utility function and the scheme of benefits for the payoff matrix will be different, the optimal solutions for mixed strategies will also be different.

All these factors highlight the need to develop a detailed selection mechanism based on an appropriate mathematical model and algorithm to find the optimal solution. This model can be used to improve the recruitment process and to train candidates for the competition. To prove this, the next step would be an empirical experiment with a cooperating company that defines the company's individual utility function, against which the theoretically proven suitability of the game theory approach can be demonstrated. The elements of the model can in more distant future be integrated into recruitment software to make the process more efficient for all users.

References

Armstrong, M., Taylor, S. (2017). Armstrong's handbook of human resource management practice,

Carless, S. A. (2002). Recruitment and job choice: How important are fit perceptions? Paper presented at the 17th Annual Meeting of the Society for Industrial and Organizational Psychology, Toronto, Ontario, Canada

Chakrabarty, P.S., Kanaujiya A. (2023). Mathematical Portfolio Theory and Analysis. Springer Nature Singapore. 2023. https://doi.org/10.1007/978-981-19-8544-7

Chapman, D. S., Rowe, P. M., Webster, J. (1999). Modeling applicant reactions to selection interview structure and communication medium: Signal detection, justice or meta-perception? In R. L. Dipboye: From both sides of the desk: Applicant and interviewer perspectives. Symposium conducted at the 14th Annual Meeting of the Society for Industrial and Organizational Psychology, Atlanta, GA.

Chapman, D. S., Uggerslev, K. L., Webster, J. (2003). Applicant reactions to face-to-face and technology-mediated interviews: A field investigation. Journal of Applied Psychology, 88, 944 –953.

Chaudhary, N., Nirala, A. (2014). Recruitment and Selection and Its Current Challenges. International Research Journal of Management Sociology & Humanity (IRJMSH). Vol 5 Issue 5. 2014. 233-242.

Dessler, G. (2020). Human resource management (16th ed.). Pearson. Fourteenth edition. New York: Kogan Page Limited. https://www.pearson.com/us/higher-education/program/Dessler-My-Lab-Management

Gaikwad, S., Vaishnav, V. (2022). Stages in Recruitment and its Importance: A Study. International Journal of Engineering Research & Technology (IJERT). Vol. 11 Issue 03, March-2022. 128-131.

Genping, Y. (2022). Critically Discuss Challenges and Recommendations in Recruitment and Selection. Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development

(ICFIED 2022). Advances in Economics, Business and Management Research, Vol. 648. Atlantic Press. 274-279.

Gupta, P., Fernandes, S.F., Jain, M. (2018). Automation in recruitment: a new frontier. J. Inf. Technol. Teach. Cases, vol. 8, no. 2, pp. 118–125, Nov. 2018. https://doi.org/10.1057/s41266-018-0042-x

Jatoba, M., Ferreira, J., Fernandes, P., Teixeira, J. (2023). Intelligent human resources for the adoption of artificial intelligence: a systematic literature review. Journal of Organizational Change Management. 10.1108/JOCM-03-2022-0075.

Kristof, A. L. (1996). Person - organization fit: An integrative review of its conceptualization, measurement, and implications. Personnel Psychology, 49, 1–50

MMR. AI Recruitment Market: Global Industry Analysis and Forecast (2024-2030). https://www.maximizemarketresearch.com/market-report/global-ai-recruitment-market/63261/

Nawaz, N. (2019). Artificial intelligence is transforming recruitment effectiveness in CMMI level companies. International Journal of Advanced Trends in Computer Science and Engineering. Vol. 8, No. 6. 3017-3021. http://www.warse.org/IJATCSE/static/pdf/file/ijatcse56862019.pdf https://doi.org/10.30534/ijatcse/2019/56862019

Nikolaou, I., Oostrom, J. K. (2015). Employee recruitment, selection, and assessment: Contemporary issues for theory and practice, Psychology Press.

Odili, P. O., Daudu, C. D., Adefemi, A., Ekemezie, I. O., & Usiagu, G. S. (2024). The impact of artificial intelligence on recruitment and selection processes in the oil and gas industry: a review. Engineering Science & Technology Journal, 5(2), 612-638.

Rafaeli, A. (1999). Pre-employment screening and applicants' attitudes toward an employment opportunity. Journal of Social Psychology, 139, 700 –712

Samuelson, L. (2016). Game Theory in Economics and Beyond. Journal of Economic Perspectives, 30 (4): 107-30. DOI: 10.1257/jep.30.4.107

Schmidt, F. L., Hunter, J. E. (1992). Development of causal models of processes determining job performance. Current Directions in Psychological Science, 1, 89-92.

Schmidt, F. L., Hunter, J. E. (1998). The Validity and Utility of Selection Methods in Personnel Psychology: Practical and Theoretical Implications of 85 Years of Research Findings. Psychological Bulletin. September 1998, 262-274.

Schmidt, F. L., Ones, D. S., Hunter, J. E. (1992). Personnel selection. Annual Review of Psychology, 43, 627-670.

Tasheva, Z., & Karpovich, V. (2024). Transformation of recruitment process through implementation of ai solutions. Journal of Management and Economics, 4(02), 12-17.

Welasari, U. S., Agustino, L., Sulaeman, A. (2019). Recruitment and Selection of Head Department (In West Java Province's Government of Indonesia). Proceeding of the 6th International Conference on Social Sciences, Vol. 6, 2019, pp. 11-20. DOI: https://doi.org/10.17501/2357268X.2019.6102

THE IMPACT OF LABOR MARKET FLEXIBILITY ON UNEMPLOYMENT: AN ANALYSIS IN THE MIDDLE EAST AND NORTH AFRICA REGION

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ABSTRACT

Purpose:
This study examines the relationship between labor market flexibility and unemployment in the MENA region from 2003 to 2020, aiming to assess whether increased labor market flexibility can reduce unemployment.
Design/methodology:
The study employs a panel regression model, using the labor market flexibility index (LMFI), encompassing seven key labor market domains, as the main independent variable. Fixed-effect models are applied to account for country-specific heterogeneity across 10 MENA countries.
Findings:
The analysis reveals a negative but statistically weak relationship between labor market flexibility and unemployment, indicating that increased flexibility may reduce unemployment but not as strong as neoclassical theory predicts.
Research/practical implications:
The findings indicate that policymakers should implement labor market reforms tailored to the local context, aiming to reduce rigidities while tackling structural challenges like urban-rural disparities and the limited development of the private sector.
Originality/value:
This paper uniquely explores labor market dynamics in the MENA region, offering region-specific insights often overlooked in studies focusing on developed economies.

Keywords: Labor market, flexibility, Unemployment, MENA, regulations

JEL Classification: J08, J88

1. Introduction

Labor market regulations are of paramount importance in modern societies. On the one side, they provide security and serve as the cornerstone for protecting workers' rights and ensuring fair employment practices. However, excessive protection and rigidity in the labor market lead to reduced competitiveness, lower job creation, and slower economic growth. On

the flip side, the flexibility of the labor market allows for quicker adjustments to changing economic conditions, technological advancements, and shifts in consumer demand. Yet, a highly flexible labor market can also lead to insecurity for workers. In this context, the "flexicurity" concept emerged in reaction to the difficulties brought up by technology development and globalization. It became well known in the late 1990s and early 2000s, especially in European nations, to address the dual objectives of enhancing labor market flexibility and ensuring social security for workers (Keller & Seifert, 2005). This unique blend, based on the flexicurity concept, provides both flexibility in employment arrangements and security for citizens.

Studying the impact of labor market regulations on unemployment is crucial for understanding the broader economic ecosystem and shaping effective policies that foster a thriving economy. The degree of flexibility embedded in these regulations underscores the global heterogeneity observed. While some nations adopt rigid measures, others opt for a more flexible approach, influenced by economic philosophies, historical legacies, and societal norms. Previous empirical evidence generally suggests that less flexible labor market regulations may lead to higher levels of unemployment. For instance, (Botero J. C., Djankov, Porta, Lopez-de-Silanes, & Shleifer, 2004) found that more rigid employment laws are associated with high unemployment, especially among youth. Similarly, according to (Bassanini & Akcigit, 2006), high unemployment benefits and tax wedges correlate with lower employment. However, research on this subject is scarce in developing regions, particularly in the MENA countries, which are pivotal globally but lack comprehensive studies on labor market dynamics. This gap motivated an investigation into the labor market of the Arab World, considering its unique characteristics, such as the 'segmented market economy' described by (Hatab, Eibl, & Hertog, 2022). This paper aims to explore the relationship between labor market flexibility and unemployment rates in ten MENA countries from 2003 to 2020. Through a structured approach encompassing literature review, methodology, empirical findings, and discussion, this study seeks to answer the following research questions:

- ✓ How does labor market flexibility influence employment patterns in the MENA region?
- ✓ Which labor market indicator has the most significant effect on unemployment rates in the MENA region?

- ✓ What policy reforms related to labor market flexibility can effectively address unemployment challenges in the MENA region?

2. Literature review

Labor market regulations are essential for ensuring fair treatment and equitable conditions for workers, addressing the inherent power imbalances between employers and employees. These regulations, including minimum wage laws and safety standards, serve to protect workers from exploitation and unsafe working conditions while fostering social equity and inclusive economic growth (Freeman & Medoff, 1985); (Rodrik, 1998). The relationship between labor market flexibility and unemployment rates is subject to varying interpretations within the existing literature. Some studies support a meaningful connection, highlighting that increased labor market flexibility tends to correlate with lower unemployment rates. For instance, (Bernal-Verdugo & Furceri, 2012) found a statistically significant negative influence of labor market flexibility on overall unemployment, youth unemployment, and long-term unemployment across 97 countries. Similarly, (Feldmann, 2009) noted a negative relationship between labor market regulations and unemployment rates in their respective analyses of global and country-specific data. (Agnello, Castro, Jalles, & Sousa, 2014) analyzed data from a panel of 17 countries spanning 1978 to 2009 and found that labor market flexibility mitigates the negative impact of tax policy consolidations on unemployment rates, particularly for youth unemployment. Conversely, other studies have failed to identify a significant association between labor market flexibility and unemployment rates. (Ahmed & Aljane, 2014) found no statistically significant correlation between labor regulation and unemployment across 115 developing countries, although they acknowledged a direct connection with firing and hiring regulations. (Liotti, 2020) similarly concluded, based on data from Italy that labor market flexibility did not lead to improved outcomes in adolescent unemployment during economic crises. These divergent findings underscore the complexity of the relationship between labor market regulations and unemployment rates, suggesting that contextual factors and policy interactions play crucial roles in shaping employment outcomes.

3. Research design

3.1. Empirical data

This paper compiles a dataset from 2003 to 2020 encompassing 10 MENA countries for which data on the labor flexibility index could be obtained. Labor market flexibility data are sourced from the Fraser Institute's Economic Freedom of the World (EFW) database, incorporating indicators across seven areas: (i) minimum wage (MW); (ii) hiring and firing regulations (HF); (iii) centralized collective wage bargaining (CCB); (iv) hours regulations (HR); (v) mandated cost of work dismissal (MCD); (vi) conscription (CONS); (vii) foreign labor (FL). Each indicator is standardized on a 0–10 scale, where higher scores represent greater labor market flexibility. (Annex I.)

To enhance the precision and reliability of our analysis, we included both macroeconomic and demographic variables as controls: Population growth (PG), urbanization (URB), size of the government (SG), inflation (INF), current account balance % of GDP (CAB) and population size (PS) sourced from IMF's World Economic Outlook (WEO), the World Bank's World Development Indicators (WDI), the Penn World Table version 7.0. (Annex II.)

3.2. Empirical methodology

Using EViews Student version and based on the Chow and Hausman tests, there is a significant increase in goodness-of-fit in the fixed effect model; therefore, the unemployment rate is regressed against our measure of labor market flexibility and a set of macroeconomic and demographic control variables as follows:

$$U_{it} = \alpha_i + \beta Lab_{it} + \gamma X_{it} + \varepsilon_{it} \quad (1)$$

Where U_{it} is the unemployment rate for country i at time t, α_i is the country fixed effects, β and γ are the coefficients for the endogenous and exogenous variables used, X_{it} is a vector of control variables.

To provide a comprehensive analysis, the study first incorporates the overall Labor Market Flexibility Index (LMFI) into the model to assess its aggregate impact on unemployment. Subsequently, the impact of each individual component is tested separately to identify the relative significance and influence of specific labor market regulations.

3.3. Research hypothesis

- ✓ H1: Increased (LMFI) significantly reduces the unemployment rate in the MENA region.
- ✓ H2: At least one component of the (LMFRI) has a significant impact on the unemployment rate in the MENA region.

3.4. Research procedure

The analysis follows a structured procedure beginning with data collection, where labor market flexibility and control variables were sourced from reliable international databases. To ensure comparability, all variables were standardized. Based on preliminary diagnostic tests, the fixed-effects model was selected to account for unobserved heterogeneity across countries. Finally, hypotheses were tested through regression analysis, assessing the impact of labor market flexibility on unemployment while incorporating control variables.

4. Results

Table 1 illustrates that the coefficient -0.236619, reveals that a one-unit increase in the labor market flexibility index is associated with a decrease in the unemployment rate. However, the coefficient is not statistically significant at conventional levels ($p = 0.3996$): Hypothesis 1 is partially accepted. Among the control variables, the coefficients for urbanization (URB), the size of the government (SG), and the current account balance (CAB) exhibit statistically significant relationships with the unemployment rate. Overall, the model's R-squared indicates that approximately 89.7% of the variability in the unemployment rate is explained by the independent variables included in the model. The F-statistic is 77.47055, indicates that the regression model is statistically significant as a whole.

Table 1: The static effect of the labor market flexibility index on the unemployment rate

Variable	U	U	U	U	U	U	U
LMRI	-0.236619 (0.3996)						
PG		0.057174 (0.3041)					
URB			-19.90344 (0.0055)				
PS				0.073877 (0.1307)			
SG					14.73463 (0.0771)		
INF						-0.031350 (0.4147)	
CAB							0.047292 (0.0461)
R-Squared = 0.897215 / P-value = 77.47055							

Source: Own elaboration

Table 2 highlights that among the labor market flexibility indicators, (CCB) shows a substantial negative association with unemployment rates (β = -0.622742, p = 0.0320), indicating that countries with decentralized bargaining systems tend to have lower unemployment rates. The correlation between the (MW) and unemployment rates shows a negative trend, though it is not significant at the traditionally accepted level of 0.05. Hypothesis 2 is accepted. The R-squared value is 0.904742, indicating that approximately 90.5% of the variability in the unemployment rate is explained by the independent variables included in the model. The F-statistic is 94.19706, indicating that the regression model is statistically significant as a whole.

Table 2: The static effect of labor market flexibility indicators on the unemployment rate

Variable	U	U	U	U	U	U	U
MW	-0.655110						
	(0.0897)						
HF		0.033833					
		(0.7796)					
CCB			-0.622742				
			(0.0320)				
HR				-0.037414			
				(0.7438)			
MD					-0.098495		
					(0.4689)		
CONS						-0.028480	
						(0.6873)	
FL							0.085249
							(0.5721)
R-Squared= 0.904742 / P-value = 94.19706							

Source: Own elaboration

5. Discussion and conclusion

The analysis provides nuanced insights into the dynamics of labor market flexibility, control variables, and their impact on unemployment rates, particularly within the MENA region. The findings suggest that while there is an association between increased flexibility and reduced unemployment, the lack of statistical significance at conventional levels warrants caution in interpreting this relationship. This aligns with prior studies, such as (Ahmed & Aljane, 2014) and (Liotti, 2020), emphasizing that the relationship is far from straightforward. Within the MENA region, economic, political, and social complexities, including informal labor markets, structural inefficiencies, demographic pressures, and political instability, can diminish the direct impact of labor market reforms (Anthony, Marie-Estelle, & Jorge, 2024) and (Hatayama, 2022). Cultural norms emphasizing job security and state involvement in employment further moderate the effects of labor market flexibility reforms.

A critical challenge in the region is the mismatch between workforce skills and labor market demands, particularly for tertiary-educated individuals often overqualified for available technical roles (ILO, n.d.). This highlights the need for employment policies that align education systems with evolving labor market requirements, ensuring that reforms effectively translate into job creation.

Exploring specific labor market flexibility indicators, the negative association between centralized collective bargaining (CCB) and unemployment underscores the potential benefits of decentralized labor market governance in fostering job creation. In a region often characterized by centralized bargaining and rigid regulations, decentralizing decision-making and encouraging employer-worker dialogue could improve employment outcomes.

Similarly, the correlation between minimum wage (MW) regulations and unemployment shows that adaptable wage policies could help reduce joblessness. Rigid MW policies often act as barriers, compelling workers to seek better-paying jobs abroad or remain unemployed. More flexible (MW) regulations, tailored to regional and sector-specific contexts, could create a more inclusive labor market environment.

Among the control variables, urbanization (URB) shows a significant negative association with unemployment, indicating that expanding urban areas can provide better infrastructure and job opportunities. Conversely, the positive relationship between the size of the government (SG) and unemployment highlights the region's overreliance on public-sector employment, calling for reforms promoting private-sector-led growth. Additionally, the positive correlation between the current account balance (CAB) and unemployment suggests that improvements in external trade balances, while beneficial economically, may coincide with reduced domestic consumption or investment, potentially limiting job creation.

Linking these findings to employment policies within the MENA region, it is evident that labor market flexibility reforms alone are insufficient. Policies must address structural barriers such as skill mismatches, limited female labor force participation, and urban-rural development disparities. A holistic approach combining labor market flexibility reforms with targeted employment policies can better support job creation and social stability. By considering the unique socio-economic dynamics of the MENA region, policymakers can design evidence-

based interventions that promote inclusive economic growth and improve livelihoods across the region.

To summarize, this study examined the impact of labor market flexibility on unemployment rates in 10 MENA countries from 2003 to 2020, using the Labor Market Regulation Index (LMRI) to measure flexibility. Contrary to neoclassical economic theory, the findings show little evidence that increased flexibility reduces unemployment. Among the index's components, centralized collective bargaining (CCB) and minimum wage (MW) had negative effects, often leading to workers seeking opportunities abroad or remaining unemployed until securing higher-paying jobs. Other significant factors affecting unemployment include urbanization, government size, and the current account balance. Recommendations emphasize balanced regional development, improving rural infrastructure, facilitating entrepreneurship, and promoting export-oriented industries to stimulate job creation. This paper offers novel insights into the relationship between labor market flexibility and Unemployment through three key contributions.

This paper offers unique insights into the relationship between labor market flexibility and unemployment in the MENA region. Unlike previous studies focused on developed countries, it delves into the complexities of emerging and transitional economies. By employing a composite indicator of labor market flexibility, the study provides a nuanced understanding of how labor market regulations impact unemployment. Through rigorous econometric analysis and consideration of various control variables, the paper enhances our understanding of this relationship, offering valuable insights for policymakers striving to address unemployment challenges in the MENA region and beyond.

This study acknowledges some limitations that may affect the generalizability of its findings. Firstly, the partial coverage of MENA countries due to data availability constraints may introduce biases and limit the applicability of the results. Additionally, the relatively short period covered in the analysis may not adequately capture the full spectrum of economic and labor market dynamics in the region. Future research should aim to address these limitations by expanding data collection efforts and extending the period of analysis to provide a more comprehensive understanding of labor market flexibility and its implications for unemployment in the MENA region.

References

Agnello, L., Castro, V., Jalles, J. T., & Sousa, R. M. (2014). Fiscal adjustments, labour market flexibility and unemployment. Economics Letters, 124(2), 231–235. https://doi.org/10.1016/j.econlet.2014.05.029.

Ahmed, S., & Aljane, A. (2014). Labor regulation and unemployment: the case of Tunisia. International Journal of Economics and Business Administration, II(Issue 4), 3–13. https://doi.org/10.35808/ijeba/52.

Anthony, O., Marie-Estelle, R., & Jorge, G. M. (2024). Opportunities and Challenges in the MENA Region. https://www.oecd.org/mena/49036903.pdf. Accessed 15 January 2024.

Ball, L., Jalles, J., & Loungani, P. (2015). Do forecasters believe in Okun's Law? An assessment of unemployment and output forecasts. International Journal of Forecasting, 31(1), 176–184. https://doi.org/10.1016/j.ijforecast.2014.03.009.

Barnes, M. L., Gumbau-Brisa, F., & Olivei, G. P. (2012). Do real-time Okun's law errors predict GDP data revisions? RePEc: Research Papers in Economics. https://www.bostonfed.org/economic/wp/wp2013/wp1303.pdf. Accessed 17 January 2024.

Bassanini, A., & Akcigit, U. (2006). Employment patterns in OECD countries: Reassessing the role of policies and institutions. OECD Economics Department Working Papers No. 486. OECD Publishing (NJ1). https://eric.ed.gov/?id=ED503957. Accessed 30 January 2024.

Bernal-Verdugo, L. E., & Furceri, D. :. (2012). Labor Market Flexibility and Unemployment: New Empirical Evidence of static and Dynamic Effects. Comparative Economic Studies, 54(2), 251–273. https://doi.org/10.1057/ces.2012.3.

Bhagwati, J. N., & Hamada, K. (1974). The brain drain, international integration of markets for professionals and unemployment. Journal of Development Economics, 1(1), 19–42. https://doi.org/10.1016/0304-3878(74)90020-0.

Blanchard, O., & Landier, A. (2002). The perverse effects of partial labour market reform: Fixed-Term contracts in France. The Economic Journal, 112(480), F214–F244. https://doi.org/10.1111/1468-0297.00047.

Botero, J. C., Djankov, S., La Porta, R., López-De-Silanes, F., & Shleifer, A. (2004). The regulation of labor. The Quarterly Journal of Economics, 119(4), 1339–1382. https://doi.org/10.1162/0033553042476215.

Djankov, S. (2009). The Regulation of Entry: A survey. World Bank Research Observer, 24(2), 183–203. https://doi.org/10.1093/wbro/lkp005.

Feldmann, H. (2009). The unemployment effects of labor regulation around the world. Journal of Comparative Economics, 37(1), 76–90. https://doi.org/10.1016/j.jce.2008.10.001.

Freeman, R. B., & Medoff, J. L. (1985). What do Unions Do? ILR Review, 38(4), 640–642. https://doi.org/10.1177/001979398503800410.

Hatab, S., Eibl, F., & Hertog, S. (2022). (Accepted/In press). Political Economy and Development in the MENA Region. In M. Lynch, J. Schwedler, & S. Yom (Eds.), The Political Science of the Middle East Oxford University Press.

Hatayama, M. (2022). Too strict? A stocktaking of labor regulations in the Middle East and North Africa (MENA) region. World Bank Blogs. https://blogs.worldbank.org/jobs/too-strict-stocktaking-labor-regulations-middle-east-and-north-africa-mena-region. Accessed 24 January 2024.

ILO. (n.d.). Retrieved from https://www.ilo.org/beirut/areasofwork/skills-and-employabiltiy/lang--en/index.htm Accessed 6 January 2024.

Keller, B., & Seifert, H. (2005). Atypical employment and flexicurity. Management-Revue, 16(3), 304–323. https://doi.org/10.5771/0935-9915-2005-3-304.

La Porta, R., López-De-Silanes, F., Shleifer, A., & Vishny, R. W. (1999). The quality of government. The Journal of Law, Economics, and Organization, 15(1), 222–279. https://doi.org/10.1093/jleo/15.1.222.

Liotti, G. (2020). Labour market flexibility, economic crisis and youth unemployment in Italy. Structural Change and Economic Dynamics, 54, 150–162. https://doi.org/10.1016/j.strueco.2020.04.011.

Rodrik, D. (1998). Why do More Open Economies Have Bigger Governments? Journal of Political Economy, 106(5), 997–1032. https://doi.org/10.1086/250038.

Annex I : Sub-components of the Labor market flexibility index

Data	Source	Description
(i)Minimum wages (area5bi)	World Bank doing business	This sub-component uses the following components: (1) whether fixed-term contracts are prohibited for permanent tasks; (2) the maximum cumulative duration of fixed-term contracts; and (3) the ratio of the minimum wage for a trainee or first-time employee to the average value added per worker.
(ii) Hiring and firing Regulations (area5bii)	World Economic Forum's Global Competitiveness Report.	This sub-component is based on the Global Competitiveness Report question: "The hiring and firing of workers is impeded by regulations (= 1) or flexibly determined by employers (= 7)". The question's wording has varied over the year.
(iii)Centralized collective bargaining (area5biii)	World Economic Forum's Global Competitiveness Report.	This sub-component is based on the Global Competitiveness Report question: "Wages in your country are set by a centralized bargaining process (= 1) or up to each individual company (= 7)". The wording of the question has varied over the years. In earlier years, the actual union density was used to determine ratings for select countries.
(iv) Hours regulation (area5biv)	World Bank's Doing Business data.	This sub-component is based on the Employing Labor section in the World Bank's Doing Business; it uses the following five components: (1) whether there are restrictions on night work; (2) whether there are restrictions on holiday work; (3) whether the length of the work week can be 5.5 days or longer; (4) whether there are restrictions on overtime work; and (5) whether the average paid annual leave is 21 working days or more.
(v) Mandated cost of worker dismissal (area5bv)	World Bank's Doing Business data.	This sub-component is based on the World Bank's Doing Business data on the cost of the advance notice requirements, severance payments, and penalties due when dismissing a redundant worker with 10-years tenure. The formula used to calculate the zero-to-10 ratings

		was (Vmax − Vi) / (Vmax − Vmin) multiplied by 10. Vi represents the dismissal cost (measured in weeks of wages). The values for Vmax and Vmin were set at 58 weeks (1.5 standard deviations above the average in 2005) and 0 weeks, respectively.
(vi)Conscription (area5bvi)	International Institute for Strategic Studies' "The Military Balance," and the War Resisters International's "World Survey of Conscription and Conscientious Objection to Military Service,"	Data on the use and duration of military conscription were used to construct rating intervals. Countries with longer conscription periods received lower ratings.
(vii)Foreign labor (area5bvii)	World Economic Forum, Global Competitiveness Report; Economist Intelligence Unit, Business Environment Ratings.	This subcomponent is based on two sources. (a) The first source is the Global Competitiveness Report question: "To what extent does labor regulation in your country limit the ability to hire foreign labor? (The question's wording has varied over the years). (b) The second source is the "Hiring of foreign nationals" indicator from the Economist Intelligence Unit. The final rating is the average of whichever of these sources are available, and the data are chain-linked to assure time consistency.

Annex II : Data description

Type	Name	Definition	Source
Dependent variables	Unemployment rate	Percentage of the total labor force that is currently unemployed.	WDI
Control variables	Population growth	Annual % which counts all residents regardless of legal status or citizenship.	WDI
	Urbanization	% of the total population living in urban areas as defined by national statistical offices.	WDI
	Population size	Population (in millions).	PWT
	Size of the government	Share of government consumption at current PPPs	PWT
	Inflation rate	The percentage change in the average consumer price index.	IMF
	Current account balance % GDP	The sum of net exports of goods and services, net primary income, and net secondary income.	IMF

EXPLORING CONSUMER BEHAVIOR IN SLOVAKIA'S ELECTRIC VEHICLE MARKET

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ABSTRACT

Purpose:
This study explores consumer behavior in Slovakia's electric vehicle (EV) market through secondary data analysis, with a focus on the key factors influencing EV adoption. The research aims to identify consumer motivations, attitudes, and barriers while analyzing the role of price, income, and social norms in shaping purchasing decisions. By applying established behavioral theories, this study contributes to understanding the decision-making processes and provides insights into strategies to foster sustainable transportation.

Design/methodology:
A secondary data analysis approach was employed, utilizing data from academic journals, government reports, market studies, and industry publications. The analysis applies the Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB) to examine the motivations, perceived barriers, social norms, and economic factors (such as price and income) affecting EV adoption in Slovakia.

Findings:
The study finds that key drivers of EV adoption in Slovakia include environmental awareness, perceived financial incentives, and societal influence. Price sensitivity and the availability of financial incentives were identified as major barriers, along with limited charging infrastructure. A comparison with Czechia reveals a higher price-to-income ratio in Slovakia, indicating that affordability may be a more significant barrier in Slovakia compared to its neighbour. The application of TRA and TPB underscores the influence of social norms and attitudes in shaping consumer behaviour towards EV adoption.

Research/practical implications:
The findings provide valuable insights for policymakers and industry stakeholders, highlighting the need for targeted strategies to reduce economic barriers, such as price subsidies and infrastructure improvements. The study's use of TRA and TPB offers a framework for future research and practical interventions aimed at increasing EV adoption in Slovakia and other similar markets.

Originality/value:
This research is original in its application of secondary data analysis to explore consumer behaviour in Slovakia's EV market, with a focus on the relationship between income, price sensitivity, and adoption decisions. The integration of behavioural theories with empirical data enhances understanding of the factors influencing EV adoption, providing actionable recommendations for policy and practice to promote sustainable transportation in Slovakia.

Keywords: Consumer Behavior, Electric Vehicles, Slovakia, Theory of Reasoned Action, Theory of Planned Behavior

JEL Classification: L62, Q54, M31

1. Introduction

The transportation sector has experienced profound transformations in recent decades, driven by technological advancements and the urgent need for sustainable solutions. Almost 14 million new electric cars were registered globally in 2023, increasing the total number on the roads to 40 million. This closely aligns with the sales forecast provided in the Global EV Outlook 2023. Additionally, electric car sales in 2023 were 3.5 million higher than in 2022, reflecting a 35% year-on-year increase (International Energy Agency, 2024).

In the European Union (EU), the adoption of electric vehicles (EVs) has surged. In 2023, 1.5 million new battery-only electric passenger cars were registered, raising the total to 4.5 million—a 48.5% growth compared to 2022, when the total stood at 3.0 million (Eurostat, 2024). This trend is echoed in Slovakia, where as of December 31, 2023, 12,599 EVs were registered, signaling notable progress in the country's transition toward electric mobility (Ministry of Internal Affairs of SR, 2024).

Despite the rising interest in EVs, the adoption rate in Slovakia remains relatively modest compared to other EU nations. This disparity highlights the need for a deeper understanding of the factors influencing consumer behavior, particularly within the Slovak context. Among these factors, price and its relationship with consumer income stand out as critical yet underexplored elements shaping purchasing decisions.

This study employs secondary data analysis as its primary research method, drawing on existing theoretical literature, market research studies, official statistics, and other reputable empirical sources to systematically examine consumer behavior regarding EV adoption in Slovakia. Grounded in the Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB), the analysis explores key behavioral drivers, perceived barriers, social norms, and other influential factors. Special attention is given to the interplay between price sensitivity and

income levels, providing nuanced insights into how economic factors influence Slovak consumers' decision-making processes.

Ultimately, this study aims to contribute both theoretical and practical insights, offering policymakers and industry stakeholders actionable recommendations to promote EV adoption in Slovakia and accelerate the transition toward sustainable transportation solutions.

2. Literature review/theoretical background

The adoption of electric vehicles (EVs) has garnered significant attention in recent years as governments and industries strive to achieve sustainability goals. Numerous studies have explored the factors influencing EV adoption, drawing on established consumer behavior theories such as Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB).
The Theory of Planned Behavior (TPB) identifies three independent determinants of intention that influence behaviour. The first is attitude toward the behaviour, which reflects the degree to which an individual has a favourable or unfavourable evaluation of the behaviour in question. The second determinant is subjective norm, representing the perceived social pressure to perform or not perform the behaviour. The third factor is perceived behavioural control, which refers to the perceived ease or difficulty of performing the behaviour, encompassing past experiences and anticipated obstacles (Ajzen, 1991).

This theoretical framework is particularly relevant for understanding consumer behaviour in Slovakia's electric vehicle (EV) market, where attitudes, societal influences, and perceived challenges may shape intentions to adopt EVs.

The Theory of Reasoned Action (TRA) suggests that the most proximal predictor of volitional behaviour is an individual's behavioural intention. These intentions are shaped by two key influences: individual attitudes toward performing the behaviour and subjective norms, or the perceived social pressures related to the behaviour. Fishbein and Ajzen formalized this relationship mathematically as:

$$BI=(A)\ W_1 +(SN)\ W_2$$

where BI represents behavioural intention, A denotes the attitude toward the behaviour, SN represents subjective norms, and the weights (W_1 and W_2) are empirically derived (Hale, Householder, & Greene, 2002).

This theoretical foundation provides a valuable lens through which to explore consumer behaviour in Slovakia's electric vehicle (EV) market, particularly in understanding how individual attitudes and social influences impact intentions to adopt EVs.

Both the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) are grounded in the premise that individuals make logical and reasoned decisions to engage in specific behaviours based on the evaluation of information available to them. However, TPB extends TRA by incorporating the concept of perceived behavioural control, acknowledging that individuals' behaviour is not always entirely voluntary or fully within their control (Durmuş Şenyapar & Akil, 2023)

The Theory of Planned Behavior (TPB) highlights the importance of subjective norms in shaping behavioural intentions. Within this framework, peer pressure and mass media influence emerge as critical factors influencing consumer behaviour in the context of electric vehicle (EV) adoption. Peer influence refers to the degree to which individuals perceive that peers, colleagues, or family members share information about the benefits of adopting EVs. These interactions are facilitated by regular opportunities to exchange information, which has been further amplified by the rise of social media, making the dissemination of peer-driven insights quicker and easier. This exchange often promotes product consciousness across various demographics, directly or indirectly affecting users' adoption intentions (Dutta & Hwang, 2023).

Mass media influence, on the other hand, refers to the perception of how media impacts individual behaviour and decisions. Ajzen (1991) identified mass media as a significant antecedent of subjective norms, capable of shaping IT and technology adoption behaviours. The mass media can determine behaviour positively or negatively, with numerous studies confirming its positive and significant impact on subjective norms in shaping consumer intentions (Dutta & Hwang, 2023).

The Theory of Planned Behavior (TPB) provides a useful framework for understanding the factors influencing consumer behaviour in the electric vehicle (EV) market. According to

Secinaro, Calandra, Lanzalonga, and Ferraris (2022), consumer choices regarding EV adoption are influenced by both positive and negative factors, which can be categorized as follows:

Positive Factors:

- New Technology: The appeal of advanced and innovative technologies integrated into EVs.
- Environmental Consciousness: Growing consumer awareness of the environmental benefits of EVs, including reduced emissions and sustainable energy use.
- Policy Makers' Incentives: Financial incentives, tax benefits, and subsidies provided by governments to promote EV adoption.

Negative Factors:

- Price: The high initial cost of EVs compared to traditional vehicles.
- Charging Mode Issues: Concerns about the availability, speed, and convenience of charging infrastructure.
- Change Effectiveness and Energy Efficiency: Questions regarding the efficiency of EVs, especially compared to improvements in traditional vehicles.

These factors, summarized in Figure 1, highlight the complex interplay of technological, economic, and psychological influences on consumer decision-making in the EV market (Secinaro et al. 2022)

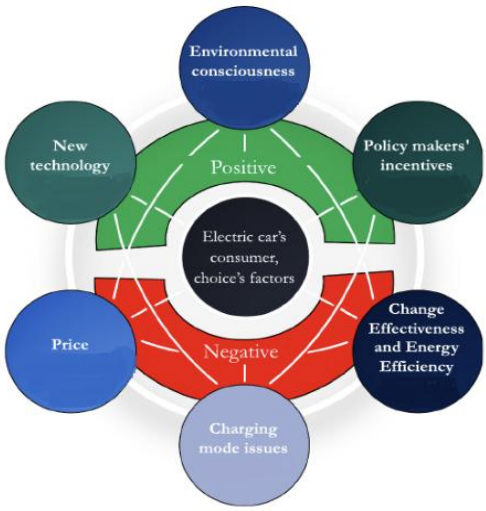

Figure 1. Positive and negative factors influencing EV consumer choice
Source: Secinaro et al., 2022

Income levels play a significant role in shaping consumer behaviour and access to electric vehicles (EVs). According to Bauer, Hsu, and Lutsey (2021), lower-income households tend to own fewer vehicles and drive fewer miles annually, which reduces the potential savings from electrification. However, these households often purchase older and less fuel-efficient vehicles, which could enhance the operational savings from transitioning to EVs and narrow the difference in upfront costs.

Charging behaviour and electricity rates also influence cost dynamics for lower-income households. Although these households incur slightly higher charging costs compared to higher-income groups, rural residency and associated lower electricity rates can mitigate these differences. The analysis further highlights that while cost parity between electric vehicles (EVs) and gasoline-powered vehicles is projected for both new and used vehicles, entry-level used BEVs may reach parity slightly later due to delays in availability. By 2030, used BEVs are estimated to cost around $10,000 on average, similar to their gasoline counterparts, though supply constraints for affordable models may pose challenges (Bauer et al., 2021).

3. Methods

The methodology of this study is based on a secondary data analysis approach to explore consumer behaviour in Slovakia's electric vehicle (EV) market, with a particular focus on the interplay between price and consumer income as influential factors in EV adoption. Data were collected from a diverse range of reputable sources, including academic journals, industry reports, government publications, and market research studies, ensuring a robust and comprehensive foundation for analysis. The research is grounded in the theoretical frameworks of the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB), which guide the examination of consumer attitudes, social norms, and perceived behavioural control. By synthesizing existing empirical evidence and aligning it with these behavioural theories, this study aims to identify key drivers and barriers to EV adoption in Slovakia, offering insights into how economic factors, such as price sensitivity and income distribution, shape consumer decision-making processes. This methodological approach provides a systematic and replicable framework for understanding consumer behaviour in emerging EV markets.

4. Results and discussion

The results section focuses on the affordability of electric vehicles (EVs) in Slovakia, specifically examining the relationship between EV prices and consumer income, and compares these findings with neighbouring Czechia. By calculating the price-to-income ratio using the minimum EV price and the average nominal monthly wage in each country, this analysis aims to highlight the financial barriers that impact EV adoption. The findings are contextualized within the broader theoretical frameworks of the Theory of Planned Behavior (TPB) and the Theory of Reasoned Action (TRA), emphasizing the role of economic feasibility as a determinant of consumer behaviour. This comparison provides valuable insights into how affordability influences EV adoption rates in Slovakia and offers actionable recommendations for improving accessibility through targeted policies and incentives.

Electric vehicle prices are notably high in Slovakia, mirroring the trend observed in other European Union countries. The analysis of economic factors reveals significant differences in the average nominal monthly salaries between Slovakia and Czechia for 2023. In Slovakia, the average nominal monthly salary of an employee in 2023, calculated as the average of all four quarters, was €1,430 (Statistical Office of the Slovak Republic, 2023). In comparison, the average nominal monthly salary in Czechia for the fourth quarter of 2023 was CZK 46,013, which equates to approximately €1,861.07 as of December 31, 2023, based on the exchange rate data from the National Bank of Slovakia (Czech Statistical Office, 2023; National Bank of Slovakia, 2023).

These figures illustrate a higher average nominal monthly salary in Czechia compared to Slovakia, highlighting potential disparities in purchasing power and affordability of electric vehicles (EVs) between the two countries. Such differences could influence consumer behaviour and adoption rates of EVs in these markets.

An analysis of the electric vehicle (EV) market in Slovakia reveals that the Dacia Spring Electric is the most affordable EV model as of 2023. According to research published on mojelektromobil.sk (2024), the Dacia Spring Electric ranks as the cheapest EV available in Slovakia. Further investigation on the official Slovakian Dacia website (dacia.sk) confirms that the Dacia Spring Essential model is priced starting at €16,900 as of 2024.

This pricing positions the Dacia Spring Essential as an attractive entry-level option for consumers seeking an affordable transition to electric mobility. Its affordability could play a significant role in shaping EV adoption trends, particularly among lower-income households in Slovakia.

In the Czech Republic, the Dacia Spring Electric has been identified as the most affordable electric vehicle (EV) in 2023. According to research published by Allianz Czechia (allianz.cz) in 2024, the Dacia Spring Electric holds the position of the cheapest EV model in the market. An examination of the official Czech Dacia website (dacia.cz) confirms that the price for the Dacia Spring models starts at 419,900 CZK. Based on the exchange rate data provided by the National Bank of Slovakia, this price is equivalent to approximately €16,983.50 in 2024 (nbs.sk).

This pricing highlights the affordability of the Dacia Spring Electric in the Czech market, making it an attractive choice for cost-conscious consumers. Similar to Slovakia, its low entry cost could be a significant factor in encouraging EV adoption in the Czech Republic. To assess the affordability of electric vehicles (EVs) in Slovakia and Czechia, the price-to-income ratio was calculated. This ratio compares the minimum price of an electric vehicle to the average nominal monthly salary in each country. The calculation is as follows:

$$Ratio\ (Slovakia) = \frac{Minimum\ EV\ Price}{Average\ Nominal\ Monthly\ Salary} = \frac{16{,}900\ EUR}{1{,}430 EUR/month} = 11.8$$

$$Ratio\ (Czechia) = \frac{Minimum\ EV\ Price}{Average\ Nominal\ Monthly\ Salary} = \frac{16{,}983.5\ EUR}{1{,}861.07 EUR/month} = 9.1$$

This ratio provides a measure of the relative affordability of EVs, with a lower ratio indicating greater affordability. The Dacia Spring Essential, as the most affordable EV in both Slovakia and Czechia, was selected as the representative model for this analysis.

These findings are significant in the context of the Theory of Reasoned Action (RAT) and Theory of Planned Behavior (TPB), both of which emphasize the role of attitudes, subjective norms, and perceived behavioural control in shaping consumer intentions and actions.

According to these theories, the attitudes of Slovak consumers toward EVs are likely influenced by the perceived cost of adopting such vehicles. A higher price-to-income ratio in Slovakia suggests that financial constraints may act as a significant barrier to EV adoption.

Furthermore, subjective norms as described in the RAT and TPB, which reflect societal pressures and expectations, could also be influenced by the affordability of EVs. In Slovakia, where the price-to-income ratio is higher, there may be less social motivation to adopt EVs, as the financial burden on consumers is more pronounced. Conversely, in Czechia, the relatively lower price-to-income ratio may make EV adoption appear more attainable and, therefore, more socially acceptable.

In addition, the perceived behavioural control aspect of TPB—referring to the ease or difficulty with which consumers believe they can make the decision to adopt EVs—also plays a crucial role here. The higher price-to-income ratio in Slovakia suggests that Slovak consumers may feel they have less control over their ability to afford an EV, thereby diminishing their intentions to adopt. The price of electric vehicles (EVs) remains a critical barrier to widespread adoption, as highlighted by Wang et al. (2017) in their study on the adoption of EVs in Shenzhen, China. According to their analysis, the high initial cost of EVs significantly impedes consumer adoption. This factor is consistent with other global markets, including Slovakia and Czechia, where the upfront price of EVs continues to be a key consideration for potential buyers.

This analysis highlights the importance of factors such as price and income in influencing consumer behaviour towards electric vehicle adoption. Policymakers and industry stakeholders should consider these economic disparities when designing strategies to promote EV adoption in Slovakia and other similar markets. Financial incentives, subsidies, and policies aimed at reducing the price gap between conventional and electric vehicles could be effective tools in improving the affordability of EVs and encouraging their uptake in Slovakia.

5. Conclusion

The findings from this study underscore the significant role that price and income play in shaping consumer intentions to adopt electric vehicles. The price-to-income ratio comparison between Slovakia and Czechia highlights that consumers in Slovakia face greater economic

challenges when considering EV adoption. This analysis is consistent with the theoretical frameworks of Reasoned Action Theory and Theory of Planned Behavior, where financial barriers influence attitudes, perceived behavioural control, and ultimately the intention to adopt sustainable technologies like electric vehicles. The results emphasize the need for targeted policies that address these economic barriers, with potential implications for increasing EV adoption in Slovakia and improving its overall electric mobility landscape.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Allianz Czechia. (2024). Cheapest electric cars in Czechia, 2023. Retrieved from https://allianz.cz

Bauer, G., Hsu, C.-W., & Lutsey, N. (2021). When might lower-income drivers benefit from electric vehicles? Quantifying the economic equity implications of electric vehicle adoption. Working Paper 2021-06, International Council on Clean Transportation. Retrieved from https://theicct.org/sites/default/files/publications/EV-equity-feb2021.pdf

Czech Statistical Office. (2023). Average nominal monthly salary of an employee in Czechia, 4th quarter. Retrieved from https://csu.gov.cz

Dacia Czechia. (2024). Dacia Spring Electric pricing. Retrieved from https://www.dacia.cz

Dacia Slovakia. (2024). Dacia Spring Essential pricing. Retrieved from https://www.dacia.sk

Durmuş Şenyapar, H. N., & Akil, M. (2023). Analysis of consumer behavior towards electric vehicles: Intentions, concerns and policies. Gazi University Journal of Science, Part C, 11(1), 161–183. Retrieved from https://dergipark.org.tr/tr/download/article-file/2882612

Dutta, B., & Hwang, H. G. (2021). Consumers' purchase intentions of green electric vehicles: The influence of consumers' technological and environmental considerations. Sustainability, 13(21), 12025. https://doi.org/10.3390/su132112025

Eurostat. (2024, March 2). EU electric vehicle statistics: 2023 overview. Retrieved from https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240802-1#:~:text=In%202023%2C%201.5%20million%20new,total%20number%20was%203.0%20million

Hale, J. L., Householder, B. J., & Greene, K. L. (2002). The theory of reasoned action. In J. Dillard & M. Pfau (Eds.), The SAGE handbook: Development in theories and practices (pp. 259–285). https://books.google.sk/books?id=I_ByAwAAQBAJ&printsec=frontcover#v=onepage&q&f=false

International Energy Agency. (2024). Global EV outlook 2024. Retrieved from https://www.iea.org/reports/global-ev-outlook-2024

Ministry of Internal Affairs of Slovakia. (2024). Electric vehicle registrations in Slovakia: 2023 overview. Retrieved from https://www.minv.sk/?pocet-evidovanych-elektromobilov-a-hybridov

Mojelektromobil.sk. (2024). The cheapest electric cars in Slovakia: Current list and prices. Retrieved from https://mojelektromobil.sk

National Bank of Slovakia. (2023). Exchange rate data, December 31, 2023. Retrieved from nbs.sk

Statistical Office of the Slovak Republic. (2023). Average nominal monthly salary of an employee in Slovakia. Retrieved from statdat.statistics.sk

Secinaro, S., Calandra, D., Lanzalonga, F., & Ferraris, A. (2022). Electric vehicles' consumer behaviours: Mapping the field and providing a research agenda. Journal of Business Research, 150, 399–416. https://doi.org/10.1016/j.jbusres.2022.04.045

Wang, F. P., Yu, J. L., Yang, P., Miao, L. X., & Ye, B. (2017). Analysis of the barriers to widespread adoption of electric vehicles in Shenzhen, China. Sustainability, 9(4), 522. https://doi.org/10.3390/su9040522

ASSESSING GERMAN EXIT TAXATION IN LIGHT OF THE ATAD DIRECTIVE

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ABSTRACT

Purpose:
This paper aims to conduct a comprehensive analysis of Germany's exit taxation regime by examining its alignment with the Anti-Tax Avoidance Directive (ATAD) standards set by the European Union. It seeks to identify the extent to which German tax law complies with ATAD requirements, focusing on challenges and discrepancies between national legislation and EU directives.
Design/methodology:
The methodology includes a comparative analysis of § 6 AStG (German Foreign Tax Act) and the EU Anti-Tax Avoidance Directive (ATAD), alongside a review of its implementation in other member states. An overview of the exit taxation rules in § 6 AStG and the ATAD provisions will focus on their objectives, scope, and mechanisms. The analysis will identify discrepancies and alignments between the two, as well as differences in member states' implementations. This study relies primarily on legislative texts due to the limited existing literature on the subject.
Findings:
The analysis suggests that Germany's enactment of § 6 AStG, in compliance with the Anti-Tax Avoidance Directive, embraces a more stringent interpretation than other EU member states, surpassing ATAD's requirements in multiple areas. This strict application could hinder the synchronization of anti-tax avoidance measures across the EU, underscoring a possible divergence from the wider goals of ATAD.
Research/practical implications:
The question arises to what extent it is permissible in the field of tax policy to interpret directives much more strictly. Here, a higher level of protection clashes with the interests of other member states. As a result, legislators will have to make amendments. The norm de lege ferenda will be presented in the context of my dissertation.
Originality/value:
So far, there is no literature that provides a comparison between the directive and the legislative implementation in Germany.

Keywords: Exit taxation, tax policy, tax evasion, Legislative implementation

JEL Classification: K34, K33

1. Introduction

The 2008 global financial crisis led industrialized nations to urge the OECD to counter multinational tax avoidance, culminating in the BEPS project to deter profit shifting to low-tax countries. Subsequently, the EU introduced the Anti-Tax Avoidance Directive (ATAD I) in 2016, aligning with BEPS standards, though its implementation varies across member states due to diverse tax systems. In Germany, ATAD I's 2021 enactment revised § 6 AStG, tightening exit taxation laws and sparking debates on EU law compatibility. However, a detailed examination of ATAD I's national implementation is prerequisite. Specifically, § 6 AStG imposes a final tax on share value increases without a sale, expanding § 17 EStG's application without actual liquidity inflow (Brandis/Heuermann, 2023, AStG § 6 ref. 1).

As part of the legislative implementation of the ATAD Directive I of 25 June 2021 (BGBl. 2021 I 2035), the legislator of the Federal Republic of Germany amended and partially tightened the provisions on exit taxation pursuant to § 6 AStG. These legislative adjustments, which were made in direct response to European requirements, already raised fundamental questions regarding their compatibility with EU law in the preliminary phase of their implementation. There are already numerous specialist articles on this in the literature (Bösken, 2021, p. 589; Cloer/Niemeyer, 2018, p. 1017; Ditz/Quilitzsch, 2021, p. 485; Escher/Grzella, 2020, p. 540; Häck/Oertel, 2021, pp. 287; Hagemann/Link, 2021, p. 471; Haug, 2020, p. 84; Kraft/Hohage, 2021, p. 538; Naumann/Riehm, 2022, p. 1577; Ruiner, 2012, p. 49; Schaumburg in: FS Herzig, 2010, p. 711; Schön, 2022, p. 181; Schreiber/Jaun, 2004, p. 769; Weiss, 2019, p. 117; Wilke, 2020, p. 366; Zimmer, 2003, p. 3585.; in particular in light of the ECJ ruling of 26 February 2019, C-581/17, known as "Wächtler", a more intensive critical examination took place: Kühn/Weiss, 2020, p. 46, 53; Schiefer, 2020, p. 84; Schönfeld/Erdem, 2022, p. 76). However, an in-depth analysis and critical assessment of these legislative reorganisations at national level requires a detailed discussion of the implementation of that directive by the German legislator.

2. Methodology

The methodology includes a comparative analysis of § 6 AStG (German Foreign Tax Act) and the EU Anti-Tax Avoidance Directive (ATAD), alongside a review of its implementation in other member states. An overview of the exit taxation rules in § 6 AStG and the ATAD provisions will focus on their objectives, scope, and mechanisms. The analysis will identify discrepancies and alignments between the two, as well as differences in member states' implementations. This study relies primarily on legislative texts due to the limited existing literature on the subject.

3. Intent of the Directive

The Directive aims to effectively combat tax avoidance practices within the internal market and ensures that taxation is carried out consistently at the place where profits are actually realised and value is created (Recital 1 of the Directive). The directive makes explicit reference to global tax policy priorities and the recommendations of the Organisation for Economic Cooperation and Development (OECD), particularly in light of the BEPS initiative (Recital 1 of the Directive). In particular, the Directive addresses legal entities that are subject to corporation tax in a Member State with the overarching aim of preventing market distortions and preserving the tax bases (Recital 4 of the Directive). The Directive therefore aims to strengthen the resilience of the internal market against tax avoidance strategies (Recital 16 of the Directive).

4. Comparison of the directive with national implementation in Germany

4.1. Scope of application (Art. 1 ATAD Directive)

Art. 1 of Directive 2016/1164/EU defines its scope, applying to all taxpayers subject to corporation tax in one or more Member States, including permanent establishments located in Member States but tax-resident in third countries.

In German law, § 6 AStG exclusively targets natural persons, particularly shareholders of legal entities. § 6 (1) AStG explicitly references § 17 EStG, which applies only to natural persons, and § 6 (2) sentence 1 confirms this focus. If the conditions of § 6 AStG are met, a

share sale is assumed, triggering income tax at the shareholder level. The explanatory memorandum (BR-Drs. 19/28652, p. 47 ff.) does not address this divergence.

The EU mandates taxation at the entity level, consistent with Art. 5 (1) of the Directive, while Germany taxes at the shareholder level, linking exit to income tax realization. In Germany, shareholders—not corporations—are taxed when a corporation is sold, aligning with its tax system. However, taxing only when a corporation is a shareholder of another corporation would also have been conceivable. Whether restricting the scope to entities would cause tax gaps remains open and is addressed in the outcome (point 5). Germany's approach significantly exceeds the Directive's scope, extending it to a different tax type and system. Only Belgium (Art. 208 ff. CIR92), Bulgaria (Art. 155 Corporate Tax Act), Ireland (section 627(2)–627(3) TCA 1997), Czechia (§§ 23g, 23h Income Tax Act), and Hungary (Art. 16a Corporate Tax Act) limit the personal scope exclusively to corporations, fully aligning with the Directive's requirements.

4.2. Characteristic of the exit tax (origin on the merits)

Art. 5(1) of the Directive outlines scenarios for taxation rights adjustments:

- Asset transfer from the corporation's main office to a permanent establishment in another Member State or third country, resulting in the original Member State losing taxation rights (Art. 5(1)(a) Directive).
- Asset transfer from a permanent establishment to the main office or another permanent establishment in a different Member State or third country, causing the initial Member State to lose taxation rights (Art. 5(1)(b) Directive).
- Corporation's tax residency relocation to another Member State or third country, excluding assets tied to a permanent establishment in the original Member State (Art. 5(1)(c) Directive).
- Business activity transfer by a permanent establishment to another Member State or third country, leading to the original Member State's loss of taxation rights on the transferred assets (Art. 5(1)(d) Directive).

According to § 6(1) cl. 1 no. 1 AStG, exit taxation is triggered at national level if a person holds shares in a corporation within the meaning of § 17 EStG after at least ten years of

unlimited income tax liability in Germany and loses their unlimited tax liability status by physically moving away from Germany. A share within the meaning of § 17 EStG is deemed to exist if the seller has directly or indirectly held at least 1 per cent of the company's capital within the last five years (§ 17(1) EStG).

§ 6(1) cl. 1 no. 2 AStG covers cases in which shares are transferred free of charge to a person who is not subject to unlimited tax liability. The existence of a specific legal transaction no longer plays a role here. Nevertheless, transfers through living or acquisition transactions are still covered (BT-Drs. 19/28652, p. 48).

According to the catch-all provision of § 6(1) cl. 1 no. 3 AStG, the regulation requires "the exclusion or restriction of the right of taxation of the Federal Republic of Germany". This offence is subsidiary. (Brandis/Heuermann, 2023, AStG § 6 ref. 59).

The case examples in the Directive therefore relate to movements within the business assets, i.e. the active transfer of assets of a chapter company to another country or the change in business activities in such a way that the unlimited corporation tax liability shifts to another country. Germany, on the other hand, is linked to a transaction in private assets, the shareholder transfers his residence to another country, as a result of which the share in a corporation that is part of his private assets is taxed.

The Directive is therefore aimed at cross-border movements in business assets, while the German transposition is aimed at cross-border movements in private assets.
There is no justification for this approach at national level in the explanatory memorandum.

4.3. Payment by instalments and their termination

According to Art. 5(2) of the Directive, taxpayers may pay tax on realized capital gains or exit taxes (Art. 5(1)) in installments over five years, provided the conditions of Art. 5(1), such as the transfer of business assets, are met. This also applies to third countries within the EEA that have agreements on equivalent tax recovery assistance as outlined in Directive 2010/24/EU.

If there is proven risk of non-payment, deferral may require security (Art. 5(3)). Under Art. 5(4), deferral ends, and tax becomes immediately due if assets are sold, transferred to a third

country, tax residency shifts, insolvency occurs, or payment obligations are unmet within 12 months.

Germany uniquely extends installment payments to seven years, requiring an application and security deposit. In contrast, France rejects installment payments, maintaining deferral (Art. 167 bis General Tax Code).

According to § 6 (4) sentence 4 AStG, installment payments must be terminated immediately in the following cases:

- if the installment is not paid on time (§ 6 (4) sentence 4 no. 1 AStG),
- in case of non-compliance with the duty to cooperate (§ 6 (4) sentence 4 no. 2 AStG),
- upon filing for insolvency (§ 6 (4) sentence 4 no. 3 AStG),
- upon sale or transfer of shares (§ 6 (4) sentence 4 no. 4 AStG), and
- upon profit distribution or return of capital contributions exceeding one-quarter of the share's value (§ 6 (4) sentence 4 no. 5 AStG).

The division into seven equal annual installments under German law deviates from the Directive but does not, in my view, undermine the minimum level of protection, as a longer payment period does not necessarily increase the risk of tax loss. This is particularly true since the Directive's minimum protection standard (Art. 3) applies to corporations. However, German law requires a security deposit in all cases, regardless of risk, which justifies the more extended payment period. Only Croatia (Art. 30 d Profit Tax Act) and Spain (Art. 95 bis Income Tax Act) similarly require unconditional security deposits, while most Member States link this requirement to justified doubts (e.g., Estonia, § 54 ITA; Finland, §§ 51a, 51e Income Tax Act) or do not require a deposit at all (e.g., France, Art. 167 bis General Tax Code; Italy, Art. 166 bis TUIR).

The Directive provides for installment termination in cases of sale, transfer to a third country, insolvency, or lack of cooperation. For cooperation, the Directive grants taxpayers 12 months to resolve the issue. German law is stricter, terminating installments after the first violation. It also ends installments for profit distributions or return of contributions exceeding one-quarter of the company's value—a redundant measure since the unconditional security deposit already safeguards assets.

No justification for these deviations from the Directive is provided in the legislative reasoning.

The deferral concept is also debatable following the ECJ's *Wächtler* judgment (CJEU, February 26, 2019 – C-581/17, Wächtler, IStR 2019, 260). The ECJ concluded that installment payment schemes are incompatible with EU law, as they disproportionately restrict fundamental freedoms. Instead, the ECJ advocates deferral of the exit tax until actual realization, potentially with a security deposit. Given the loyalty obligation under Art. 4(3) TEU, the ATAD Implementation Act's replacement of the deferral concept with installments is highly questionable. This contradicts ECJ case law and could be deemed contrary to EU law (Schönfeld/Erdem, 2021, p. 527).

Thus, it becomes evident that the Directive's provisions are not fully compliant with Union law.

5. Minimum level of protection (Art. 3 ATAD Directive)

The minimum protection level under Article 3 of the Directive aims to prevent aggressive tax planning within the internal market by ensuring consistent corporate tax rules across Member States. While the ATAD sets a baseline to avoid a "race to the bottom," Member States are allowed to implement stricter rules, provided they comply with EU fundamental freedoms, reflecting flexibility in addressing national tax systems' diversity.

The minimum protection level under Article 3 of the Directive encompasses the extension of the personal scope and its application to asset transfers within private wealth. Additionally, the security deposit required under § 6 (4) sentence 2 AStG aligns with the Directive's minimum protection level, though its full compliance with EU law requires further scrutiny.

6. Results

The decisive break between the ATAD Directive and its implementation at national level can be identified, on the one hand, in the scope of application. While the scope of the directive is limited to corporations, the national implementation applies to natural persons. The system of German tax law could serve as a justification for this contradiction, as the increases in the value of a corporation or its shares are taken into account at the level of the shareholder, even

if the shareholder holds the shareholding as private assets. The key question is therefore whether § 6 AStG closes a systematic gap in the German system of unentanglement taxation. Assuming that the German exit tax would only apply to legal entities, would the German state lose taxation rights if the shareholder in a corporation moves to another member state even though the corporation remains in existence in the country? If there were a sale after the shareholder had moved to another member state, the German state would become aware of the sale because the company would still have its registered office in Germany. The shareholder would now be subject to limited tax liability within the meaning of § 1 (4) EStG and would generate income from within the country within the meaning of § 49 (1) No. 2 (e) EStG; this norm is explicitly linked to § 17 EStG. In the event of a sale of shares and the realization of hidden reserves, taxation could still take place at the level of the shareholder, provided Germany is allocated the taxation right under a double taxation agreement (DTA). Analyzing DTAs with other Member States reveals that Germany is clearly allocated the taxation right in agreements with Bulgaria (Art. 13(2) in conjunction with Art. 13(6) DTA-Bulgaria), Denmark (Art. 13(5) DTA-Denmark), Finland (Art. 13(6) DTA-Finland), Luxembourg (Art. 13(6) DTA-Luxembourg), Austria (Art. 13(2) in conjunction with Art. 13(6) DTA-Austria), Sweden (Art. 13(5) DTA-Sweden), Slovakia (Art. 13(3); Art. 13(4) DTA-Slovakia), Slovenia (Art. 13(5) DTA-Slovenia), Czechia (Art. 13(3) DTA-Czechia), and Hungary (Art. 13(6) DTA-Hungary). In such cases, § 6 AStG does not close a systematic gap, as there is no risk of Germany losing its taxation right. Accordingly, in the event of a sale of the share and thus the realization of hidden reserves, there is still an opportunity to determine these with the shareholder. The question of recovery closes. Here, the EU Recovery Directive (RL 2010/24/EU) offers an opportunity to collect the taxes incurred within the Union by means of administrative assistance. In this respect, the German state does not suffer any real loss. For the operational area, the state already has protection to the extent that it loses the right to tax individual assets via § 4 (1) cl. 3 EStG at the level of income tax (natural persons) and via § 12 (1) KStG at the level of corporations.

In this respect, the German legislature's interpretation of the scope of application and the relevant elements of the offense is incorrect, as the directive only addresses operational issues.

References

Alber, M. et al. (2023). *Beck'sches Steuer- und Bilanzrechtslexikon* (66th ed.). München: Verlag C.H. Beck.

Bösken, S. (2021). Die Unionsrechtskonformität der Wegzugsbesteuerung in § 6 AStG nach der Reform durch das ATAD-Umsetzungsgesetz. Ubg, 10, 589-597.

Brandis, P., & Heuermann, B. (2022). AStG. München: Verlag C.H. Beck.

Cloer, A., & Niemeyer, N. (2018). Die rückwirkende Umsetzung der ATAD – eine nationale und unionale Folge. FR, 1017-1029.

Ditz, X., & Quilitzsch, C. (2021). Die Neuregelung der Hinzurechnungsbesteuerung durch das ATAD-Umsetzungsgesetz - Überblick und kritische Würdigung. Ubg, 485-495.

Escher, J., & Grzella, P. (2020). Aktuelles zur Wegzugsbesteuerung gem. § 6 AStG - FG Münster zur vorübergehenden Abwesenheit gem. § 6 Abs. 3 AStG und Referentenentwurf zum ATAD-Umsetzungsgesetz. BB, 540-543.

Häck, N., & Oertel, E. (2021). Künftige Wegzugsbesteuerung nach § 6 AStG i.d.F. des ATAD-UmsG. ISR, 8, 287-294.

Hagemann, T., Kahlenberg, C., Höppner, D., & Schuh, M. (2019). Die „Exit"-Besteuerung nach mehr als einer Dekade EuGH-Rechtsprechung – immer noch offene Fragen zur Wegzugsbesteuerung nach § 6 AStG. FR, 9, 427-436.

Haug, F. (2020). Grenzen für die Investmentbesteuerung aufgrund „ATAD-UmsG" und „JStG 2019". Ubg, 84-95.

Kraft, G., & Hohage, U. (2021). Unmittelbare ATAD-Anwendung in begünstigend wirkenden Situationen. FR, 538-543.

Kühn, M., & Weiss, B. (2020). Die geplante Reform der Wegzugsbesteuerung nach § 6 AStG – Verschärfungen der Wegzugsbesteuerungsregeln im privaten Bereich. IWB, 2, 46-55.

Naumann, J., & Riehm, P. (2022). Tagungsbericht zum 12. Hamburger Forum für Unternehmensteuerrecht 2022. DStR, 1577-1588.

Ruiner, C. (2012). Überlegungen zur deutschen Wegzugsbesteuerung von Gesellschaften im Licht des EuGH-Urteils in der Rs. National Grid Indus BV. IStR, 49-51.

Schaumburg, H. (2010). Festschrift für Norbert Herzig zum 65. Geburtstag (pp. 711-729). München: Verlag C.H. Beck.

Schiefer, F. (2020). Die geplante Neukonzeption der Wegzugsbesteuerung des § 6 AStG durch das ATADUmsG. ISR, 84-90.

Schön, W. (2022). Internationale Steuerpolitik zwischen Steuerwettbewerb, Steuerkoordinierung und dem Kampf gegen Steuervermeidung. IStR, 181-191.

Schönfeld, J., & Erdem, E. (2022). Wegzugsbesteuerung nach § 6 AStG n.F. und EU-Recht. StuW, 76-100.

Schönfeld, J., & Erdem, E. (2021). § 6 AStG idF ATADUmsG im Fokus des Unionsrechts: Ist ein Ratenzahlungskonzept mit der EuGH-Rechtsprechung vereinbar? IStR, 527-533.

Schreiber, R., & Jaun, R. (2004). EuGH-Urteil zur Wegzugsbesteuerung eine Chance für die Schweiz? Niederlassungsfreiheit höher gewichtet als Besteuerung stiller Reserven. ST, 9, 769-776.

Weiss, M. (2019). EuGH: Sofortige Fälligkeit der Steuer nach § 6 AStG bei Wegzug in die Schweiz ist unverhältnismäßigkeit. EStB, 117-119.

Wilke, U. (2020). Entstrickungsbesteuerung nach der "ATAD"-Umsetzung. IStR, 366-371.

Zimmer, D. (2003). Nach „Inspire Art": Grenzenlose Gestaltungsfreiheit für deutsche Unternehmen? NJW, 3585-3592.

Judgments:

BFH. (2017). Judgment of April 12, I R 36/15. BFH/NV, 18, 58.

ECJ. (2019). Judgment of February 26, Case C-581/17, Wächtler. IStR, 2019, 260.

BFH. (2022). Judgment of December 21, I R 55/19. BStBl II, 2023, 898.

SENIORS, ELIMINATION OF LONELINESS AND THE USAGE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

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ABSTRACT

Purpose:
The purpose of this research is to identify older people's needs, the qualities that a social worker from Telefonul Vârstnicului helpline should have and its history.
Design/methodology:
The method used for research was the in-depth interview, followed by observation notes. I chose this research method because it gave me the ability to notice the expressions and postures of the interviewees.
Findings:
I found out the needs of the seniors who call Telefonul Vârstnicului helpline, such as: moral support, communication, eliminating loneliness and the desire to receive useful information. Those whose families live abroad had to learn to adapt and this is why they felt the need and desire to learn more about technology. Among the qualities that a social worker working in this helpline should have, there are: great communication skills, to listen actively, to be patient, to be calm, to be resilient to stress.
Research/practical implications:
The added value of this research is revealed from the qualitative research and the originality of the case-study. The need to age actively is satisfied by participating in various activities through senior clubs.
Originality/value:
The topic is original and the need to study this specific cluster of people from this helpline is order related to the understanding of how active aging and use of new technology is realized in an older people's dedicated helpline in Romania.

Keywords: active aging; senior helpline program; eliminating loneliness.

JEL Classification: L31, Z13, Z19

1. Introduction

The aim of this study is to identify which are seniors' needs and what capacities a person working day by day with seniors should have. It also offers an overview of the *Telefonul Vârstnicului* helpline.

I chose to research this subject because I feel there is a gap between the needs of people over 65 years old and the capacity of using technology. I firmly believe this study along with the research can offer a detailed perspective of these differences and fill this gap.

Peacock & Künemund (2007) discussed in their research that individual's experiences through their lifetime are a key element in the process of adapting to a new community or group of new people despite their differences.

Many NGOs are doing their best to help people over 65 years old, eliminating their loneliness. (Tsertsidis et al., 2019).

Hutto et al. (2015) talk about the wish that seniors have to learn more about ICT. They try to keep up with different trends, but also they want to be more connected to their families. That is exactly what NGOs are trying to do: to create a safe environment for seniors, so that they become more digitalized in time.

In the second part of the study, I will present the methodology: in-depth interview along with observatory participation. The interview guide was built considering the research objectives and research questions. It was applied to four social workers from *Telefonul Vârstnicului*.

The study is divided as follows: *First Part* is a review of the literature of eliminating loneliness, *The Second Part* is about methodology, *The Third Part* describes the analysis and interpretation of the case study data from the *Telefonul Vârstnicului* and *The Fourth Part* shows the conclusions.

2. Literature review/theoretical background

Eliminating loneliness

Seniors are not always up to date with everything that happens on the Internet or they do not even have the desire of doing so. They usually choose to spend time on social media even

because they have to talk to their families or because they wish to escape from their everyday life. They usually use Facebook and Whatsapp (Bell et al., 2013).

Seniors have started to spend more time on the Internet and social media. They feel the need to keep in touch with their families (Hutto et al., 2015). They are also afraid that they are not digitalised enough to know how to properly use the ICT.

People over 65 years old feel the need to always know how their children or grandchildren are, so they feel motivated to use ICT even if they do not like it or are afraid of using it (Marston et al., 2020). They feel like they have no choice, but to adapt.

If we take into consideration the *Technology Acceptance Model* (TAM), there are several steps: understanding the usefulness, understanding the difficulty, the need to use and the final step of using that app (Martín-García et al., 2022). The external factors may influence the way of accepting these steps. NGOs started telephone trainings in seniors' clubs, creating task lists and implementing lists of steps, so that seniors understand how to properly use a device (Haase et al., 2021).

Seniors choose to use technology because they want to be aware of their families, to be updated about the news, to use online banking and to get rid of boredom and loneliness (Zhang, 2021). The most used apps by seniors In the study conducted by Guner and Acarturk (2020) are Facebook (65.95%) and Whatsapp (61.21%).

The backstage of using social media, from seniors' perspective

Seniors choose to use technology when they have no other choice, just like when their families move to another city, country or even continent (Cotton et al., 2022). There are some steps of using the technology-approach model: ignoring, approaching, rejecting and approaching (Ivan & Fernández-Ardèvol, 2017). Based on what they receive in exchange, seniors choose the channel they use to socialize. When they are away, they prefer to use Skype, Facebook or email because they are easily customizable, offering reciprocity (Ivan & Fernández-Ardèvol, 2017).

Social media offers many gratifications to seniors, including: not feeling lonely anymore, searching for different topics and leisure (Gitari, 2015). Seniors don't want to lose track of the

advantages that technology has to offer, especially as technology has become so important in the last years (Fernández-Lores et al., 2021).

Social media also has downsides that seniors are not always aware of. Let's take into consideration the addiction or that seniors may become victims of cyberbulling. They do not have much experience in anticipating such situations and identifying them. Also cyberbulling is another effect of using social media as a senior (Roberto et al., 2014). Blake and Kerr (2019) talk about the relationship between loneliness and health issues (heart attack, depression, or other mental illnesses). Seniors are aware that social isolation is something that would happen to another person but especially not to them, so this mean they would rather think this happens to a third party and not to them.

Loneliness might be influenced by: socio-demographic, personal, individual mobility characteristics, social network, and living environment approaches. The ones who have a well-developed social network, are more likely to be more satisfied with their social network and subsequently less likely to feel lonely. The ones that had in-depth sense of loneliness will be less likely to feel close to their neighbourhood (Kemperman, 2019).

3. Methods

I wish to understand more about *Telefonul Vârstnicului's* history, how it understands seniors' needs and the skills that social working should have. The research objectives are mentioned down below:

O1. The history of Telefonul Vârstnicului helpline.

O2. Understanding the needs seniors have.

O3. Describing the skills that a social worker should have to work everyday with seniors.

I opted for qualitative research, so that I can get detailed responses and notice the nonverbal communication signs. I chose this helpline because it is the most developed one in Bucharest. When I started the research there, I was announced that I can only moderate interviews with the employees for this specific project and the number of them is 4. They were the only ones who knew how this project worked and could offer in-depth responses. This is the reason this sample is limited. But in the future I plan to compare this helpline with others abroad.

This study starts from the objective of identifying the history of the *Telefonul Vârstnicului* helpline, but also to find out what are the challenges that seniors face in their daily life and why they use this program. The aim is to identify both through the use of in-depth interviews and participatory observation. The objectives are followed by three research questions that address the three areas of discussion: *the particularities of the program, the needs seniors have and the qualities of social workers.*

The in-depth interviews took place at Telefonul Vârstnicului office in Bucharest where I moderated them myself. The interviews were recorded with my personal mobile phone in mp3 format. I took notes myself during the moderation part. The questions are present in Annexes.

RQ1. What are the particularities/history of this helpline?

RQ2. What are the needs of the seniors and how are they satisfied?

RQ3. What kind of skills should a social worker have in order to work with seniors?

I interviewed four social workers, employed at *Telefonul Vârstnicului*. The sample used for interviews were the 4 social workers of the helpline:

Table 1 sample of social workers

Gender	**Age**	**Knowledge**	**Role**	**Experience in the field**
Female	32	Faculty of Sociology and Social Assitence	Social Worker	3 years
Female	26	Faculty of Sociology and Social Assitence	Social Worker	2 years
Female	35	Faculty of Sociology and Social Assitence	Program coordinator and Team Leader	8 years
Female	29	Faculty of Sociology and Social Assitence	Social Worker	5 years

Source: my own elaboration

The method used for research was an in-depth interview, supplemented by observation sheets. I chose this research method because it gave me the ability to notice the tone of voice, speech rhythm, the posture and facial expressions of the employees. It gave me the opportunity to see nonverbally how employees respond as social workers to the challenges of this job and

to observe the tone of voice, speech rhythm and their posture and facial expressions. The age of the respondents to the survey ranged from 26 to 32 years old, being people who have graduated from Faculty of Sociology and Social Assitence, both Bachelor and Master graduates.

Interviews lasted between 27 (Interview 2) and 44 minutes (Interview 1). The interview started with the moderator's introduction, opening questions, followed by the first topic, followed by the topic on the needs that seniors have. We discussed about communication with seniors and what abilities a social worker must have. Interview questions are in the annexes for more reference.

Each social worker had a different background. The coordinator of the program had other responsibilities regarding to the social work area, regarding the team, the presentation of the program and the audiences. The limit of this study is the number and gender of the participants. The number of subjects is 4 and they are only female.

Another limit is the level of study of the participants. All participants had the chance to learn at a well-known university in Bucharest and came from an urban place, so it would be a great idea in the future to realize a study using males maybe from a rural place in the future.

4. Results and discussion

Regarding the history of this helpline, Telefonul Vârstnicului Program was established in 2015 and aims to help older people socialize and stop feeling lonely. It was born out of a desire to help seniors.

Through this helpline, the founders want to change the way people think, feel and act towards the issue of aging, how communities develop so that they are responsive to active aging, aim to provide integrated person-centered care and primary health services that meet the needs of older people.

One of the reasons why the seniors turn to the helpline is because it meets their needs, such as the need to socialize, not to feel loneliness, to receive useful information from social workers and to be guided according to their needs to certain homes for the seniors. The demand for home care and socialization are two main reasons why older people turn to the program.

The Telefonul Vârstnicului's team consists of four social workers, one of whom is the project coordinator. Most of the older people who call the Telefonul Vârstnicului do not show

high digital skills. Among the reasons why the seniors turn to the program is because it meets their needs, such as the need to socialize and eliminate loneliness.

When we refer to the seniors' needs, we take into account: moral support, communication and eliminating the feeling of loneliness.

From what I see, I see that the needs would be for socialization, moral support, to talk to someone, because for a long time, they haven't talked to anyone. They feel lonely. Many people live with their families, but they still feel lonely. That's why it's important not how we see it from the outside, but how they feel it. As well as socializing and the need for moral support, to talk to someone, to relieve the feeling of loneliness, there is also the need to receive useful information. Also, on the care side, they are looking to move even into a home where they can be helped, we also give them information, contact details of various institutions. Maybe they don't find the need, but we identify it and then we refer them. The three most important needs of seniors would be: daily care, socialization and useful information. (Woman, 32, social worker in the Telefonul Vârstnicului Program)

The needs of people calling *Telefonul Vârstnicului* are related to medical problems, financial problems, moral support, home care and travel. And social workers try their best to help them when they are in need of useful information.

We talk about the desire of socialization, psychological counseling, home care, financial needs, useful information to contact certain institutions. We try to provide them with the most accurate information that will help them as much as possible, we offer guidance, information, guidance, not actual solutions. (Woman, 26 years old, social worker in the Telefonul Vârstnicului Program)

Technology has advanced a lot and everything is modern and they are a bit behind and need guidance. The fact that they are not visited, some of them don't talk to anyone, some of them find it hard to find their words, so some of them don't talk to anyone but us and they feel the need to tell stories a lot. (Woman, 29 years old, social worker in the Telefonul Vârstnicului Program)

Among the qualities that a social worker working in this programme should have are: to be a good communicator, to know how to actually listen, to be patient, to be calm, to be resilient to stress.

Patience, empathy, very good communication skills. Patience about the fact that the seniors, because maybe they understand and take notes more slowly. There is also the empathy part, to understand the problem and what it means for us, but at the same time we have to not get very involved because we get consumed, there is also detachment, but also empathy. Empathy is there all the time, otherwise, we wouldn't be here. (Female, 26, social worker in the Telefonul Vârstnicului Program)

Even when it is though, social workers feel content when seniors are grateful for their work and even just say thank you. This study comes along with useful and insightful information regarding seniors and ways of eliminating loneliness.

Communication is very important when we talk to older people (Caldeira & Chen, 2019) because the social workers discuss between themselves to find a manner to guide seniors. Regarding the team leader, every day is different and she ensures everything runs smoothly.

On another note, it has been disproved by Marston et al. (2020) that once people age, the wish to have more friends is not that high. In this study, we saw that older people really want to communicate and make new friends in the seniors' clubs.

Some seniors believe it is very difficult to learn something new. It takes time, but they are willing to learn, so that they eliminate loneliness. This is validated by Kim et al. (2016) study mentioned in the literature review.

Blake & Kerr (2019) talked about loneliness that can create anxiety or depression among seniors, which is even noticed in the research conducted because as seniors age, they are prone to illness. In these moments, loneliness can become really overwhelming.

Discussion about the helpline

Communication is key in discussions with seniors (Caldeira & Chen, 2019), but also in team discussions, because whenever there are more difficult cases, employees consult among themselves to find a good way to guide seniors. In the case of the project coordinator, every day comes with new challenges, she makes sure that everything is going in the right direction and that employees have the necessary resources to carry out work. She solves technical problems, makes reports, attends conferences and she is active on e-mail and many other responsibilities.

On the other hand, it has been disproved by Marston et al. (2020) that with advancing age, the desire to create new friendships decreases. In the present research, we observed that older people really do want to socialize a lot, to meet new people, especially people of a close age with whom to socialize.

The majority of senior citizens who call the Telefonul Vârstnicului program do not have high digital skills. In general, those who have a family away in a foreign country have had to learn to use technology to somehow keep in touch with family.

There are some day clubs to encourage seniors to meet people of the same age and socialize. Sometimes even social workers find out about certain services from seniors themselves and then investigate them on their own. Their needs also come from the fact that technology has developed, but they have somehow fallen behind and then need support in the digital area.

5. Conclusion

Telefonul Vârstnicului helpline wants to help seniors, provide them with guidance in many situations where they encounter problems and that a social worker should have empathy, be well prepared, be senior-oriented and understand their needs. Of course, because it is a qualitative research, these results cannot be generalised.

The results are in line with other studies regarding this topic, such as the ones written and discussed in literature review by many authors, such as: Peacock & Künemund (2007), Marston et al. (2020) and Blake and Kerr (2019).

The value of this paper is noticed from the qualitative research of this case-study. Seniors have medical and financial issues, but they also need to escape, socialise and age actively and these needs are satisfied with the help of the social workers.

It would be fascinating in a future study to clear differences between women and men in order to see their capacity and desire to understand issues that seniors have, also to understand their level of digitalization and to analyze the experience and knowledge between a male versus a female working in this field of Sociology.

For a new research in the future, I could carry out comparative research between a helpline of this type in Romania versus one abroad, to see similarities and differences, advantages and disadvantages.

References

Bell, C., Fausset, C., Farmer, S., Nguyen, J., Harley, L. și Fain, W. (2013). *Examining social media use among older adults*. In Proceedings of the 24th ACM conference on hypertext and social media. 158-163. https://doi.org/10.1145/2481492.2481509

Blake, J. și Kerr, D. (2019). S*eniors' Use of Social Media.* In Proceedings of the 24th Asia-Pacific Decision Science Institute International Conference (APDSI). 220-229.

Caldeira, C., & Chen, Y. (2019). *Seniors and self-tracking technology*. Perspectives on humancomputer interaction research with older people, 67-79.

Fernández-Lores, S., Marquez, J. A. și Villaverde, S. (2021). Mobile communication and seniors: An exploratory study on their consumption of apps. *Journal of Promotion Management*. 27(7), 952-970. https://doi.org/10.1080/10496491.2021.1888183

Gitari, J. M. (2015). *Social media and senior citizens : uses and gratification approach.*

Guner, H. și Acarturk, C. (2020). The use and acceptance of ICT by senior citizens: a comparison of technology acceptance model (TAM) for seniors and young adults. *Universal Access in the Information Society*. 19(2), 311-330. https://doi.org/10.1007/s10209-018-0642-4

Haase, K. R., Cosco, T., Kervin, L., Riadi, I., & O'Connell, M. E. (2021). *Older adults' experiences with using technology for socialization during the COVID-19 pandemic*: Cross-sectional survey study. JMIR aging, 4(2), e28010. https://doi.org/10.2196/28010

Hutto, C. J., Bell, C., Farmer, S., Fausset, C., Harley, L., Nguyen, J. și Fain, B. (2015). Social media gerontology: Understanding social media usage among older adults. In *Web intelligence*. 13(1), 69-87. https://doi.org/10.3233/web-150310

Ivan, L., & Fernández-Ardèvol, M. (2017). Older people and the use of ICTs to communicate with children and grandchildren. *Transnational Social Review*. 7(1), 41-55. https://doi.org/10.1080/21931674.2016.1277861

Kemperman, A., van den Berg, P., Weijs-Perrée, M. și Uijtdewillegen, K. (2019). Loneliness of older adults: Social network and the living environment. *International journal of environmental research and public health*. 16(3). https://doi.org/10.3390/ijerph16030406

Khosravi, P., Rezvani, A. și Wiewiora, A. (2016). The impact of technology on older adults' social isolation. *Computers in Human Behavior*. 63, 594-603. https://doi.org/10.1016/j.chb.2016.05.092

Kim, S., Gajos, K. Z., Muller, M. și Grosz, B. J. (2016). *Acceptance of mobile technology by older adults: a preliminary study.* In Proceedings of the 18th international conference on human-computer interaction with mobile devices and services. 147-157. https://doi.org/10.1145/2935334.2935380

Marston, H. R., Ivan, L., Fernández-Ardèvol, M., Rosales Climent, A., Gómez-León, M., Blanche-T, D., Earle, S., Ko, P., Colas, S., Bilir, B., Çalikoglu, H. O., Arslan, H., Kanozia, R., Kriebernegg, U., Großschädl, F., Reer, F., Quandt, T., Buttigieg, S. C., Silva, P. A., ... Rohner, R. (2020). COVID-19: technology, social connections, loneliness, and leisure activities: an international study protocol. *Frontiers in sociology*. 5, 574811. https://doi.org/10.3389/fsoc.2020.574811

Martín-García, A. V., Redolat, R., & Pinazo-Hernandis, S. (2022). Factors Influencing Intention to Technological Use in Older Adults. The TAM Model Aplication. *Research on Aging*, 44(7-8), 573-588. https://doi.org/10.1177/01640275211063797

Peacock, S. E. și Künemund, H. (2007). Senior citizens and Internet technology. *European journal of ageing*. 4(4), 191-200. https://doi.org/10.1007/s10433-007-0067-z

Roberto, A. J., Eden, J., Savage, M. W., Ramos-Salazar, L., & Deiss, D. M. (2014). Prevalence and predictors of cyberbullying perpetration by high school seniors. *Communication Quarterly*, 62(1), 97-114. https://doi.org/10.1080/01463373.2013.860906

Tsertsidis, A., Kolkowska, E., & Hedström, K. (2019). Factors influencing seniors' acceptance of technology for aging in place in the post-implementation stage: A literature review. *International journal of medical informatics*, 129, 324-333. https://doi.org/10.1016/j.ijmedinf.2019.06.027

Zhang, K., Kim, K., Silverstein, N. M., Song, Q., & Burr, J. A. (2021). Social media communication and loneliness among older adults: The mediating roles of social support and social contact. The Gerontologist, 61(6), 888-896. https://doi.org/10.1093/geront/gnaa197

Annexes

1 Semi-structured interview guide

I conducted a series of discussions with people who have been involved in the Telefonul Vârstnicului Helpline, in order to understand the role of this program in the lives of the elderly, what problems the elderly who call this phone face, how those problems are solved and what is needed when running such a program.

Particularities of the Telefonul Vârstnicului Helpline (approximately 20 min)
In depth: When did it start? How are the activities carried out? What do the volunteers do? Who is involved in the project and what tasks/responsibilities do those involved have?
• What does a typical day at the Telefonul Vârstnicului look like?
In depth: What specifically happens in a working day within this program? Are there less common times? Who gets involved? What does a volunteer actually do in a working day? But what about those who have other positions?

Seniors' requests (approximately 20 min)
• Tell me about the things seniors call for.
Test in depth about:

- The problems they call for (what kind of problems with concrete examples for each problem being discussed).
- If there are situations in which the elderly cannot manage to use the Internet, different devices, applications and call for this. How are problems of this type addressed?
- What kind of digital skills do the elderly with whom they interact lack? Is there a learning process – after the operator has solved such a situation? How is this process described?

Communication with the elderly (approximately 20 min)
• Let's talk about what an employee working at the Telefonul Vârstnicului should be like.
Test in depth about:

- Ask about what qualities someone who talks to the elderly should have? What is difficult? What is easy in talking to the elderly? What challenges are there?
- How do you choose the employees who participate in this program?

Finally

• If you could change something in this helpline (Telefonul Vârstnicului), what would you change?

2 Questionnaire

Socio-Demographic Data

(The data below will be completed by the interviewer, with the help of the person he/she interviewed)

1) Your gender: □ male □ female

2) Your age (in years): _____

3) Marital status: □ single □ married □ cohabiting / not married

□ separated / divorced □ widowed

4) Last school graduated:

□ less than 10 classes

□ unfinished high school

□ completed high school

□ college. Which college?: _____

□ master's degree. Which master's degree?: _____

5) What is your occupation/was your occupation (if retired)? _____

6) Position in the Telefonul Vârstnicului helpline.

7) How long have you been working in this program?¬¬¬¬¬¬¬¬¬¬¬¬

8). Do you have another position/role in the Princess Margareta Foundation of Romania?

NO

YES (Specify the position/role, including how long)_____

9) Are you employed in another organization (you can tick more than one, according to your situation)

Full-time employee □ YES □ NO

Part-time employee □ YES □ NO

I am not employed, but not retired either □ YES □ NO

Retired □ YES □ NO

Student □ YES □ NO

EXPLORING DESTINATION MANAGEMENT ORGANIZATIONS' PERCEPTIONS AND ENGAGEMENT WITH ELECTRONIC WORD-OF-MOUTH IN TOURISM

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ABSTRACT

Purpose:
Destination management organizations (DMOs) face new opportunities, among which is the strengthening of interest in electronic word of mouth (eWOM) among visitors to destinations. Previous publications have largely addressed destination-related eWOM from a demand perspective, dominantly addressing the impact of eWOM on visitor behavior in tourism, although existing studies partially explore eWOM in destination management, it can be concluded that this field still remains largely unexplored. Therefore, this study endeavours to elucidate the perceptions of DMOs regarding eWOM and to assess the extent of their involvement with this phenomenon.

Design/methodology:
In the paper, the method of sociological questioning is employed, and standardized interviews serve as the technique for data collection. Interviews were conducted with representatives from DMOs in Slovakia and Czech Republic. Data collection occurred between April and August 2023. For the subsequent content analysis of the data, Atlas.ti, a software specifically designed for qualitative data analysis, was employed.

Findings:
Up to 79.3% of DMOs engage in the monitoring of eWOM concerning tourism destinations or their respective entities. They indicate that this monitoring activity spans specifically directed towards eWOM that directly addresses either the tourism destination or the DMO itself, such as visitors' comments on DMOs' social media posts, reviews, or emails. Representatives of DMOs predominantly conduct eWOM monitoring on popular social media platforms such as Facebook, Instagram, YouTube, and Google Maps, while also receiving eWOM via email.

Research/practical implications:
The paper provides a comprehensive overview of the social media platforms and websites utilized by DMOs for monitoring eWOM pertaining to tourism destinations or DMOs. Such an overview holds potential to assist other DMOs in strategically selecting suitable social media platforms for integrating eWOM monitoring into their operational frameworks. Future research endeavors could be directed towards delving deeper into the content disseminated across the social media platforms and websites.

Originality/value:
While existing studies have partially investigated the phenomenon of eWOM within the realm of tourism destination management, no prior research appears to have explored eWOM from the specific viewpoint of DMOs. This underscores a notable gap in the current body of research.

Keywords: Destination management organization, Electronic word-of-mouth, eWOM, Tourism destination

JEL Classification: L83, Z32

1. Introduction

Contemporary destination managers are posited by Bigné & Decrop (2019), van der Zee et al. (2020), and Gao et al. (2023) to emphasize the discernment of dynamic tourist preferences and the formulation of nuanced development strategies through the comprehensive analysis of diverse user-generated online content. The pertinence of digital data in tourism is underscored by Giglio et al. (2019) and Reinhold et al. (2023), as it empowers destination managers to decode visitor behaviors, understand the motivations underlying specific activities, and ascertain their significance. Additionally, digital data furnish insights into the broader dynamics of tourism at a given destination. Van der Zee et al. (2020) specifically highlight electronic word-of-mouth (eWOM) as a crucial information conduit for destination managers, noting that insights gleaned from eWOM content spawn novel avenues for destination management. Consequently, this study aims to illuminate the perceptions of destination management organizations (DMOs) regarding eWOM and to evaluate the degree of their engagement with this digital phenomenon.

2. Literature review/theoretical background

The advent of eWOM emerged from an increased interest among individuals in digital environments and their interactions within these spaces. Defined by scholars such as Hennig-Thurau et al. (2004), Thorson and Rodgers (2006), Litvin et al. (2008), Xun and Reynolds (2010), Bronner and de Hoog (2011), Kietzmann and Cantoho (2013), and Ismagilova et al. (2017), eWOM encompasses statements about products or services made by visitors, encompassing communication and the exchange of information between visitors and representatives of businesses or organizations.

In the current highly digitized context, it is crucial for managerial organizations to grasp the consumer behavior of visitors, particularly how they process and adopt information encountered on social media and websites, whether disseminated by the organizations themselves or by other visitors (García-Carrión et al., 2024). Previous research (e.g., Chang and Wang, 2019; Ran et al., 2021; Tapanainen et al., 2021; Nguyen and Hsu, 2022; Ismail et al., 2023) has predominantly explored eWOM in the context of tourism destinations from a demand perspective, focusing on its impact on visitor behavior.

On the supply side, studies such as those by Önder et al. (2019) have examined DMOs' demand for destinations based on predefined emoticons from Facebook users, like thumbs-up on business accounts. Their findings suggest that reactions from both current and historical periods, when coupled with historical visitor data, can refine the accuracy of demand forecasting in tourism. Molina et al. (2020) assessed the marketing effectiveness of DMOs' posts on Facebook through content analysis, considering variables such as follower count, post frequency, and the nature of eWOM in the form of emoticons, as well as post characteristics like emotional or informative content. They noted that posts with cultural, children-focused, or entertainment themes were most effective for marketing, whereas those centered on sports were less successful. Additionally, García-Carrión et al. (2024) employed eye-tracking methods to analyze how ordinary users process and evaluate content from DMO posts and comments on Facebook. Van der Zee et al. (2020) also utilized restaurant reviews on TripAdvisor to assess the applicability of eWOM content for tourism destination management.

Despite these contributions, the exploration of eWOM within destination management is still relatively nascent. This research lacuna is primarily due to the academic community only recently beginning to focus on this domain. Consequently, no study to date has thoroughly examined eWOM from the perspective of DMOs, signaling a significant gap in the existing literature.

3. Methods

In this study, the methodological approach utilized was sociological questioning, with standardized interviews serving as the primary technique for data collection. Representatives from 25 DMOs in Slovakia, including 21 at the local level and 4 at the regional level, were

interviewed. Additionally, 21 DMOs in the Czech Republic were involved, encompassing 16 local-level destinations and 5 regional-level destinations. The research sample represented 53.2% of the existing DMOs in Slovakia and 27.3% in the Czech Republic. A variety of methods were employed to conduct the interviews, including in-person meetings, telephone conversations, and online applications, with the data collection phase spanning from April to August 2023. For the analysis of the collected data, Atlas.ti software, which is specifically designed for qualitative data analysis, was used to perform content analysis.

4. Results and discussion

In the digital realm, characterized by a deluge of information, DMOs increasingly rely on eWOM as a critical determinant influencing visitors' decisions on their leisure destinations. According to the study, half of the respondents (50.0%) view eWOM as crucial in the selection of a tourism destination. Even those representatives of DMOs who do not consider eWOM as central to destination selection acknowledge its relevance and usefulness in aiding visitors' final decisions about visiting specific locations.

Furthermore, a significant majority (79.3%) of representatives monitor eWOM related to tourism destinations or their respective DMOs. The monitoring of eWOM—encompassing comments on social media posts, published reviews, or feedback received via email—is executed at various frequencies, with many focusing on daily or regular intervals. It was observed that DMOs at the regional level, particularly within the Czech Republic, allocate more resources to eWOM management. DMOs that do not actively monitor eWOM cite personnel and time constraints as primary reasons for their inaction, despite recognizing its importance.

Social media emerges as the predominant channel for gathering visitor feedback, with DMOs frequently scouting platforms such as Facebook, Instagram, Google Maps, and emails for eWOM. Additional attention is also given to other online platforms and websites utilized as distribution channels for their offerings, such as booking systems with extensive visitor databases that facilitate feedback collection. Specific platforms like TripAdvisor, Booking.com, and Kudyznudy are monitored by DMOs that manage attractions or accommodations, highlighting their role in gathering visitor feedback.

Selected DMOs from the Slovak Republic primarily engage with eWOM on Facebook, Instagram, Google Maps, and through received emails, while their counterparts in the Czech Republic focus mainly on Facebook and Instagram. This varied approach underscores the tailored strategies adopted by DMOs in different regions to leverage eWOM effectively within their operational frameworks (Figure 1).

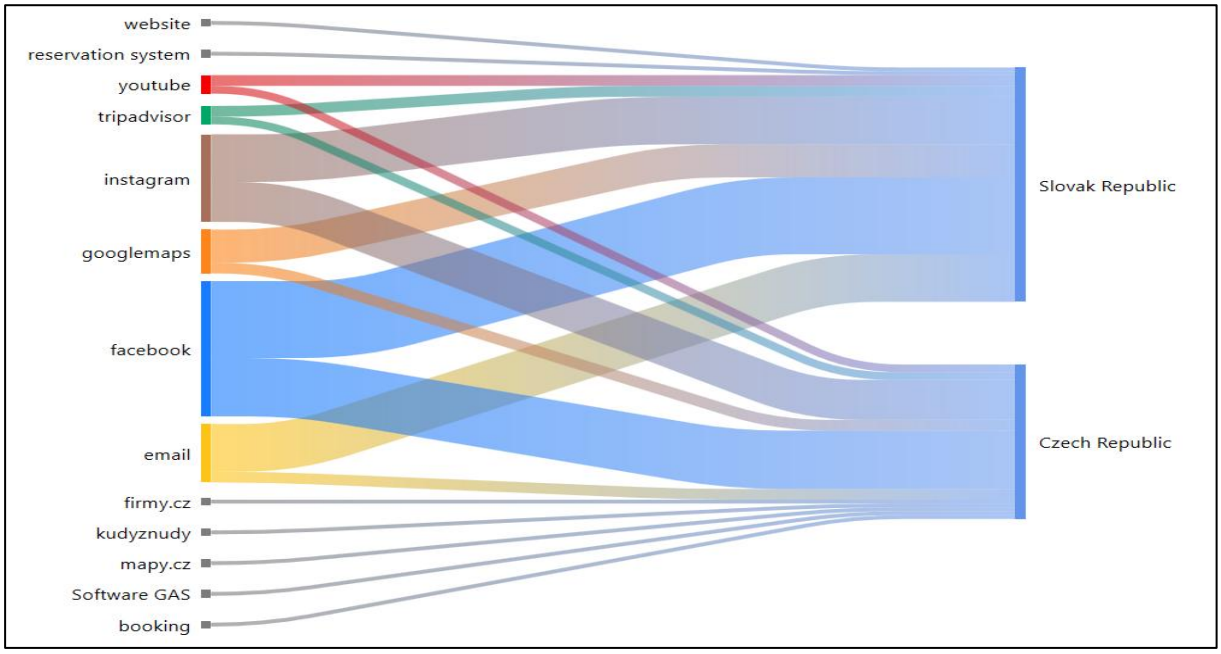

Figure 1 Social media and websites where representatives of DMOs seek eWOM about the tourism destination or DMO from a country perspective
Source: Own elaboration, 2023.

The engagement with eWOM varies notably depending on the operational level of the DMOs. Representatives of regional DMOs predominantly monitor eWOM on social networks such as Facebook and Instagram. This preference underscores the importance of these platforms for broad, regional outreach and their effectiveness in capturing diverse visitor experiences and feedback across a wider geographic area.

Conversely, representatives of local DMOs more frequently receive eWOM through email and Google Maps (Figure 2). This indicates a more localized approach to gathering feedback, where direct communication via email and location-specific reviews on Google Maps are particularly valuable. These methods likely provide more targeted and immediate insights into visitor experiences at specific locales, which are crucial for local DMOs focused on the detailed management of distinct attractions or services within their smaller operational areas.

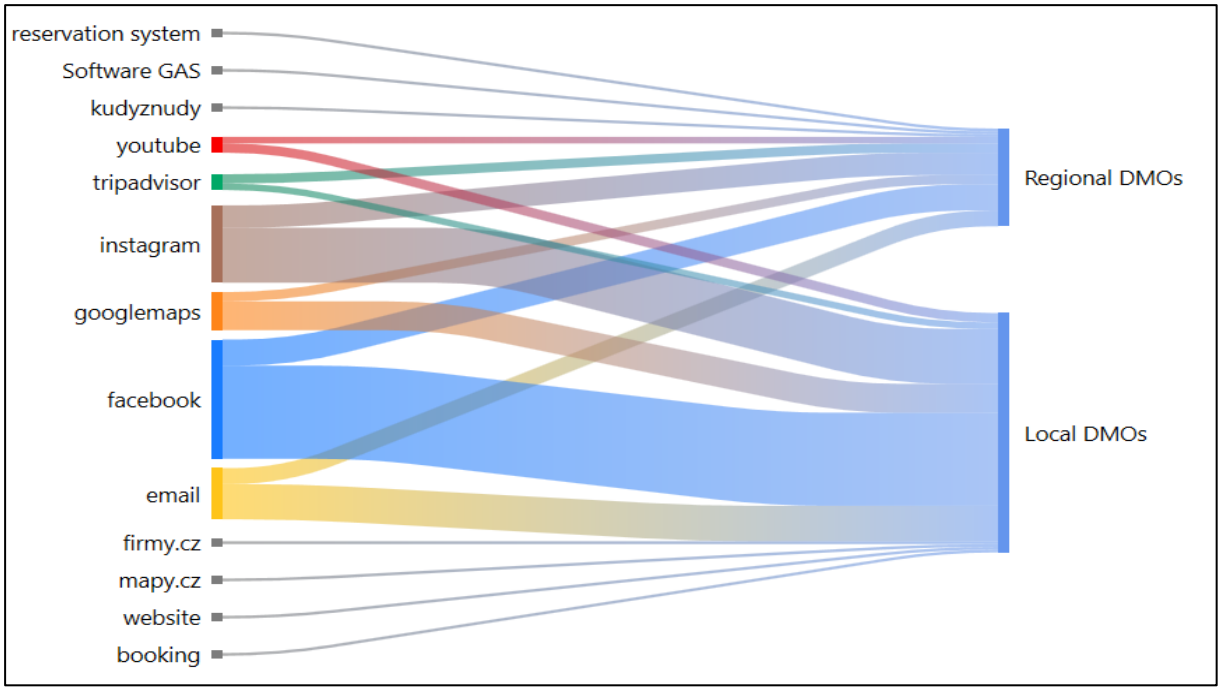

Figure 2 Social media and websites in terms of the level at which the managerial organization operates
Source: Own elaboration, 2023.

It is evident that, irrespective of the staffing configuration within DMOs - whether there is a designated employee responsible for handling eWOM or the task is distributed among all staff members—social networks, particularly Facebook and Instagram, remain the primary sources for eWOM about tourism destinations. This trend underscores the pivotal role these platforms play in the digital strategy of DMOs, providing a broad and interactive channel for gathering visitor insights and feedback (Figure 3).

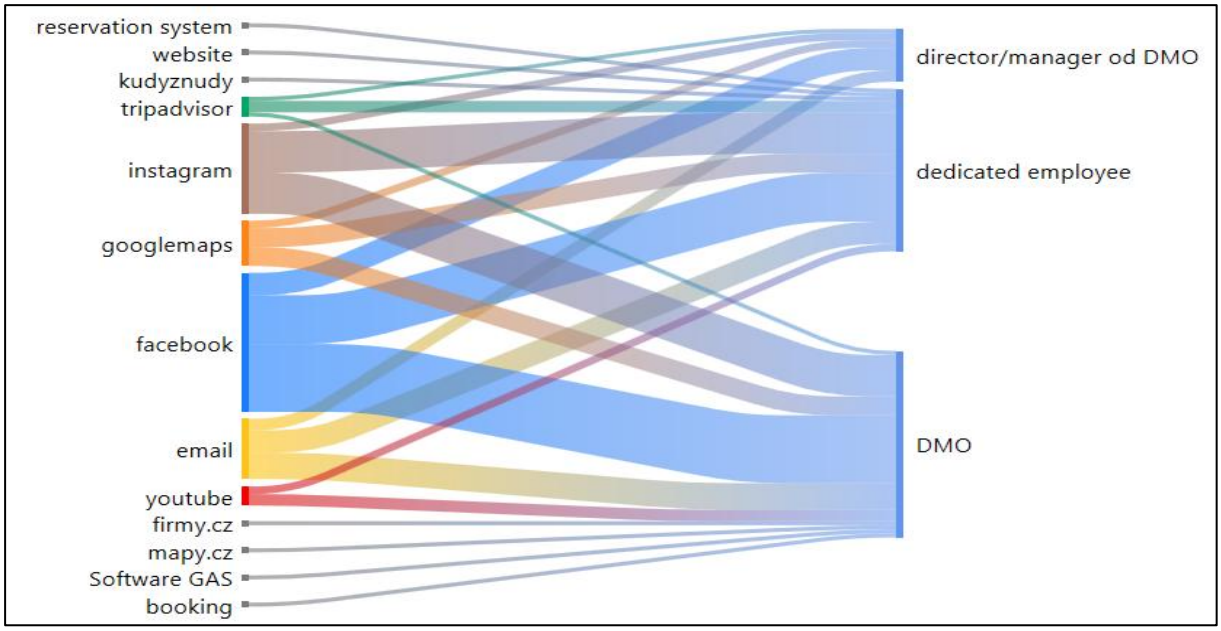

Figure 3 Social media and websites in terms of employee specialization
Source: Own elaboration, 2023.

DMOs gain significant motivation from positive eWOM, which not only validates their efforts but also reinforces their positive engagement with the public at both the target location and within the management organization. Conversely, negative eWOM provides DMOs with the ability to swiftly identify and address deficiencies at the target destinations. This feedback mechanism offers DMOs an authentic view of visitors' perceptions of the tourism destination.

eWOM is crucial for DMOs in understanding and identifying the needs of visitors and enhances marketing communication efforts. Through eWOM, individual attractions and entrepreneurs within the region can more effectively engage with visitors, thus enhancing the appeal of the tourism destination. It also aids in improving communication with entrepreneurs operating within the tourism sector at the destination, enhances the quality of services, and supports the planning, creation, development, and implementation of both new and existing tourism products. Additionally, eWOM influences the planning of future seasons, the development of infrastructure, the updating of information on websites and social networks, the implementation of changes at the tourism destination, the formulation of strategies for upcoming years, and the overall improvement of organizational activities.

To date, the investigation into DMOs' attitudes toward eWOM has been limited. Apart from Kushcheva (2022), who conducted a study with a minimal sample size of three participants, no

significant research has been undertaken. Notably, a majority (79.3%) of Slovak and Czech DMOs actively monitor eWOM focused on their tourism destinations. DMOs that do not monitor eWOM, often due to constraints in personnel and time, still acknowledge its importance as it provides a broad evaluation of their efforts and solutions as perceived by visitors. This underscores the need to address eWOM not only at the level of individual tourism entrepreneurs and attractions but also more comprehensively at the level of the tourism destination itself.

5. Conclusion

This research examined the role and impact of eWOM as perceived and leveraged by DMOs. The empirical data suggest that DMO representatives consider eWOM to be a critical factor influencing visitors' destination choices. While some DMOs do not view eWOM as pivotal, they nonetheless acknowledge its relevance and utility in shaping potential visitors' decisions regarding destination selection. It is predominantly monitored on social media platforms such as Facebook and Instagram. Interviews indicate that DMOs primarily source eWOM from these networks, which facilitates their understanding of visitors' preferences and enhances their operational strategies.

Future research could explore the perspectives of destination managers on eWOM within an international framework, noting that this aspect remains relatively unexplored. Such studies could specifically address the technological tools employed by these managers to manage eWOM, the strategies for responding to and assessing eWOM, among other related themes.

References

Bigné, E.. & Decrop, A. (2019). *Paradoxes of Postmodern Tourists and Innovation in Tourism Marketing*. In FAYOS-SOLÀ, E. COOPER, CH. (eds.) The Future of Tourism: Innovation and Sustainability. Cham: Springer, 131-154. ISBN 978-3-319-89941-1.

Bronner, F., & de Hoog, R. (2011). Vacationers and eWOM: who posts, and why, where, and what? *Journal of Travel Research*, 50(1), 15-26. http://dx.doi.org/10.1177/0047287509355324

Gao, J., Peng, P., Liu, F. Claramunt, C., Qiu, P., & Xu, Y. (2023). Towards travel recommendation interpretability: Disentangling tourist decision-making process via knowledge graph. *Information Processing & Management*, 60(4), https://doi.org/10.1016/j.ipm.2023.103369

García-Carrión, B., Muñoz-Leiva, F., Del Barrio-Garciá, S., & Porcu, L. (2024). The effect off online message congruence, destination-positioning, and emoji's on users' cognitive effort and affective evaluation. *Journal of Destination Marketing & Management*, 31. http://dx.doi.org/10.1016/j.jdmm.2023.100842

Giglio, S. Bertacchini, F., Bilotta, E., & Pantano, P. (2019). Using social media to identify tourism attractiveness in six Italian cities. *Tourism Management*, 72, 306-312. https://doi.org/10.1016/j.tourman.2018.12.007

Hennig-Thurau, T., Gwinner, K. P., Walsh, G., & Gremler, D. D. (2004). Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the Internet? *Journal of Interactive Marketing*, 18(1), 28-52. https://doi.org/10.1002/dir.10073

Chang, J-H., & Wang, S-H. (2019). Different levels of destination expectation: The effects of online advertising and electronic word-of-mouth. *Telematics and Informatics*, 36, 27-38. http://dx.doi.org/10.1016/j.tele.2018.11.004

Ismagilova, E., Dwivedi, Y. K., Slade, E., & Williams, M. D. (2017). *Electronic word of mouth (eWOM) in the Marketing Context: A state of the Art Analysis and Future Directions*. Cham: Springer International Publishing. ISBN 978-3-319-52458-0.

Ismail, A. N. N., Zainordin, N. M. S. N. M., & Aziz, Y. A. (2023). The Impact of Destination Personality and Electronic Word-of-Mouth on Tourists Destination Choice. *International Journal of Economics and Management*, 17(2), 197-209. http://dx.doi.org/10.47836/ijeam.17.2.04

Kietzmann, J., & Cantoho, A. (2013). Bittersweet! Understanding and Managing Electronic Word of Mouth. *Journal of Public Affairs*, 13(2), 146-159. http://dx.doi.org/10.1002/pa.1470

Kushcheva, N. (2022). *MONITORING ONLINE REPUTATION OF TOURIST DESTINATIONS IN FINLAD*. INTED Proceedings. https://doi.org/10.21125/inted.2022.2451

Litvin, S. W. Goldsmith, R. E., & Pan, B. (2008). Electronic word-of-mouth in hospitality and tourism management. *Tourism Management*, 29(3), 458-468. http://dx.doi.org/10.1016/j.tourman.2007.05.011

Molina, A., Gómez, M., Lyon, A., Aranda, E., & Loibl, W. (2020). What content to post? Evaluating the effectiveness of Facebook communications in destinations. *Journal of Destination Marketing and Management*, 18(1), 1-43. http://dx.doi.org/10.1016/j.jdmm.2020.100498

Nguyen, D. T. A., & Hsu, L. (2022). Exploring visit intention to India among Southeast Asian solo female travelers. *Journal of Destination Marketing & Management*, 25, https://doi.org/10.1016/j.jdmm.2022.100725

Önder, I. Gunter, U., & Gindl, S. (2019). Utilizing Facebook Statistics in Tourism Demand Modeling and Destination Marketing. *Journal of Travel Research*, 59(2), 1-14. https://doi.org/10.1177/0047287519835969

Ran, L., Luo, Z., Bilgihan, A., & Okumus, F. (2021). Marketing China to U. S. travelers through electronic word-of-mouth and destination image: Taking Beijing as an example. *Journal of Vacation Marketing*, 27(3), 1-20. http://dx.doi.org/10.1177/1356766720987869

Reinhold, S., Beritelli, P., & Laesser, Ch. (2023). The 2022 consensus on advances in destination management. *Journal of Destination Marketing & Management*, 29. https://doi.org/10.1016/j.jdmm.2023.100797

Tapanainen, T., Dao, T. K., & Nguyen, T. T. H. (2021). Impacts of online word-of-mouth and personalities on intention to choose a destination. *Computers in Human Behavior*, 116. http://dx.doi.org/10.1016/j.chb.2020.106656

Thorson, K. S., & Rodgers, S. (2006). Relationship between Blogs as eWOM and Interactivity, Perceived Interactivity, and Parasocial Interaction. *Journal of Interactive Advertising*, 6(2), 34-44. https://doi.org/10.1080/15252019.2006.10722117

Van der Zee, E., Bertocchi D., & Vanneste. D. (2020). Distribution of tourists within urban heritage destinations: a hot spot/cold spot analysis of TripAdvisor data as support for destination management. *Current Issues in Tourism*, 23(2), 175-196. https://doi.org/10.1080/13683500.2018.1491955

Xun, J., & Reynolds, J. (2020). Applying netnography to market research: the case of the online forum. *Journal of Targeting, Measurement and Analysis for Marketing*, 18(1), 17-31. https://doi.org/10.1057/jt.2009.29

ENHANCING FRAUD PREVENTION THROUGH AI AND DEMOGRAPHIC INSIGHTS

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ABSTRACT

Purpose:
The digital age has seen a significant rise in financial fraud, introducing complex challenges that affect diverse demographic groups in varying degrees. This study proposes using Artificial Intelligence (AI) for risk management with a focus on cybersecurity and fraud prevention. It suggests that understanding the socio-demographic and psychological profiles of potential fraud victims is crucial for developing AI tools that can provide tailored fraud protection measures.

Design/methodology:
The study outlines a theoretical approach that combines a thorough review of existing literature with an analysis of demographic data. It aims to develop AI models based on behavioral analysis and the detection of risky behaviors. By demonstrating how AI can improve fraud detection through demographic specificity, the research outlines a path for creating more effective fraud prevention strategies.

Findings:
Preliminary insights reveal the vital role of demographic knowledge in enhancing the accuracy and efficiency of fraud detection methods. The study highlights how certain demographic characteristics can increase susceptibility to fraud, suggesting that AI's adaptability could be key in combating cyber threats. This approach promises a shift towards cybersecurity measures that are both nuanced and inclusive.

Research/practical implications:
This study marks an important step towards understanding how AI can be used alongside demographic analysis to advance fraud prevention efforts. It calls for a shift towards developing sophisticated, demographic-specific fraud detection tools and sets the stage for further empirical research into adaptive AI models that could set new standards in the field.

Originality/value:
This study's primary contribution is its proposal to integrate AI with demographic analysis to enhance fraud prevention strategies. By proposing this multidisciplinary method, it opens up new avenues for creating personalized and effective risk management solutions, addressing the complex dynamics of digital fraud across different population segments.

Keywords: Artificial Intelligence, Fraud Prevention, Risk Management, Demographic Analysis, Cybersecurity

JEL Classification: K42, C45, D81

1. Introduction

Fraudulent activities, from internal fraud to organized crime, pose challenges to individuals, organizations, and economies. Fraudsters increasingly exploit technological advancements to target vulnerabilities in detection systems, with payment card fraud alone causing $416 billion in losses in 2017 (Ryman-Tubb et al., 2018). This highlights the urgent need for more robust fraud prevention strategies.

Advances in Artificial Intelligence (AI) and Machine Learning (ML) offer promising solutions. AI systems, as described by Russell and Norvig (2010), perceive environments, learn from data, and take action to detect and predict fraudulent activities. However, challenges such as scalability, concept drift, and biases in training data persist, necessitating innovative methodologies to enhance fairness and interpretability (Hilal et al., 2022).

The European Union's AI Act provides essential guidelines for ethical AI deployment, emphasizing transparency, accountability, and fairness to safeguard fundamental rights (European Union, 2024). Compliance ensures fraud detection systems are effective while aligning with societal and legal expectations.

This study extends existing research by focusing on integrating demographic factors into AI-driven systems. Addressing gaps in dataset representativeness and adapting to evolving fraud patterns, it contributes to ethical and innovative AI applications in financial fraud prevention. The following section explores the existing body of work on fraud typologies, detection techniques, and the integration of AI in combating fraud.

2. Literature review/theoretical background

Artificial Intelligence (AI) has significantly advanced fraud detection and cybersecurity by analyzing vast datasets to identify patterns and anomalies. Early works (Fawcett and Provost, 1997) highlighted AI's adaptability in countering evolving fraud tactics. AI systems (Russell

and Norvig, 2010) excel at learning from data and making decisions under uncertainty, making them powerful tools for tackling fraud.

Fraud typologies, ranging from identity theft to imposter scams (Levi, 2008; Federal Trade Commission, 2023), underscore fraud's multifaceted nature. Central to detection are anomaly detection techniques that leverage supervised and unsupervised learning to identify outliers in data (Hodge and Austin, 2004; Chandola et al., 2009).

Key challenges, such as real-time detection and data imbalance, persist (Bolton and Hand, 2002; Phua et al., 2010). Synthetic datasets have been proposed to address these limitations, enhancing systems' ability to handle underrepresented groups and evolving patterns. Advancements like graph-based anomaly detection (Pourhabibi et al., 2020) and hybrid models (Ngai et al., 2011) address issues such as concept drift and scalability, aligning with the objectives of this study to develop ethical and effective fraud detection frameworks.

This study extends these techniques by integrating demographic factors into fraud detection models, introducing a novel and underexplored dimension to the field.

3. Methods

The methodology integrates theoretical insights and empirical data to address challenges in fraud detection. A detailed investigation of fraud categories, rankings, and financial repercussions, informed by a comprehensive literature review, established a framework for categorizing and prioritizing financial fraud based on prevalence and impact.

The initial research phase explored fraud classifications and rankings using empirical evidence and data analysis, identifying the most prevalent and impactful types. Victim reports and financial loss data highlighted areas requiring immediate intervention and resource allocation.

In the next phase, a synthetic credit card transaction dataset, created using the Sparkov Data Generation tool (Leroy et al., 2024) and sourced from Kaggle (Kartik, 2020), was employed to develop and test fraud detection models. This dataset, emulating real-world transactions with embedded fraud instances, avoids ethical and privacy concerns and allows for scalable, controlled testing of detection algorithms. Advanced AI and ML techniques, including anomaly

detection and supervised learning, were applied to iteratively refine models for identifying fraud patterns and adapting to evolving tactics.

The methodology aligns with the European Union's AI Act by incorporating transparency, accountability, and fairness, ensuring compliance with ethical guidelines while enhancing practical relevance and reliability.

In summary, this study bridges theoretical insights with practical application by leveraging empirical data and synthetic datasets, advancing fraud detection in credit card transactions and contributing to adaptive fraud prevention strategies.

4. Results and discussion

The analysis of specified fraud categories and their financial impact on victims reveals significant insights, consistent with the theoretical framework outlined in the methodology. The hierarchical ranking of fraud types indicates that identity theft and credit card fraud are the predominant categories, underscoring the critical threat these activities pose in the digital finance ecosystem. This finding aligns with existing literature, including the (Federal Trade Commission's, 2023) analysis, which highlights that these categories account for a significant proportion of reported fraud cases. The growing sophistication and frequency of these fraud types, as emphasized by Ryman-Tubb et al. (2018), further reflect the dynamic and adaptive nature of fraudsters in exploiting technological advancements.

The analysis of the Federal Trade Commission's Consumer Sentinel Network data for 2023 (Federal Trade Commission, 2023) reveals an intriguing insight: the top ten fraud categories alone represent approximately 72.29% of all reported cases, as summarized in Table 1. This concentration suggests that a significant portion of fraudulent activities are dominated by a few prevalent schemes, with Identity Theft, Imposter Scams, and issues related to Credit Bureaus leading the pack. Such findings align with observations by Levi (Levi, 2008), who emphasized the disproportionate impact of a small subset of fraud types on victims and the economy. This distribution underscores the urgent need for focused preventive measures and education, particularly aimed at protecting the elderly, who are especially susceptible to these frauds. The targeting of elderly victims has been linked to their perceived vulnerability and higher

likelihood of compliance (Button et al., 2009). By prioritizing the most common fraud types, resources can be more effectively directed toward combating these threats.

Table 3 Top Ten Fraud Categories of 2023

Rank	Fraud Category	# of Reports	Percentage of Total
1	Identity Theft	1,036,903	19.23 %
2	Imposter Scams	853,935	15.84 %
3	Credit Bureau Issues	711,802	13.20 %
4	Online Shopping Issues	369,469	6.85 %
5	Banks and Lenders Issues	230,224	4.27 %
6	Auto-Related Complaints	178,100	3.30 %
7	Lottery and Sweepstakes	157,520	2.92 %
8	Internet Services	125,118	2.32 %
9	Debt Collection	124,450	2.31 %
10	Business and Job Opportunities	110,364	2.05 %

Source: Commission's Consumer Sentinel Network data for 2023 (Federal Trade Commission, 2023)

The examination yields critical insights into the demographics of fraud victims, payment preferences, and the median financial losses incurred across different age groups. Table 2 reveals that younger individuals, particularly those aged between 20 and 29, show a preference for payment apps or services, distinguishing their transaction behaviors from the broader population. Social media dominates as the primary communication method across age groups. Older populations experience significantly higher median losses, with individuals aged 70 and above, particularly those 80 and older, being the most financially impacted. This analysis builds upon prior studies (Federal Trade Commission, 2023) by integrating demographic factors with fraud patterns, an area that remains underexplored in existing literature. These findings suggest a heightened vulnerability among the elderly to more severe financial fraud, emphasizing the need for targeted protective measures for this demographic.

Table 4 Age Groups, median losses and payment and contact methods

Age Group	Median Loss	#1 Payment Method	#1 Contact Method
20-29	$480	Payment App or Service	Social Media
30-39	$460	Credit Card	Social Media
40-49	$450	Credit Card	Social Media
50-59	$470	Credit Card	Social Media
60-69	$500	Credit Card	Social Media
70-79	$803	Credit Card	Phone Call
80+	$1450	Credit Card	Phone Call

Source: Commission's Consumer Sentinel Network data for 2023 (Federal Trade Commission, 2023)

In the pursuit of a more robust and accurate fraud detection model, various datasets were explored, including one available on Kaggle, generated by the Sparkov Data Generator. This dataset provides a wealth of information, yet it lacks one crucial element: the age of the victim. Analysis of the Federal Trade Commission's Consumer Sentinel Network data for 2023 (Federal Trade Commission, 2023) has shown that age can be a significant factor in fraud susceptibility, with certain age groups experiencing higher median losses. Incorporating age data into the model could potentially enhance predictive accuracy and facilitate the creation of rule-based models for credit card fraud detection. However, the absence of this data in the current dataset underscores the challenges in building comprehensive and effective fraud detection systems. While Babich and Hilal (2022) emphasize the importance of addressing data limitations in fraud detection, this study extends this focus by integrating demographic factors, such as age, to better capture fraud patterns. As the model is refined, these limitations are acknowledged, and efforts are continually made to overcome them.

As the fraud detection model is refined, future research will aim to identify additional factors beyond age to enhance predictive accuracy. These factors may include elements such as social background, digital literacy, and transaction patterns, among others. While prior studies have highlighted the importance of behavioral patterns in fraud detection (Chandola et al., 2009; Babich and Hilal, 2022), this research extends this focus by emphasizing the integration of demographic and behavioral data. Incorporating a broader range of these factors is expected to result in a more comprehensive and effective tool for fraud detection.

In light of recent regulatory developments, it is important to underscore that this research aligns with the ethical guidelines set forth by the European Union's Artificial Intelligence Act

(European Parliament, 2024). This comprehensive set of regulations, established in December 2023, ensures that AI systems are used responsibly and ethically, explicitly prohibiting the use of sensitive characteristics, such as race, to categorize individuals. Adherence to these principles is maintained by focusing solely on demographic factors that contribute to enhancing fraud detection and prevention strategies. By incorporating data such as age and transaction patterns, the goal is to better understand and address the vulnerabilities of individuals, ultimately benefiting potential victims of fraud. This approach aligns with the regulation's overarching goal of fostering fairness and transparency in AI applications. Supporting these ethical standards contributes to the creation of a safer digital environment for all through the responsible and innovative use of AI.

In terms of methodology, two potential routes are being considered. The first involves the direct application of AI to detect fraudulent transactions. This approach would leverage the power of machine learning algorithms, such as supervised and unsupervised models, to analyze transaction data and identify patterns indicative of fraud. Techniques such as convolutional neural networks (CNNs) and autoencoders, which have shown promise in detecting anomalies within transaction sequences (Hilal et al., 2022; Chalapathy and Chawla, 2019), could be explored to enhance this approach. The second route involves using AI to fine-tune a rule-based detection model. Here, AI would optimize the rules and thresholds used in the detection model, potentially incorporating feedback from historical data to adapt to evolving fraud tactics. This hybrid approach aligns with recent research advocating the integration of AI-driven insights into traditional detection frameworks to balance precision and interpretability (Pourhabibi et al., 2020).

5. Conclusion

In conclusion, this research highlights the critical role of AI and demographic analysis in enhancing fraud prevention strategies, with a particular emphasis on the integration of demographic insights—a novel contribution of this study. While prior works (Ryman-Tubb et al., 2018; Hilal et al., 2022; Babich and Hilal, 2022) have extensively explored the application of AI in fraud detection, the explicit consideration of demographic factors remains largely absent in existing literature. This gap underscores the unique value of this work, which

introduces a more comprehensive approach to understanding and mitigating fraud by incorporating demographic data into detection models

Analysis of the Federal Trade Commission's Consumer Sentinel Network data for 2023 (Federal Trade Commission, 2023) demonstrates the significant impact of age on fraud susceptibility, revealing that older populations experience higher median financial losses. However, the datasets utilized lacked certain demographic variables, such as social background and digital literacy, which limits the breadth of the analysis. Addressing these limitations presents an important avenue for future research, as incorporating a wider range of demographic and behavioral factors could significantly enhance the predictive accuracy and fairness of fraud detection models.

Aligned with the EU AI Act (European Parliament, 2024), this research upholds fairness, transparency, and avoids prohibited characteristics like race. By exploring the integration of ethically sourced demographic data, the aim is to contribute to the development of fraud detection systems that are both effective and compliant with regulatory standards.

The practical implications of this work are substantial. Advancing fraud detection systems that account for demographic risk factors can improve protections for vulnerable groups and create a safer digital environment for all. Although the fight against digital fraud is ongoing, the integration of AI and a deeper understanding of demographic insights represents a significant step forward. As the approach is refined, a commitment remains to overcoming current limitations and contributing to the evolution of more equitable and adaptive fraud prevention systems.

References

Bar-Lev, E., Liviu-George, M., & Topliceanu, S. C. (2022). Financial frauds' victim profiles in developing countries. *Frontiers in Psychology*, 13. DOI: 10.3389/fpsyg.2022.999053, ISSN: 1664-1078.

Button, M., Lewis, C., & Tapley, J. (2009). Fraud typologies and the victims of fraud: literature review. *National Fraud Authority.*

Button, M., McNaughton, N. C., Kerr, J., & Owen, R. (2014). Online frauds: Learning from victims why they fall for these scams. *Australian and New Zealand Journal of Criminology*, 47, 391–408. DOI: 10.1177/0004865814521224.

Chalapathy, R., & Chawla, S. (2019). *Deep learning for anomaly detection*: A survey. arXiv preprint, arXiv:1901.03407.

European Parliament. (2024). *Artificial intelligence act*. Retrieved from https://artificialintelligenceact.eu/the-act/

Fawcett, T., & Provost, F. (1997). Adaptive Fraud Detection. *Data Mining and Knowledge Discovery*, 1, 291–316. DOI: 10.1023/A:1009700419189.

Federal Trade Commission. (2023). Profile | *Tableau Public*. Retrieved from https://public.tableau.com/app/profile/federal.trade.commission/vizzes

Hilal, W., Gadsden, S. A., & Yawney, J. (2022). Financial fraud: A review of anomaly detection techniques and recent advances. *Expert Systems With Applications*, 193, 116429. DOI: 10.1016/j.eswa.2022.116429.

Kartik, S. (2020). *Credit Card Transactions Fraud Detection Dataset*. Kaggle. Retrieved from https://www.kaggle.com/datasets/kartik2112/fraud-detection

Levi, M. (2008). Organized Frauds and Organising Frauds: Unpacking the Research on Networks and Organisation. *Criminology and Criminal Justice*, 8, 389–419. DOI: 10.1177/1748895808096479.

Leroy, B., Harris, B., & Shenoy, K. (2024). GitHub - namebrandon/Sparkov_Data_Generation: Synthetic Credit Card Transaction Generator used in the Sparkov program. GitHub. Retrieved from https://github.com/namebrandon/Sparkov_Data_Generation

Ngai, E. W., Hu, Y., Wong, Y. H., Chen, Y., & Sun, X. (2011). The application of data mining techniques in financial fraud detection: A classification framework and an academic review of literature. *Decision Support Systems*, 50, 559–569. DOI: 10.1016/j.dss.2010.08.006.

Pourhabibi, T., Ong, S. H., Loo, C. K., & Lai, K. K. (2020). Fraud detection: A systematic literature review of graph-based anomaly detection approaches. *Decision Support Systems*, 133, 113303. DOI: 10.1016/j.dss.2020.113303.

Ribeiro, M. T., Singh, S., & Guestrin, C. (2016). "*Why should I trust you?" Explaining the predictions of any classifier*. Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, 1135–1144. DOI: 10.1145/2939672.2939778.

Ryman-Tubb, N. F., Krause, P., & Garn, W. (2018). How Artificial Intelligence and Machine Learning Research Impacts Payment Card Fraud Detection: A Survey and Industry Benchmark. *Engineering Applications of Artificial Intelligence*, 76, 130–157. DOI: 10.1016/j.engappai.2018.07.008.

Russell, S., & Norvig, P. (2010). *Artificial Intelligence: A Modern Approach* (3rd Edition). Prentice Hall. ISBN: 978-0136042594.

FACTORS OF CONTRACTING OUT SERVICES IN THE PUBLIC SECTOR

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ABSTRACT

Purpose:
Contracting out as a service delivery arrangement in the 21st century is a popular topic, but the **studies** done in the 21st century show the need to shift the focus towards factors which can influence contracting out. The paper focuses on three key factors and their influence on contracting out services in the public sector. The aim of the paper is to analyze the current knowledge of these factors – market concentration, transaction costs and consumer sensitivity based on market competitiveness – and their effect on contracting out public services in the domestic and foreign environment.
Design/methodology:
The paper takes the form of a literature review of domestic and foreign studies on the topic of the three factors. With the help of the snowball method, we have gathered 45 studies and articles with the use of databases like Emerald, Science direct, Scopus and Google Scholar.
Findings:
Market concentration is studied the most in Slovakia. In almost all the cases, the market concentration is very high, but the effect of this indicator on contracting out could not be determined. Transaction costs have proven to be very hard to calculate, but the studies which have managed to do so show that these costs make up a significant part of the total costs of contracting out. The paper shows a lack of domestic studies analyzing consumer sensitivity based on market competitiveness, but foreign studies show that with the change of market concentration, consumer preferences also change. With lower market concentration comes the need to consume higher quality, but potentially more expensive service.
Research/practical implications:
Results show the lack of domestic studies analyzing these factors, especially in the case of transaction costs and consumer sensitivity based on market competitiveness. Nonetheless, the effect of these factors on contracting out public services is apparent.
Originality/value:
The paper, unlike the ones before it, focuses on not only one factor, but multiple factors. Besides the more well-known factors like market concentration and transaction costs, the paper also analyses the lesser known third factor, which has been appearing in foreign studies only in the past couple of years. The paper provides a concise look at the current knowledge of these three factors needed for further analysis.

Keywords: contracting public services, market concentration, transaction costs, consumer sensitivity

JEL Classification: H44, L33

1. Introduction

Based on multiple studies by domestic authors (Nemec et. al., 2016, Mikušová Meričková, Mališová, Murínová, 2022a,b), in the conditions of the Slovak republic, contracting out is the dominant form of providing public services on a municipal level, such as collection and removal of municipal solid waste. Contracting out establishes a contractual relationship between the provider (public institution) and an external producer (private, non-profit, or other public organization). If we look at the theory and experience from abroad, contracting out public services should theoretically result in lower costs and higher quality of the service, among other things (Petersen, Hjelmar, Vrangbæk 2018, Greene 2002, Hodge, 2000, Kamerman, Kahn, 1989, Sclar, 2000). If we look at the results in our environment, this theory does not seem to be valid.

The problem is that the outcome of contracting out may also be influenced by external factors beyond the control of the contracting out organization itself. Among the external factors, we can include service market concentration, transaction costs or consumer sensitivity based on market competitiveness. Because of this, studies from the last 10 years point to the importance of studying these factors and the influence they can have on the price and quality of the contracted public service. (Petersen, Hjelmar, Vrangbæk, 2018, Bel, Rosell, 2016, Mikušová Meričková, Soukopová, Šumpíková, Křápek, 2021)

2. Methods

The main aim of the paper is to analyze the current knowledge of these factors – market concentration, transaction costs and consumer sensitivity based on market competitiveness – and their effect on contracting out public services in the domestic and foreign environment. To achieve this aim, we conducted a literature review at the end of 2023 of existing studies on the above mentioned 3 factors.

To gather these studies, we used multiple key words, such as “contracting out public services”, “municipal waste management”, “transaction costs in public services”, “consumer sensitivity based on market competitiveness”. After finding relevant studies, we further used the snowball method to broaden the number of both domestic and foreign studies. We used databases like Emerald and Research Gate, but most studies were found through Google Scholar. In the paper, we work with 45 studies which analyze factors which can influence the outcome of contracting out. At first, we worked with twice the amount, but – especially in the case of transaction costs – these had to be omitted because they only focused on these factors in the private sector.

3. Results and discussion

In this part, we will analyze the findings of domestic and foreign studies for each of the chosen factors – market concentration, transaction costs and Consumer sensitivity based on market competitiveness.

Market concentration

Most foreign and domestic studies analysing market concentration and its effect on contracting out use the Herfindahl-Hirschman index and most of these studies point out a very high market concentration ((Bel, Costas,2006, Dijkgraaf, Gradus, 2006, Soukopová, Malý, Ficek, 2013, Gradus, Schoute, Dijkgraaf, 2018, Di Foggia, Beccarello, 2021, Mikušová Meričková, Mališová, Murínová, 2022a,b).

Based on the findings of the analysed studies, we cannot prove that the outcome of contracting out is dependent on market concentration. On one side, we have studies which could prove this dependence – studies of authors Soukopová, Vaceková (2015), Pavel, Slavík (2017), Di Foggia, Beccarello (2021) found a directly proportional relationship, meaning that the higher the market concentration is, the higher the costs for contracting out the service are. On the other side, there are studies of authors Bel, Costas (2006), Dijkgraaf, Gradus (2006), Massarutto (2007), Soukopová, Malý (2012), Soukopová, Malý, Ficek (2013), Gradus, Schoute, Dijkgraaf (2018) which could not confirm this relationship and found the indicators independent of each other. In other cases, the findings were ambiguous or contradictory.

Authors propose multiple solutions to the high market concentration problem. The first one being to shorten the contract period (Bel, Costas, 2006, Bel, Fageda, 2011, Mikušová Meričková, Mališová, Murínová, 2022a, Murínová, 2023) to strengthen the market competitiveness, making a contract with a different private producer, or a subject of another public institution (Bel, Fageda, 2011, Mikušová Meričková, Mališová, Murínová, 2022a, Murínová, 2023). Marques and Simões (2008) describe a "sunny approach", or a system of periodical public benchmarking of performance indicators of different producers on the market, which could show the weakness of the producer and create an opportunity to increase the market performance. Antonioli and Massarutto (2012) focus on the need to change the European legislation since some indicators have the tendency to reach an international level. Authors like Bel and Costas (2006), Pavel and Slavík (2017), Gradus, Schoute and Dijkgraaf (2018), Mikušová Meričková, Soukopová, Šumpíková and Křápek (2021) propose inter-municipal cooperation as a better alternative of service delivery.

Transaction costs

Transaction costs have been the most talked about factor out of the three in recent years. Perunović and Pedersen (2007) describe the traction cost theory as one of the fundamental economic theories used in literature on contracting out. The main question of the theory, based on Geyskens, Steenkamp and Kumar (2006) is whether the transaction is more effective when performed inside the company or outside of it. In some cases, it is possible that transaction costs will reach a level where internalisation is the better option. Williamson (1979), Brown and Potoski (2003) and Warner and Hefetz (2012) assume that total costs of contracting out are made up of 2 parts -total costs of production and transaction costs. This is why it is important to take them into consideration to achieve a true understanding of the situation (Brown, Potoski, Van Slyke, 2015). In case of internalization, transaction costs can be compared to administrative costs.

We recognise 2 (Hirsch, 1991) or 3 (Pavel, Vítek, 2016) types of transaction costs:

1. Ex-ante costs – preparation of the documentation, public procurement notice, evaluation of the producers.
2. Costs created during the contract – communication between both sides, monitoring of the producer.

3. Ex-post costs – handling of complaints, legal disputes, selection of a new producer.

Brown and Potoski (2005) and Schoute, Budding and Gradus (2018) divided public services into groups, depending on the assumed transaction costs. With services, which have low specificity and are easy to measure, the costs should be low. Example of this is the municipal waste management. On the other side, there are services like police or the fire department. Which should have high transaction costs (Cuypers, Hennart, Silverman, Ertug, 2021). Levin and Tadelis (2010) consider 3 factors that determine these costs: ease of measurability, need of flexibility and retention potential – with low values of these factors should come low transaction costs.

Petersen, Hjelmar and Vrangbæk (2018) found that only in 1 out of 49 studies the authors were able to calculate transaction costs. Other studies, which managed to do so, point to very high transaction costs, oftentimes to the point where contracting out is no longer a suitable service delivery choice (Keane, Marx, Ricci, 2001, Ohlsson, 2003, Rho, 2013, Nemec, Šumpíková, Orviská, Bušina , Grega, 2016).

Petersen, Hjelmar a Vrangbæk (2018) describe the first contract period as a period with the highest expected transaction costs. Gradus, Schoute and Budding (2021) found in the case of Dutch municipalities, transaction costs are the main reason for remunicipalization, with services like catering or information services, but in some cases – municipal waste management or local infrastructure administration - it resulted in inter-municipal cooperation (Clifton, Warner, Gradus, Bel, 2021).

Brown (2008), Hefetz, and Warner and Vigoda-Gadot (2014) studied the effects of these costs on inter-municipal cooperation and found that this cooperation has the potential to lower the costs more than in the case of remunicipalization, because municipalities share common goals and can divide these costs between them. On the other hand, Bel and Sebő (2021) could not confirm this finding.

Consumer sensitivity based on market competitiveness

The factor first appeared in the work of Bertini, Wathieu and Iyengar (2012), who proposed a theory that consumers know their own preferences of quality and price, but their final decision depends on the number of producers on the market. In the case of a monopoly or a few producers on the market, the priority for the consumer – in this case the municipality – is to

minimize the costs and they will choose the producer with the lowest price. (Murínová, 2020, Mikušová Meričková, Mališová, Murínová, 2022a, Murínová, 2023). But there is a second trend, where in the case of more producers on the market, consumers have the tendency to educate themselves more about what options are available to them and in the end are more willing to pay more for a higher quality service. In the mind of the consumer, the product of these producers gains more value. Authors Parker and Lehmann (2014) and Salisbury and Feinberg (2012) describe this situation as "mixed decision making", where the consumer must find balance between 2 options – lower costs or higher quality.

Kamenica (2008), Orhun (2009) or Guo and Zhang (2012) have studied this factor from the view of the producer – what choices do producers make based on the behaviour of consumers. If the consumer is not willing to educate themselves more on the supply, they will most likely make the choice the other consumers around them make, which could result in a lower interest in smaller producers on the market and make the market even more concentrated. As of writing this paper, there is no study analysing this factor in the Slovak environment.

4. Conclusion

The paper helps to identify the importance of the factors which can influence contracting out public services on a municipal level. The literature review consists of 45 studies and articles of domestic and foreign authors on the topic of market concentration, transaction costs and consumer sensitivity based on market competitiveness. In the case of the last 2 factors, studies show a clear relationship between these factors and the result of contracting out public services.

The paper is limited by the number of published studies, especially in the case of consumer sensitivity based on market competitiveness. Nevertheless, the paper provides us with a concise basis for our future studies in this area, since our goal is to provide public institutions with enough information about the above-mentioned factors, so that they can make the decision-making process as effective as possible.

In the future, we aim to calculate how each of these factors influences contracting out public services in Slovakia, which has not been done before with all 3 factors. With this data, we will formulate concrete recommendations for Slovak municipalities.

References

Antonioli, B., & Massarutto, A. (2012). The municipal waste management sector in Europe: Shifting boundaries between public service and the market. *Annals of Public and Cooperative Economics*, 83(4), 505–532.

Bel, G., & Costas, A. (2006). Do public sector reforms get rusty? Local privatization in Spain. *The Journal of Policy Reform*, 9(1), 1–24.

Bel, G., & Fageda, X. (2011). Big guys eat big cakes: Firm size and contracting in urban and rural areas. *International Public Management Journal*, 14(1), 4–26.

Bel, G., & Rosell, J. (2016). Public and private production in a mixed delivery system: Regulation, competition and costs. *Journal of Policy Analysis and Management*, 35(3), 533–558.

Bel, G., & Sebő, M. (2021). Does inter-municipal cooperation really reduce delivery costs? An empirical evaluation of the role of scale economies, transaction costs, and governance arrangements. *Urban Affairs Review*, 57(1), 153–188.

Bertini, M., Wathieu, L., & Iyengar, S. S. (2012). The discriminating consumer: Product proliferation and willingness to pay for quality. *Journal of Marketing Research*, 49(1), 39–49.

Brown, T. L. (2008). The dynamics of government-to-government contracts. *Public Performance & Management Review*, 31(3), 364–386.

Brown, T. L., & Potoski, M. (2003). Transaction costs and institutional explanations for government service production decisions. *Journal of Public Administration Research and Theory*, 13(4), 441–468.

Brown, T. L., & Potoski, M. (2005). Transaction costs and contracting: The practitioner perspective. *Public Performance & Management Review*, 28(3), 326–351.

Brown, T. L., Potoski, M., & Van Slyke, D. (2015). Managing complex contracts: A theoretical approach. *Journal of Public Administration Research and Theory*, 26(2), 294–308.

Clifton, J., Warner, M. E., Gradus, R., & Bel, G. (2021). Re-municipalization of public services: Trend or hype? *Journal of Economic Policy Reform*, 24(3), 293–304.

Cuypers, I. R., Hennart, J. F., Silverman, B. S., & Ertug, G. (2021). Transaction cost theory: Past progress, current challenges, and suggestions for the future. *Academy of Management Annals*, 15(1), 111–150.

Di Foggia, G., & Beccarello, M. (2021). Market structure of urban waste treatment and disposal: Empirical evidence from the Italian industry. *Sustainability*, 13(13), 7412–7424.

Dijkgraaf, E., & Gradus, R. (2006). Collusion in the Dutch waste collection market. *Local Government Studies*, 33(4), 573–588.

Geyskens, I., Steenkamp, E. M., & Kumar, N. (2006). Make, buy, or ally: A transaction cost theory meta-analysis. *Academy of Management Review*, 49(3), 519–543.

Gradus, R., Schoute, M., & Budding, T. (2021). Shifting modes of service delivery in Dutch local government. *Journal of Economic Policy Reform*, 24(3), 333–346.

Gradus, R., Schoute, M., & Dijkgraaf, E. (2018). The effects of market concentration on costs of local public services: Empirical evidence from Dutch waste collection. *Local Government Studies*, 44(3), 1–19.

Greene, J. D. (2002). *Cities and Privatization: Prospects for the New Century*. Upper Saddle River, NJ: Prentice Hall.

Guo, L., & Zhang, J. (2012). Consumer deliberation and product line design. *Marketing Science*, 31(6), 995–1007.

Hefetz, A., Warner, M. E., & Vigoda-Gadot, E. (2014). Professional management and local government service delivery: Strategic decisions across alternative markets. *Public Performance and Management Review*, 38(2), 261–283.

Hirsch, W. Z. (1991). *Privatizing Government Services: An Economic Analysis of Contracting by Local Governments*. Los Angeles: Institute of Industrial Relations, Publications Center, University of California.

Hodge, G. A. (2000). *Privatization: An International Review of Performance*. Boulder, CO: Westview Press.

Kamerman, S. B., & Kahn, A. J. (1989). *Privatization and the Welfare State*. Princeton, NJ: Princeton University Press.

Kamenica, E. (2008). Contextual inference in markets: On the informational content of product lines. *American Economic Review*, 98(5), 2127–2149.

Keane, C., Marx, J., & Ricci, E. (2001). *Perceived outcomes of public health privatization: A national survey of local health department directors*. Millbank Quarterly, 79(1), 115–137.

Levin, J., & Tadelis, S. (2010). Contracting for government services: Theory and evidence from U.S. cities. *Journal of Industrial Economics*, 58(3), 507–541.

Marques, R. C., & Simões, P. (2008). Does the sunshine regulatory approach work? Governance and regulation model of the urban waste services in Portugal. Resources, *Conservation and Recycling*, 52(8–9), 1040–1049.

Massarutto, A. (2007). Municipal waste management as a local utility: Options for competition in an environmentally regulated industry. *Utilities Policy*, 15(1), 9–19.

Mikušová Meričková, B., Mališová, D., & Murínová, K. (2022a). *The market concentration as the public services contracting out efficiency factor at the local government level: The case of Slovakia*. In

International Conference on Computational Science and Its Applications. Cham: Springer International Publishing.

Mikušová Meričková, B., Mališová, D., & Murínová, K. (2022b). *Market restrictions of contracting out the public service at the municipal level*. In International Conference on Applied Economics. Cham: Springer International Publishing.

Mikušová Meričková, B., Soukopová, J., Šumpíková, M., & Křápek, M. (2021). Municipal solid waste management in the Czech Republic and Slovakia: What has changed over the past 20 years? *NISPAcee Journal of Public Administration and Policy*, 15(1), 89–112.

Murínová, K. (2023). Kontrahovanie služieb vo verejnom sektore a koncentrácia trhu verejnej služby. [Master's thesis, Ekonomická fakulta Univerzity Mateja Bela].

Nemec, J., Šumpíková, M., Orviská, M., Bušina, F., & Grega, M. (2016). *Transaction costs in the public procurement: Selected findings in Czech and Slovak conditions.* In The 10th International Days of Statistics and Economics (pp. 1749–1758). Praha: Melandrium.

Ohlsson, H. (2003). Ownership and production costs: Choosing between public production and contracting-out in the case of Swedish refuse collection. *Fiscal Studies*, 24(4), 451–476.

Orhun, A. Y. (2009). Optimal product line design when consumers exhibit choice set dependent preferences. *Marketing Science*, 28(5), 868–886.

Parker, J. R., & Lehmann, D. R. (2014). How and when grouping low-calorie options reduces the benefits of providing dish-specific calorie information. *Journal of Consumer Research*, 41(1), 213–235.

Pavel, J., & Slavík, J. (2017). The relationship between competition and efficiency of waste-collection services in the Czech Republic. *Local Government Studies*, 44(2), 275–296.

Pavel, J., & Vitek, L. (2016). *Transaction costs of the Czech public procurement*. In IRSPM Hong Kong Conference.

Perunović, Z., & Pedersen, J. L. (2007). *Outsourcing process and theories*. In POMS 18th Annual Conference (pp. 1–18). Dallas.

Petersen, O. H., Hjelmar, U., & Vrangbæk, K. (2018). Is contracting out of public services still the great panacea? A systematic review of studies on economic and quality effects from 2000–2014. *Social Policy and Administration*, 52(1), 130–157.

Rho, E. (2013). Contracting revisited: Determinants and consequences of contracting out for public education services. *Public Administration Review*, 73(2), 327–337.

Salisbury, L. C., & Feinberg, F. M. (2012). All things considered? The role of choice set formation in diversification. *Journal of Marketing Research*, 49(3), 320–335.

Sclar, E. D. (2000). *You Don't Always Get What You Pay For: The Economics of Privatization*. Ithaca: Cornell University Press.

Schoute, M., Budding, T., & Gradus, R. (2018). Municipalities' choices of service delivery modes: The influence of service, political, governance, and financial characteristics. *International Public Management Journal,* 21(4), 502–532.

Soukopová, J., & Malý, I. (2012). Vliv konkurence na výši výdajů na nakládání s odpady obcí Jihomoravského kraje. *Waste Forum*, 2012(4), 173–183.

Soukopová, J., Malý, I., & Ficek, V. (2013). Má konkurenční prostředí vliv na výdaje obcí na nakládání s komunálním odpadem v ČR? *Waste Forum*, 2013(4), 231–239.

Soukopová, J., & Vaceková, G. (2015). Competition and municipal waste management expenditure: Evidence from the Czech Republic Olomouc Region. *Scientific Papers of the University of Pardubice*, 35(2015), 128–138.

Warner, M., & Hefetz, A. (2012). In-sourcing and outsourcing: The dynamics of privatization among US municipalities 2002–2007. *Journal of the American Planning Association*, 78(3), 313–327.

Williamson, O. E. (1979). Transaction-cost economics: The governance of contractual relations. *Journal of Law and Economics*, 22(2), 233–261.

KEY AUDIT MATTERS OVERVIEW – EVIDENCE FROM EUROPEAN COMPANIES

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ABSTRACT

Purpose:
Beginning with audits completed after December 15th, 2016, the audit report was extended by the introduction of Key Audit Matters (KAMs). The accounting files of researchers (Hong, Thuong, 2020; Fadzly, Ahmad, 2004) pointed out differences between audit capabilities and financial information users. One of the most significant challenges of the audit
profession was filling the audit gap between the expectations of the audit report users and the work of auditors. This paper is designed to provide an overview of the European KAMs reported in the auditor's extended reports.
Design/methodology:
To perform our analysis, we have extracted key audit matter database from Audit Analytics at 20th of December 2022. From a total of 65.786 observations of KAMs, we have obtained our final sample of 44.597 observations, reported by 3.481 companies. We have excluded any KAMs obtained from audit reports which were not published between 2016 and 2021. We have excluded companies for which audit opinions were not emitted for the entire period. To gain understanding over the KAMs reporting process, a qualitative analysis was performed. For data processing we have used Microsoft Excel.
Findings:
Key audit matters that are frequently reported include revenue and other income. The United Kingdom reported the highest number of KAMs, which is largely determined by the number of companies audited. In the retail trade industry was reported the highest average of observations per company. The distance between the auditee's headquarters and Europe can be used to correlate a higher average number of observations per company. We believe that 2019 and 2020 can be eliminated in the future analysis of key audit matters because of their unusual characteristics.
Research/practical implications:
KAMs can be perceived by managers as a way of control over their actions, and the existence of KAMs can lead to less aggressive accounting policies according to an experiment conducted by Gold, A., at all (2020). Before making any assumptions over the KAMs topic, the first step should be to understand the key elements in KAMs reporting. To do so, we analyzed KAMs

reported in Europe, their quantitative evolution from 2016 until 2021, the main topics presented in KAMs, the geographical distribution, the audit market, and the industries in which the auditees are activating.

Originality/value:

Based on our research findings, there is significant attention towards disclosure and the associated advantages of KAMs reporting, particularly in regions beyond the European Union such as China, Australia, and the US. Notably, within Europe, emphasis has been placed on the UK, Germany, and Spain. The increased focus in examining KAMs in the UK can be attributed to its pioneering role in reporting and disclosing such matters in extended audit reports, as well as its substantial number of listed audited companies. This paper aims to analyze KAM disclosures across Europe, with broader regional focus rather than concentrating on specific countries.

Keywords: key audit matters, audit, extended audit report

JEL Classification: M41, M42

1. Introduction

Audit quality was a research topic that began before 1985. As the audit profession has evolved, the focus on audit quality was changed, moving from general topics, regulators, industry, service type, audit market, auditor's size, and client size to specific units as audit office, audit partner, or even agreement terms (Molociniuc, Hritcan et al., 2022). The main drawback of studying audit quality is that it cannot be measured directly. Academics reviewed different types of quality indicators to assess the effectiveness of the audit (Diem, 2016).

Enron, Lehman Brothers, and other financial scandals caused intense questions about the role of the auditor. Literature was highly critical of the standard audit report because of the pass/fail model. As a result, audit regulators all over the globe have begun a process of reforming the audit report (Lennox, Schmidt, & Thompson, 2023). The audit report composition has undergone a significant change due to the introduction of an extended audit report that presents key audit matters or critical audit matters.

Starting with audits completed after December 15th, 2016, the audit report was extended by the introduction of Key Audit Matters (KAMs). The accounting files of researchers (Hong, Thuong, 2020; Fadzly, Ahmad, 2004) pointed out differences between audit capabilities and financial information users. One of the most significant challenges of the audit profession was filling the audit gap between the expectations of the audit report users and the work of auditors.

In Europe, reporting of KAMs was introduced through ISA 701 "Communicating Key Audit Matters in The Independent Auditor's Report". The introduction of KAMs in an audit report can be interpreted as a reconstruction of rules which are regulating the audit profession, as a link between the auditors as assurers and the ones responsible for the preparation of financial statements (Mihret, et al., 2022).

Key audit matters (KAMs) or critical audit matters (CAMs) were introduced more recently in the accounting literature, and between academic representatives there is no agreement over the degree in which KAMs are contributing to reporting quality overall, or to which extend KAMs could be an audit's quality indicator. Including information in key audit matters that has not already been published by the client should be avoided by auditors. In a study conducted by Lennox, Schmidt & Thompson (2023), argue that financial information users were aware of the risks presented in KAMs, before the audit report. Regulators emphasize the distinction between key audit matters and the explicative paragraph of the modified opinion.

Even if the key audit matters are a topic which gained interest mainly after 2016 since they became mandatory, there are countries in which KAMs were reported earlier, as United Kingdom and Netherlands. Our research follows the structured in two main parts: literature review and a qualitative analysis over the KAMs reported in Europe. We have extracted our database from Audit Analytics, in December 2022. The analyzed period is 2016 – 2021. We intend within our paper to obtain an overview regarding the reported KAMs. We will analyze the type of auditor (Big 4[2] or Non-Big 4[3]), opinion type (modified or not modified), geographical distribution of KAMs reported, industries, and the evolution of the number of KAMs in analyzed sample.

Based on our research findings, there is significant attention towards disclosure and the associated advantages of KAMs reporting, particularly in regions beyond the European Union such as China, Australia, and the US. Notably, within Europe, emphasis has been placed on the UK, Germany, and Spain. The increased focus in examining KAMs in the UK can be attributed to its pioneering role in reporting and disclosing such matters in extended audit reports, as well

[2] Big 4 Companies – PricewaterhouseCoopers (PWC), KPMG, Ernst & Young (EY) and Deloitte, biggest audit companies in the world
[3] Non-Big 4 – Any other audit company

as its substantial number of listed audited companies. This paper aims to analyze KAM disclosures across Europe, with broader regional focus rather than concentrating on specific countries.

2. Literature review/theoretical background

Key audit matters (KAMs) communication is meant to aid financial statement understanding by revealing the audit's focus (Ong, Moroney & Xiao, 2022; Pérez et al., 2021). KAMs are related to areas of significant complexity in financial information, in areas which require judgments of auditors and company managers (Gambetta et al, 2023). The obligation to include the KAMs in the extended audit report was introduced by the adoption of Regulation (EU) No 537/2014 of the European Parliament and the Council in April 2014 that took effect for accounting periods starting on or after June 17, 2016.

One of the studies researching the implementation of the European Regulation right in the first year of implementation, was conducted by Inês Pinto and Ana Isabel Morais in 2018 ("What matters in disclosures of key audit matters: Evidence from Europe"). The methodology employed in this study involves an analysis of the determinants affecting the disclosure of Key Audit Matters in audit reports across European countries. This analysis is conducted using a sample of companies listed on specific indices, all of which disclosed KAMs at the conclusion of the 2016 fiscal year. Employing regression models and Poisson regression, the study investigates the influence of various factors, including firm complexity, audit fees, precision of accounting standards, size, presence of financial institutions, and profitability, on the disclosure of KAMs. Additionally, the authors leverage Hogarth's theory on information assimilation to gain insight into the factors shaping the number of KAMs disclosed by auditors. The primary findings indicate that elements such as business complexity, audit fees, and industry regulation play pivotal roles in influencing the disclosure of Key Audit Matters in audit reports.

According to a study based on a questionnaire addressed to experienced auditors in Finland, conducted by Rautiainen, Saastamoinen, Pajunen, (2021), respondents, in general, did not consider KAMs as a factor of improvement in audit quality, but they considered them as a factor of improvement in efficiency. The Key Audit Matters are not considered to be an improvement in audit quality, their primary scope being to reduce the audit gap. Key audit matters can be

selected by taking into consideration factors such as materiality, subjectivity, difficulty, and time-based consideration (Segal, 2019), but the existent definitions of KAMs can be confusing for auditors and may not be appropriate to help some auditors in identifying the proper KAM to report (Hegazy. Kamareldawla, 2021).

According to ISA 701, Key Audit Matters are the most significant matters for the audit of financial statements of the current period, filtered by the auditor's professional judgment, and are selected from matters which are communicated with those charged with governance. They cannot replace the base for a modified opinion, which should be considered separated, and should be presented in a manner that will not affect the image or competitive advantage of the company. Also, their purpose should be to provide additional information to the users of financial statements and to ensure a high level of transparency in financial reporting.

Studies have investigated the perception of financial statements users over the KAMs, and how KAMs can influence their decisions. Asbahr, Ruhnke (2017) had analyzed a sample of 132 listed New Zealand firms. Their study based on quantitative statistical methods, concluded that following the presentation of key audit aspects in the auditor's report, users of financial statements were more confident in profitability indicators because they understood how the income and profit side was analyzed by the auditors. Non-professional investors can be influenced by Key audit matters in decisions making process, but only if there is no resolution (Gold & Heilmann, 2019). The quality of financial information is extremely important in terms of investing choices, financial reporting being the basis on which they base their decisions.

The relation between investors and reporting of KAM in the extended audit report was analyzed also by Ong, et al. (2022). In their study, the researchers showed how KAMs helps improving the understandability of the financial statements of a company for the investors, showing that the presence or absence of KAMs is relevant, but the qualitative aspects of the KAMs such as the readability and quantification enhance the ability of investors to understand the auditor's focus. The authors believe that there is a positive association between KAM readability and financial statement understandability. Another study conducted in order to analyze the relation between the investors and the extended audit report was done by Moroney, et al. (2021). This time, the focus is set on whether and how the inclusion of Key Audit Matters (KAMs) in the Enhanced Auditor's Report (EAR) affects investor perceptions of the value of

the audit and the credibility of the auditor. A surprising finding is the conceived high credibility of the audit report, especially for non Big4 auditors when including KAMs, whereas for Big4 auditors, the credibility of auditor report is viewed as high whether KAMs are included or not.

Surprisingly, some investors don't see the value added of including the KAM in the audits report since they perceive the risks as already known even before those risks are disclosed by the auditors. In the same study, Lennox, et al. (2023) exploit the impact, if such, of KAM in the investor reactions and company decisions. The conclusion, although maybe not relevant for other jurisdictions except UK, is that investors were already aware of most risks before auditors started disclosing them, leading to the lack of incremental information in the expanded audit reports. Another deep-dive analysis on how investors react to KAMs was performed by Hoang, et al. (2023) suggesting that investors react differently to KAMs in financial and non-financial contexts based on the disclosed risk item's level of risk and the relatedness of the KAM to that risk item. The study concludes that when there is a high-risk item disclosed in the financial statement of the company, the investors do not appear to use supplemental information, such as a KAM, to inform their assessment of investment riskiness. This finding holds across a financial and a non-financial context, suggesting that investors weigh negative information heavily in their decision making and forgo supplemental information. In support of the theory, when a company discloses a low-risk item, investors are affected by KAM relatedness in a way that varies across contexts.

Adams's (2019) assumption was that investors use financial statements to monitor managerial activity, and they will take measures to improve the quality of the information given. Following the regression analysis, the study concluded that companies whose financial statements provided poor information were prone to activism and shareholder dynamics, which were influenced by governance proposals. While acknowledging the study's limitations, the author notes that the evidence presented indicates a correlation between investor activism and the need for better financial statement information, but not necessarily a causal relationship. Also, KAMs seems to have a higher impact when the auditor is Non- Big 4, since the Big 4 assurance level is perceived as higher (Moroney, et al., 2021).

Noteworthy improvement of financial statements quality is noted when auditor rotation or even partner changes occur from one reporting period to the other. Lin, Yen, (2022) note in their

study that once an audit partner is changed, different key audit matters are more likely to be observed. In the same study, the authors note how the accruals quality is impacted by auditor rotation. The results reiterate the importance of fresh perspectives brought by new auditors and how changes in KAM disclosures can indicate a new auditor's fresh perspective.

Also, KAMs can be perceived by managers as a way of control over their actions, and the existence of KAMs can lead to less aggressive accounting policies according to an experiment conducted by Gold, et al. (2020). Anyways, there are academics which argue that the perception of financial information users is not influenced by the existence of KAMs, and reporting KAMs doesn't significantly affect the professional skepticism of the auditors (Asbahr & Ruhnke, 2019; Coram& Wang, 2021; ABU & Jaffar, 2020).

The overall behavior of users of the auditor report on the inclusion of KAMs was intensively studied. Anna, et al. (2018) concluded that the inclusion of these indicators can lead to reduced aggressive financial reporting behavior, enhancing financial reporting quality. Interesting fact is that the inclusion of KAMs, even of low informational precision, can lead to high changes in decisional behavior. Another worth-notedly finding is that even the analysts' work is influenced by the audit matters, those metrics being capable of influencing the quality of their forecasts. Venturini, et al. (2022) shows in their study how the quality and content of KAMs significantly impacts the earnings per share forecast and indicate a reduction in informational asymmetry.

In research, academics used different methodologies, including experimental design, questioners, and econometrical models. Ozlanski, (2016) highlight the fact that KAMs produce effects when they are associated with a precise accounting standard. Pinto & Morais (2019) concluded that higher fees can be related to a higher number of KAMs, because the KAM can be translated in identified significant risks. In literature were studies characteristics as readability, and quantifiability for KAMs (Ong, Moroney & Xiao, 2022; Velte, 2018).

Taking into consideration the number of KAMs, studies have shown that the number of KAMs is negatively associated with auditor's experience and industry expertise and KAMs understandability (Zhang, & Shailer, 2022; Sirois et al., 2017; Li, Qi, Tian, & Zhang, 2017).

Hussin, et al. (2022) conducted an analysis to quantify KAM reporting in audit reports over three years (2017-2019). The analysis highlighted a significant positive correlation between audit fees, leverage, and complexity with the number of KAM disclosures, while a significant

negative correlation was observed between female audit partners, audit firm tenure, and the number of KAM.

Before making any assumptions over the KAMs topic, first step should be to understand the key elements in KAMs reporting. To do so, we will continue by analyzing KAMs reported in Europe, their quantitative evolution since 2016 until 2021, the main topics presented in KAMs, the geographical distribution, the audit market, and the industries in which the auditees are activating.

3. Methods

To perform our analysis, we have extracted key audit matter database from Audit Analytics at 20th of December 2022. From a total of 65.786 observations of KAMs, we have obtained our final sample of 44.597 observations, reported by 3.481 companies. We have excluded any KAMs obtained from audit reports which were not published between 2016 and 2021. We have excluded companies for which audit opinions were not emitted for the entire period. To gain understanding over the KAMs reporting process, an analysis was performed. For data processing we have used Microsoft Excel.

Before making any assumptions over the KAMs topic, the first step should be to understand the key elements in KAMs reporting. To do so, we analyzed KAMs reported in Europe, their quantitative evolution from 2016 until 2021, the main topics presented in KAMs, the geographical distribution, the audit market, and the industries in which the auditees are.

4. Results and discussion

The number of KAMs reported in the data base was only 42% during the analyzed period, with 3.481 out of a total of 8.387. During the entire period considered, KAMs have not been consistently presented to all companies, as seen in Table 1.

Table 1 Number of years in which KAMs were reported by companies.

Number of Years	Companies	Percent
6	1621	47%
5	1225	35%
4	363	10%
3	114	3%
2	85	2%
1	73	2%

Source: own processing of data from Audit Analytics database

According to our findings, there are 58 KAM categories that are presented in Annex 1. The most frequent KAM reported by the auditors in related to the Revenue and other income (12% of the total, with 5.178 observations), followed by Goodwill (8% of the total, with 3.371 observations). Other usually reported topics in KAMs paragraph in the auditor's report are other investments; revenue from costumer contracts; goodwill and intangible assets; going concern; inventory; business combinations; property, plant and equipment, contingent liabilities, real estate investments; deferred and capitalized costs; other intangible assets; deferred income taxes; subsidiary/ affiliates, accounts/ loans receivable; long- lived assets.

Our analysis in Figure 1 is focused on the changes in the reported number of KAMs. In the period 2016 – 2021, the evolution in the number of KAMs reported was mainly ascending, except for 2021, where there is a decrease in the number of KAMs reported by 9%. Between 2016 and 2017, there was a 60% increase in the number of KAMs. From 2018 to 2020 the increase is 5% per year. The analyzed period from 2016 to 2021 has witnessed an overall increase of 61%. The change in number of KAMs is not influenced by the number of companies, as we only included in our sample companies which were audited for all 6 years included in the analysis.

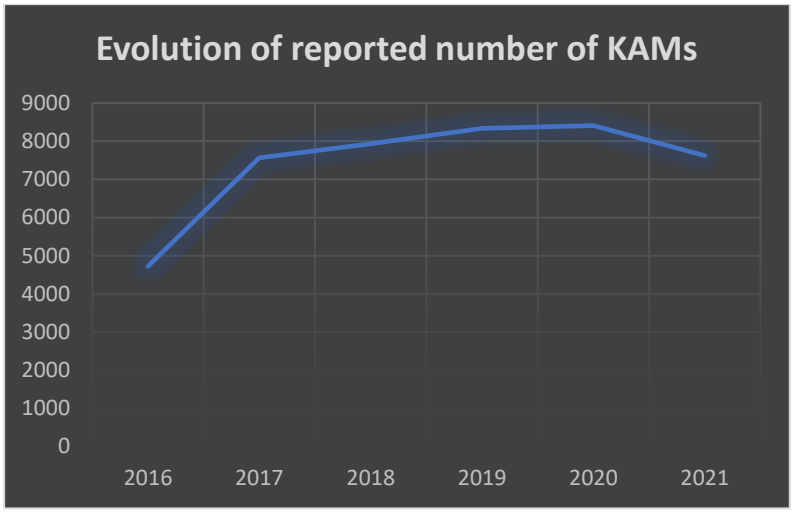

Figure 1 Changes in KAMs number over the period 2016 – 2021

Source: own processing of data from Audit Analytics database

Without considering the possible microeconomic events that can affect individual companies, the effects of the COVID-19 pandemic may affect the results of KAMs' number reporting behaviors. In Figure 2, we can observe that going concern KAMs reporting behavior are more volatile as the number of going concern KAMs reported multiplied almost 4 times between 2018 and 2020.

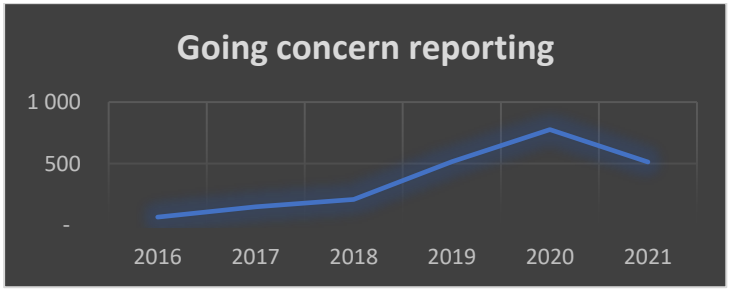

Figure 2 Going concern KAM reporting

Source: own processing of data from Audit Analytics database

In 2021, the reporting pattern can be observed to have a negative impact, as shown in Table 2. It is reasonable to assume that the going concern has a substantial effect on the quantity of KAMs during a COVID-19 pandemic, and it is necessary to exclude years 2019 and 2020 from future studies on KAMs.

Table 2 Reporting of going concern.

Yearly change in KAMs total	2016	2017	2018	2019	2020	2021
Yearly change in KAMs total	67	151	210	517	777	515
Period Change in KAMs Total		1.25	0.39	1.46	0.50	0.34
Overall change		1.25	2.13	6.72	10.60	6.69

Source: own processing of data from Audit Analytics database

The Big Four companies (PricewaterhouseCoopers, Deloitte, Ernst & Young, and KPMG) are the dominant players in the audit market, as shown in Table 3. As previously mentioned, there were 3.481 companies analyzed, but the differences seen in Table 3 are a result of joint audits. The audits of companies included in our sample were conducted and partially conducted by the four big companies. PricewaterhouseCoopers (PwC) conducted almost a quarter of companies analyzed, 4% more than KPMG (following audit company by the number of audits performed) and 8 percent more than Deloitte (forth audit company by the number of audits performed).

Table 3 Audit Market

Auditor	2016	2017	2018	2019	2020	2021	Grand Total	Percent
PWC	847	844	832	837	808	777	4,945	22%
Others	695	699	718	748	786	838	4,484	20%
KPMG	701	682	684	636	610	589	3,902	18%
EY	643	645	644	656	645	640	3,873	17%
Deloitte	538	529	514	503	493	476	3,053	14%
Grant Thornton	176	176	176	170	166	158	1,022	5%
Mazars	88	104	103	109	121	129	654	3%
PKF	26	33	37	56	82	91	325	1%
Grand Total	3,714	3,712	3,708	3,715	3,711	3,698	22,258	100%

Source: own processing of data from Audit Analytics database

Taking into account the number of KAMs, Big 4 companies typically report more KAMs (more than 2) than other auditors (less than 2). The small difference in the number of KAMs

reported by Big 4 and Non- Big 4 audit companies could be related to industry specific clients' risks, to the market share of the Big 4 companies in the audit services market, or to the complexity of Big 4 client's businesses. In the years 2019 and 2020, marked by COVID-19 pandemic, the overall average number of KAMs reported increases, a fact which confirms that years 2019 and 2020 should be excluded from KAMs future analyses, covering longer periods of time.

Table 4 Average number of KAMs reported by auditors

Auditor	2016	2017	2018	2019	2020	2021	Average
PWC	1.6	2.2	2.1	2.3	2.4	2.1	2.1
Others	0.5	1.7	1.9	2.1	2.1	2.0	1.7
KPMG	1.4	2.0	2.2	2.3	2.2	1.9	2.0
EY	1.6	2.2	2.4	2.5	2.5	2.3	2.3
Deloitte	1.6	2.4	2.4	2.4	2.3	2.1	2.2
Grant Thornton	0.7	1.8	2.0	2.2	2.4	2.0	1.8
Mazars	0.4	1.1	1.2	1.3	1.3	1.3	1.1
PKF	0.0	1.8	1.8	1.7	1.9	2.2	1.8
Grand Total	1.3	2.0	2.1	2.2	2.3	2.1	2.0

Source: own processing of data from Audit Analytics database

99% of the cases where audit reports contained KAMs during the analyzed period received an unqualified opinion. Non – Big 4 companies reported modified opinions more frequently than Big 4 companies, but since modified opinions are represented only 1 percent in our sample, we can't conclude over the results.

Table 5 Opinion type structure

Opinion Type	2016	2017	2018	2019	2020	2021	Grand Total
Unqualified	1739	2972	3207	3263	3295	3270	17746
Qualified Opinion	16	23	22	25	39	38	163
Disclaimer of Opinion	1	1	3	3	3		11
Adverse Opinion				1	1	1	3
Opinion Structure total	1756	2996	3232	3292	3338	3309	17923
Big 4 Auditors							
Unqualified	1534	2266	2370	2377	2328	2262	13137
Qualified Opinion	8	9	9	9	10	8	53
Disclaimer of Opinion			2	2	1		5
Adverse Opinion				1			1
Big 4 Auditors Total	1542	2275	2381	2389	2339	2270	13196
Non - Big 4 Auditors							
Unqualified	205	706	837	886	967	1008	4609
Qualified Opinion	8	14	13	16	29	30	110
Disclaimer of Opinion	1	1	1	1	2		6
Adverse Opinion					1	1	2
Non - Big 4 Auditors total	214	721	851	903	999	1039	4727

Source: own processing of data from Audit Analytics database

We have scrutinized the reported KAMs, taking into consideration the country headquarters of the companies that were audited. The number of KAMs reported is highly dependent on the number of companies with headquarter in each country. Table 6 presents the countries that reported the most KAMs from 2016 to 2021. The country with the highest number of KAMs is United Kingdom (17.116 KAMs reported for 6.079 reports analyzed in our sample), followed by Germany, France, Sweden, Switzerland, Finland, Netherlands, Italy, Norway, and Spain.

Table 6 Countries with the highest number of KAMs reported

Country	KAMs	Companies	Average Kam per companies
United Kingdom	17116	6,079	2.82
Germany	3091	1,280	2.41
France	2605	1,017	2.56
Sweden	2488	1,176	2.12
Switzerland	2007	956	2.10
Finland	1610	570	2.82
Netherlands	1457	455	3.20
Italy	1245	560	2.22
Norway	1223	644	1.90
Spain	899	312	2.88

Source: own processing of data from Audit Analytics database

The average number of KAMs can range from 1 to 4. Except from Netherlands and Portugal, countries with an average number of KAMs reported higher than 3 (as seen in Table 7), are located outside the Europe (Unites States, South Africa, Curacao, Gibraltar, Panama, Bangladesh). Our assumption is that there are more KAMs that can be linked to the reporting framework since there are more standard specifications.

Table 7 Countries with Highest number of KAMs/ company

Country	KAMs	Companies	Average KAM per company
Netherlands	1457	455	3.20
Portugal	473	123	3.85
United States	81	27	3.00
South Africa	78	25	3.12
Curaçao	42	12	3.50
Gibraltar	38	11	3.45
Panama	24	6	4.00
Bangladesh	9	3	3.00

Source: own processing of data from Audit Analytics database

Table 8 provides industry-specific information. The industry's number of companies is a significant factor in the number of KAMs. The highest average number of KAMs is found in Retail Trade, according to our analysis.

Table 8 The number of KAMs by industry

Industry	Count of KAM Topic	Number of Opinions	Average
Manufacturing	12,143	4981	2.44
Finance Insurance, Real Estate	11,926	5174	2.30
Services	7,340	2820	2.60
Transportation & Public Utilities	4,376	1588	2.76
Mining	3,174	1281	2.48
Retail Trade	2,024	631	3.21
Wholesale Trade	1,587	649	2.45
Construction	1,527	576	2.65
Agriculture, Forestry, Fishing	460	202	2.28
Public Administration	40	21	1.90
Grand Total	**44,597**		

Source: own processing of data from Audit Analytics database

5. Conclusion

The auditor's report introduces KAMs to bridge the gap between audit capabilities and the informational needs of financial report users. KAMs are presenting the risks which occur in auditee's economic activity.

This paper is designed to provide an overview of the European KAMs reported in the auditor's extended reports. Future research on the KAMs topic could exclude 2019 and 2020 from the analyses because of the COVID-19 impact. Between 2016 and 2021, the United

Kingdom reported the highest number of KAMs, and it is highly linked to the number of companies. Big 4 companies are the dominate players in the audit industry, reporting on average more KAMs than non-Big 4 companies.

Regarding the type of the opinion, 99% of observations analyzed reported unmodified opinion. Further research may not include modified opinions due to their low frequency of observation. During audits, the retail trade industry reported the most KAMs per company, which may indicate higher risks.

Limitations of this paper are the short period of time which has passed since the introduction of mandatory KAMs reporting at European level and the impact of COVID-19 pandemic effects which are not fully understood.

Similar studies (Pasca and Hategan, 2023) on KAM subjects have yielded results similar to ours.

References

ABU, N. A., & Jaffar, R. (2020). Audit Committee Effectiveness and Key Audit Matters. *Asian Journal of Accounting & Governance*, 14.

Asbahr, K., & Ruhnke, K. (2019). Real effects of reporting key audit matters on auditors' judgment and choice of action. International Journal of Auditing, 23(2), 165-180.

Coram, P. J., & Wang, L. (2021). The effect of disclosing key audit matters and accounting standard precision on the audit expectation gap. International Journal of Auditing, 25(2), 270-282.

Diem, T.L., (2016), The effect of auditors' workload pressure and compression on audit quality, disponibil la adresa: http://jultika.oulu.fi/files/nbnfioulu-201605121710.pdf, (accessed et 01.12.2023).

Fadzly, M-N, Ahmad, Z., (2004), Audit expectation GAP: the case of Malaysia, Managerial Auditing Journal, nr. 19(7), pp. 897-915.

Gambetta, N., Sierra-García, L., García-Benau, M. A., & Novejarque-Civera, J. (2023). The informative value of key audit matters in the audit report: Understanding the impact of the audit firm and KAM type. Australian Accounting Review, 33(2), 114-134.

Gold, A., Heilmann, M., Pott, C., & Rematzki, J. (2020). Do key audit matters impact financial reporting behavior?. International Journal of Auditing, 24(2), 232-244.

Hegazy, M.A., Kamareldawla, N.M. (2021), Key audit matters: did IAASB unravel the knots of confusion in audit reports decisions?, Managerial Auditing Journal, vol. 36, nr. 8, pp. 1025-1052.

Hoang, H., Moroney, R., Phang, S. Y., & Xiao, X. (2023). Investor reactions to key audit matters: Financial and non-financial contexts. Accounting & Finance, 63(3), 3325-3349.

Hong, N., Thuong, N., (2020), Expectation GAP in auditor responsibilities: a case study, Journal of security and sustainability issues, vol. 9, nr. 4, pp. 1283-1295

Hussin, N., Salleh, M. F. M., Ahmad, A., & Rahmat, M. M. (2022). The Influence of Audit Firm Attributes on KAM Disclosures in FTSE100 in Malaysia. Management & Accounting Review, 21(2).

International Auditing and Assurance Standards Board (2015), „International Standards On Auditing 701: Communicating Key Audit Matters in the Independent Auditors Report".

Lennox, C. S., Schmidt, J. J., & Thompson, A. M. (2023). Why are expanded audit reports not informative to investors? Evidence from the United Kingdom. Review of Accounting Studies, 28(2), 497-532.

Lin, H. L., & Yen, A. R. (2022). Auditor rotation, key audit matter disclosures, and financial reporting quality. Advances in Accounting, 57, 100594.

Mihret, D. G., Kansal, M., Muttakin, M. B., & Rana, T. (2022) „The auditing profession and the key audit matter reporting requirement", Qualitative Research in Accounting & Management, 19(1), 107-125.

Molociniuc, M., Melega, A., Grosu, M., Tulvinschi, M., & Macovei, A. G. (2022). "Evolution of scientific research on audit quality reporting in the global economic context". Entrepreneurship and Sustainability Issues, 10(2), 333.

Moroney, R., Phang, S. Y., & Xiao, X. (2021). When do investors value key audit matters?. European Accounting Review, 30(1), 63-82.

Ong, S. Y., Moroney, R., & Xiao, X. (2022). How do key audit matter characteristics combine to impact financial statement understandability?. Accounting & Finance, 62(1), 805-835.

Ozlanski, M. E. (2019). Bright lines vs. blurred lines: When do critical audit matters influence investors' perceptions of management's reporting credibility?. Advances in accounting, 45, 100416.

Pasc, L. V., & Hategan, C. D. (2023). Disclosure of Key Audit Matters: European Listed Companies' Evidence on Related Parties Transactions. International Journal of Financial Studies, 11(3), 82.

Pérez, Y. P., Miñano, M. D. M. C., Segovia-Vargas, M. J. (2021) „Risk on financial reporting in the context of the new audit report in Spain: Riesgo en la información financiera en el contexto del nuevo informe de auditoría en España", Revista de Contabilidad-Spanish Accounting Review, 24(1), 48-61.

Pinto, I., & Morais, A. I. (2019). What matters in disclosures of key audit matters: Evidence from Europe. Journal of International Financial Management & Accounting, 30(2), 145-162.

Rautiainen, A., Saastamoinen, J., & Pajunen, K (2021) „Do key audit matters (KAMs) matter? Auditors' perceptions of KAMs and audit quality in Finland", Managerial Auditing Journal, 36(3), 386-404.

Segal, M. (2019) „Key audit matters: insight from audit experts", Meditari Accountancy Research, 27(3), 472-494.

Velte, P. (2018). Does gender diversity in the audit committee influence key audit matters' readability in the audit report? UK evidence. Corporate social responsibility and environmental management, 25(5), 748-755.

Venturini, L. D. B., Bianchi, M., Machado, V. N., & Paulo, E. (2022). Informational content of key audit matters and financial analysts' forecasts. Revista Contabilidade & Finanças, 33, 281-299.

Zhang, P. F., & Shailer, G. (2022). The impact of audit committee expertise on external auditors' disclosures of key audit matters. International Journal of Auditing, 26(2), 151-170.

Annex 1 KAMs Topics

KAM Type	2016	2017	2018	2019	2020	2021	Total	Percent
Revenue and other income	612	902	950	909	920	885	5178	12%
Goodwill	336	576	599	611	639	610	3371	8%
Other investments	370	440	481	493	513	504	2801	6%
Revenue from customer contracts	163	376	415	461	443	468	2326	5%
Goodwill and intangible assets	239	357	412	429	427	406	2270	5%
Going concern	67	151	210	517	777	515	2237	5%
Inventory	218	325	334	334	339	304	1854	4%
Business combinations	206	358	369	291	227	279	1730	4%
Property, plant, and equipment	179	303	308	312	309	290	1701	4%
Contingent liabilities (Including litigation & restructuring)	157	273	258	265	259	235	1447	3%
Real estate investments	156	223	233	248	252	255	1367	3%
Deferred income taxes	179	291	254	222	196	175	1317	3%
Subsidiary/affiliate	50	172	224	257	277	295	1275	3%
Accounts/loans receivable	129	231	226	241	242	204	1273	3%
Other intangible assets	101	227	215	209	225	216	1193	3%
Deferred and capitalized costs	92	193	209	207	190	182	1073	2%
Long-lived assets	71	131	157	196	274	227	1056	2%
Pension and other post-employment benefits	163	174	163	147	136	141	924	2%
Allowance for credit losses	87	126	133	151	148	157	802	2%
Other liabilities and provisions	107	158	151	127	115	111	769	2%
Disposals, discontinued operations, and accounting for sales/divestitures	61	109	121	115	96	91	593	1%
Insurance contract liabilities	63	95	95	103	106	97	559	1%
Other income taxes	108	128	121	78	52	42	529	1%
Equity investments and joint ventures	45	92	84	90	91	95	497	1%

Policy changes	14	51	116	213	69	7	470	1%
Information technology	61	76	82	73	63	62	417	1%
Uncertain tax positions	56	62	68	77	75	69	407	1%
Internal controls	48	100	72	69	67	50	406	1%
Derivatives and hedging	48	80	68	71	64	55	386	1%
Significant one-off transactions	19	23	71	109	97	27	346	1%
Presentation - Exceptional items and non-GAAP measures	46	59	59	67	63	38	332	1%
Deferred and stock-based compensation	60	74	74	56	36	31	331	1%
Long-term investments	39	69	68	53	54	41	324	1%
KAM Type	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**	**Percent**
Proven and unproven reserves	26	58	58	54	59	53	308	1%
Leases	17	31	28	67	68	60	271	1%
Compliance with laws and regulations	40	47	49	46	45	42	269	1%
Other debt	30	51	61	43	42	31	258	1%
Vendor/supplier rebates	42	49	44	44	35	38	252	1%
Asset retirement and environmental obligations	21	34	38	45	42	43	223	1%
Warranty liabilities	19	42	35	35	32	26	189	0%
Related party transactions	19	30	36	26	28	22	161	0%
Sales return and allowances	13	31	32	26	22	16	140	0%
Depreciation and amortization	16	24	21	24	21	21	127	0%
Foreign currency, inflation, and related disclosures	11	18	22	17	44	14	126	0%
Consolidation	25	30	18	23	16	11	123	0%
Debt covenants	14	19	18	13	21	22	107	0%
Financial statements and disclosures	12	19	13	12	33	11	100	0%
Other expenses	16	16	12	13	10	12	79	0%

Other or unspecified accounting estimates	22	11	7	7	20	10	77	0%
Cash and cash equivalents	4	8	11	8	10	6	47	0%
First year audit	12	9	7	7	4	4	43	0%
Transformation initiatives	2	10	11	7	6	3	39	0%
Error corrections	3	8	7	6	5	6	35	0%
Selling, general and administrative expenses	2	5	4	3	2	3	19	0%
Segment reporting	3	4	1	3	3	3	17	0%
Listing/delisting	4	4		2	1	3	14	0%
Bribery and corruption	1	2	2	3	1	1	10	0%
Balance sheet classification of assets	1					1	2	0%
Grand Total	4.725	7.565	7.935	8.333	8.411	7.626	44.597	100%

Source: own processing

OFFSHORING INTENSITY AND LABOR MARKET: INDUSTRY-LEVEL EVIDENCE FROM SLOVAK REPUBLIC

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ABSTRACT

Purpose:
Although offshoring is not a new phenomenon, it is still a topic of interest due to its representation of the internationalization of production. Slovakia is a country with highly internationalized production, particularly in the automotive sector. Also, it is undoubtedly one of the main characteristics of the current phase of globalization. Offshoring is often used to explain the reduction in demand for the labor force. Our aim is therefore to examine the relationship between offshoring and labor market trends in Slovakia in the period 2008-2020.
Design/methodology:
The EU KLEMS & INTANPROD and OECD TiVA databases provide industry-level data for the Slovak Republic. In this study, we employ the translog cost function proposed by Berman et al. (1994). Due to limited data availability, we substituted cost shares with employment shares for each industry (see Bramucci et al., 2017). In addition, labor is not disaggregated by skill-level. We use panel data regression to examine the relationship between offshoring and labor market trends in Slovakia.
Findings:
Our findings suggest that offshoring has a positive statistically significant impact on total employment in Slovakia over the observed period. This could indicate that the productivity effect has played a significant role in the labor market. This implies that jobs created by higher sales compensated for jobs lost due to the relocation of production stages, which is in line with Hijzen and Swaim (2007).
Research/practical implications:
The findings provide insights at both macro and micro levels. The macro level refers to economic policy, while the micro level relates to its use by firms, such as for strategic planning and decision-making about future labor input needs. Therefore, conducting additional research on employment structure, considering the division of labor by educational attainment or professional groups, may be beneficial. Additionally, it is crucial to analyze the effect of offshoring on labor demand at the firm level.
Originality/value:
Our study focuses on Slovakia, a country with highly internationalized production. While most studies have focused on Western European countries, we aim to provide insight into this lesser-studied region. The analysis covers a period up to 2020, which includes the trends of the variables during the Covid-19 crisis. In addition, the results of our study can be used as lessons learned for other countries that are facing a similar transformation.

Keywords: labor market, offshoring, internationalization, Slovakia

JEL Classification: F16, J31

1. Introduction

Globalization, defined as the increasing integration and interdependence of markets and production across national boundaries, is currently one of the most significant drivers of economic growth and development worldwide (OECD, 2024). The concept of offshoring, which represents the internationalization of production, is also associated with globalization. Despite its many beneficial aspects, offshoring has been a source of concern among policymakers for decades due to its potential impact on employment, wage levels, and job security. The aim of this paper is to examine the impact of offshoring on the labor market in Slovakia between 2008 and 2020, using industry-level data.

While studies on topics related to this subject have been conducted in various developed countries (e.g., Foster-McGregor et al., 2013, which examined data from OECD countries; Hijzen et al., 2005, which focused on the UK; and Bramucci et al., 2017, which analyzed data from five major EU countries), there appears to be a lack of industry-level analysis for Slovak Republic, a country that stands out for its high level of internationalized production.

In terms of overall economic activity, manufacturing is the dominant industry in Slovakia. Furthermore, the automotive industry plays a significant role in the country's economy, contributing to the overall economic activity. It is characterized by a high degree of technological change, high levels of automation in production processes, and a comparatively low domestic value-added content in its output. Given their extensive involvement in global value chains, the labor markets of automotive-related industries are strongly linked to foreign markets and foreign final demand.

The paper is divided into five chapters. The introduction is followed by Section 1, which presents a review of the relevant empirical literature. Section 2 describes the data, the state of the labor market, and the levels of offshoring in both services and manufacturing in the Slovak Republic. Section 3 provides an overview of the model that we apply to examine the impact of offshoring on labor market trends. Section 4 presents key findings. Finally, concluding remarks are made.

2. Literature review/theoretical background

The ongoing globalization trends of the economy are expected to affect it in two ways. On the one hand, it will deepen relations between countries and lead to greater efficiency and benefits from internationalized production. On the other hand, the interconnectedness of countries may result in greater sensitivity to external shocks. Furthermore, there is a continuing discussion regarding the impact of offshoring, which is a consequence of the internationalization of production as a result of globalization, on the employment level.

The term "offshoring" can be understood in two different ways. It can be defined as the transfer of business activities overseas or as the trade in intermediate products. The following article will examine offshoring as a specific type of trade involving intermediate products. Over the last few decades, there has been a rapid growth in world production and trade in goods and services. The international fragmentation of production and trade in intermediate goods is growing rapidly, while trade in final goods is declining (Yang and Mallick, 2014). Trade in intermediate goods accounts for a significant share of total trade in most countries. According to Miroudot et al. (2009), intermediate inputs account for 56% of trade in goods and 73% of trade in services in OECD countries.

The earliest research of the impact of offshoring on wages was conducted by Feenstra and Hanson (1996) in the US. The primary objective of the study was to assess the extent to which domestic workers were replaced by workers abroad through the increase in imports of intermediate goods. The authors found that offshoring accounted for approximately 31% of the non-production wage gains that occurred in the 1980s.

The study by Hijzen and Swaim (2007) considers the impact of offshoring on employment within specific industries, while also accounting for the scale and technological effects of this phenomenon in 17 OECD countries. The technological effect represents the destruction of jobs when firms move part of their production abroad. By contrast, the scale effect captures the creation of jobs as a result of the productivity gains from offshoring. The findings indicate that that inter-industry offshoring had no discernible impact on labor intensity. However, there is evidence to suggest that it may contribute to overall industry employment. In a comparable vein, Jensen and Turrini (2004) presented a theoretical model that illustrated that international

trade in intermediate goods can enhance productivity. Furthermore, in the long term, this could also increase employment.

As outlined by Grossman and Rossi-Hansberg (2008), there are three potential channels through which offshoring can influence employment levels. The direct displacement effect represents the first of these channels and demonstrates a negative effect on employment. In contrast, the output effect, which represents productivity gain, has a positive effect. The last channel is the substitution effect, which has an ambiguous effect.

The impact of offshoring on employment remains a topic of ongoing debate. In the next phase of our analysis, we will examine the case of the Slovak Republic over the period 2008-2020.

3. Methods

This section presents and discusses descriptive statistics on the levels of offshoring and employment in Slovakia during the examined period.

Measuring offshoring is a complex task due to the lack of available data, that will be suitable for empirical analysis. The approach proposed by Foster-McGregor et al. (2013) will be followed to measure offshoring. This approach distinguishes between inter-industry (narrow) and intra-industry (broad) offshoring, taking into account imported intermediates within a specific industry and imported intermediates from all industries.

In our analysis, we will employ a broad measure of offshoring, which can be calculated as follows:

$$OFF = \frac{\sum IIM_n}{VA_n} \qquad (1)$$

where IIM stands for imported intermediate inputs from industry, n is the index of the industry and VA denotes the value added. Domestic outsourcing is calculated in a similar manner:

$$DO = \frac{\sum TIM_n - \sum IIM_n}{VA_n} \qquad (2)$$

where TIM stands for total intermediate inputs, IIM stands for imported intermediate inputs from industry, n is the index of the industry and VA denotes the value added.

Figure 1 illustrates the level of offshoring in Slovakia across various economic sectors, with a particular focus on manufacturing and services over the period of 2008-2020. It is evident that the role of offshoring in the Slovak economy has been on the rise, reaching a value of 0.506 in 2022. Furthermore, Figure 1 indicates that the offshoring of manufacturing is more significant than that of services. This is not an unexpected outcome, given the growing concentration of European manufacturing activity in the Central European core, which includes the Slovak Republic. This concentration is primarily linked to the automotive industry (Stehrer and Stöllinger, 2015). The preceding evidence thus demonstrates a persistent structural challenge for these sectors in organizing production and delivery activities on a global scale (Bramucci et al., 2017).

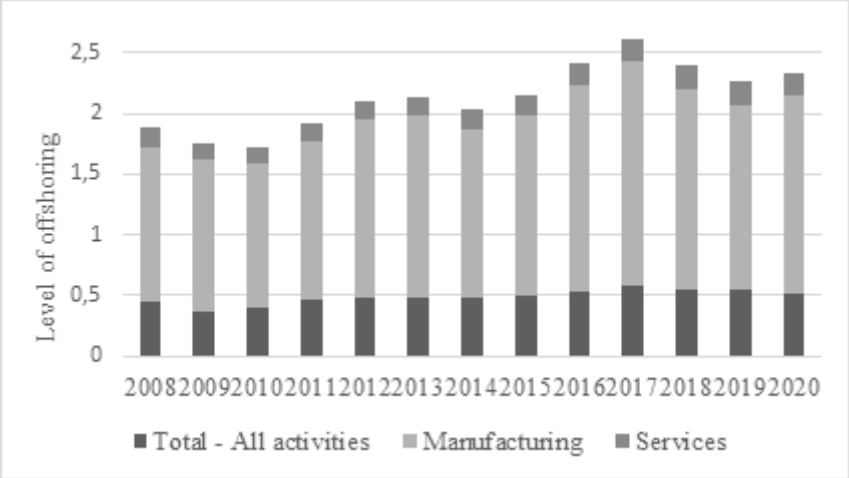

Figure 1 Level of offshoring across different industries
Source: own elaboration base on OECD TiVA data

This can also be corroborated by an examination of the manufacturing activities, which play a significant role in the overall economy of Slovakia. Figure 2 indicates that the automotive sector is one of the largest in Slovakia, representing on average approximately 32% of total manufacturing production in this region.

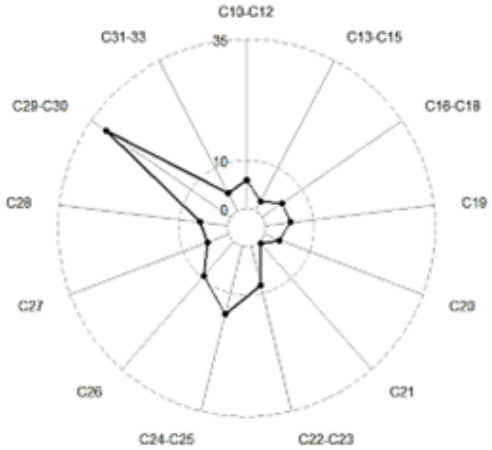

Figure 2 Average values of the share of manufacturing activities in total industrial production 2008-2020 in Slovak Republic
Source: own elaboration based on EUKLEMS & INTANPROD data

Figure 3 illustrates the share of persons engaged in each sector as a percentage of the total number of persons engaged. The manufacturing sector has historically been the dominant sector in job creation, although its share of employed individuals has slightly decreased in 2020 compared to 2008 (-10,17%). The sectors where the greatest decline in the share of employed individuals has been observed are Mining and Quarrying (-34.5%); Agriculture, Forestry, and Fishing (-19.5%); and Electricity, Gas, Steam, and Air Conditioning Supply (-24.7%). Conversely, new employment opportunities have emerged in service sectors such as Information and Communication (J); Accommodation and Food Service Activities (I); and Real Estate Activities (L). See Appendix 1 for listed industries.

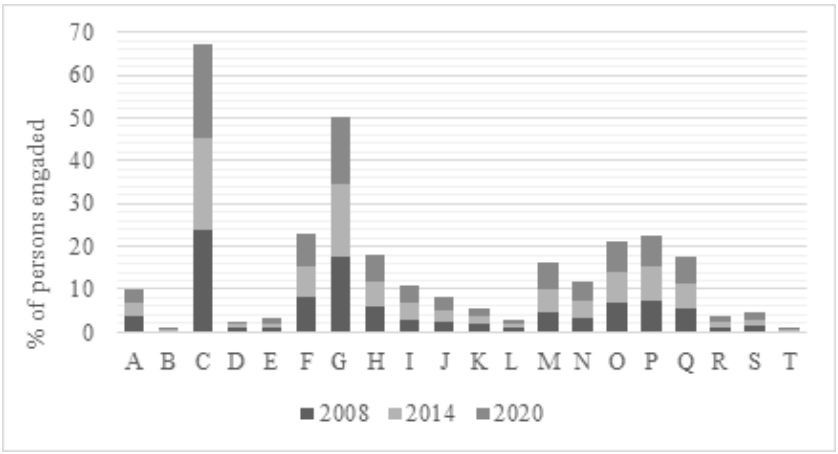

Figure 3 Share (%) of persons engaged in each sector as a percentage of the total number of persons engaged
Source: own elaboration based on EUKLEMS & INTANPROD data

Summary statistics for the growth rates of analyzed variables are presented in Table 1. During the period under study, all variables experienced an average growth rate increase. Hourly wages grew slightly faster on average than materials. Additionally, the average growth rate of offshoring in Slovakia is almost 4%. It is worth noting that the average growth rates of offshoring and domestic outsourcing are similar.

Table 1 Average growth rates of variables, 2008-2020

Variables	Mean	Maximum	Minimum	Standard deviation
EMP	0,003006	0,49699	-0,23007	0,089459
W	0,042851	0,239754	-0,05584	0,041742
Wii	0,040598	0,786443	-0,21954	0,13437
OFF	0,039855	2,481262	-0,573	0,276247
DO	0,0226	1,422732	-0,33755	0,20982
Y	0,026925	0,486786	-0,2775	0,110872
K	0,033923	0,170263	-0,19396	0,044538

Source: own elaboration based on EUKLEMS & INTANPROD and OECD TiVA data
Note: Variable names are described in Table 2

The descriptive statistics presented in this section indicate that offshoring may be a contributing factor in explaining the observed employment trends.

In order to examine the relationship between offshoring and employment, we employ a translog cost function (see Berman et al., 1994). In general terms, the translog cost function can be formulated as follows, according to Foster-McGregor et al. (2013):

$$\ln C = \alpha_0 + \sum_{i=1}^{M} \alpha_i \ln w_i + \sum_{k=1}^{K} \beta_k \ln x_k + \sum_{y=1}^{Y} \gamma_y z_y + \frac{1}{2}\sum_{i=1}^{M}\sum_{j=1}^{M} \gamma_{ij} \ln w_i \ln w_j + \\ + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} \delta_{kl} \ln x_k \ln x_l + \frac{1}{2}\sum_{y=1}^{Y}\sum_{p=1}^{R} \gamma_{yp} z_y z_p + \frac{1}{2}\sum_{i=1}^{M}\sum_{k=1}^{K} \theta_{ik} \ln w_i \ln x_k + \\ + \frac{1}{2}\sum_{i=1}^{M}\sum_{y=1}^{Y} \delta_{iy} \ln w_i z_y + \frac{1}{2}\sum_{k=1}^{K}\sum_{y=1}^{Y} \delta_{ky} \ln x_k z_y \qquad (3)$$

where C denotes total variable costs, w_i refers to wages for different skill types of labor and prices of materials, x_k refers to fixed inputs and outputs (quasi-) fixed input capital and gross output), z_y denotes to proxies for technological change, OFF stands for offshoring, and DO for domestic outsourcing, which is quasi-fixed.

The first derivatives of the cost function for wages and materials give:

$$\frac{\delta lnC}{\delta lnw_i} = \left(\frac{\delta lnC}{\delta lnw_i}\right)\left(\frac{w_i}{C}\right) \quad (4)$$

Denoting $\left(\frac{\delta C}{\delta w_i}\right)$ as a demand for input i. When differentiating translog cost function (1) with respect to $ln\, w_i$, the result is:

$$s_i = \alpha_i + \frac{1}{2}\sum_{j=1}^{M}\gamma_{ij}\, lnw_j + \frac{1}{2}\sum_{k=1}^{K}\theta_{ik}\, lnx_k + \frac{1}{2}\sum_{y=1}^{Y}\delta_{iy}\, lnz_y, \qquad i = 1,\ldots,M \quad (5)$$

Taking the differences between two periods, the equations for the wage shares of different types of labor skills and materials in industries n = 1,...,N are estimated as follows:

$$\triangle s_i = \alpha_0 + \sum_{j=1}^{M}\gamma_{ij}\, lnw_j + \theta_K \triangle lnK + \theta_Y \triangle lnY + \delta_{OFF} \triangle lnOFF + \delta_{DO} \triangle lnDO + \varepsilon_i \quad (6)$$

Our model differs in several ways from the general outline provided. Due to limited data availability, we replaced cost shares with employment shares for each industry (see Bramucci et al., 2017). And the labor is not divided into different skill levels. In line with this, the model is:

$$EMP_i = \alpha_0 + \sum_{j=1}^{M}\gamma_{ij}\, lnw_j + \theta_K \triangle lnK + \theta_Y \triangle lnY + \delta_{OFF} \triangle lnOFF + \delta_{DO} \triangle lnDO + \varepsilon_i \quad (7)$$

The EUKLMS & INTANprod and OECD TiVA databases provide industry-level data for the Slovak Republic. Due to data availability, we examine the period from 2008 to 2020 to ensure balanced panel data. Although the databases cover 19 industries, we only include 13 of them in our analysis. We exclude the mining and quarrying sector (B) due to its low value-added and high levels of offshoring, which could distort our results. Furthermore, in accordance with the methodology proposed by Foster McGregor et al. (2013), we also exclude industries O, P, Q, R, and S. These industries are classified as non-market services, and the level of imported intermediate inputs is relatively minimal. The 19 industries are presented in Appendix 1.

A variety of tests were employed to select the most appropriate model, including the F-test, Lagrange multiplier test, and Hausman test. Furthermore, the model was assessed against the assumptions typical in panel data regression analysis. Cross-sectional dependence, indicating

correlation between countries, was evaluated using the Pesaran CD test; serial correlation, indicating dependence between years, was examined with the Breusch-Godfrey test; and heteroskedasticity was tested using the Breusch-Pagan test. In instances where these assumptions were not met, we employed the variance-covariance matrix based on the Arellano method to address the issue.

The dataset corresponds to theoretical and empirical literature. The description of variables can be found in Table 2.

Table 2 Description of variables

Variable	Description	Source
EMP	Employment rate in each industry is measured as the ratio of the number of persons employed in the industry to the total number of persons employed.	EUKLMS & INTANprod
W	Average hourly wage in each industry is calculated by dividing the total labor compensation by the total hours worked in that industry	EUKLMS & INTANprod
Wii	Intermediate purchases	EUKLMS & INTANprod
OFF	See Section 2.	OECD TiVA
DO	See Section 2.	OECD TiVA
K	Capital stock	EUKLMS & INTANprod
Y	Gross output	EUKLMS & INTANprod

Source: own elaboration

4. Results and discussion

It is anticipated that offshoring will result in a reduction in the labor intensity of an industry, commonly referred to as the technology effect. Concurrently, there is an expectation that the level of output will increase due to productivity gains, which is known as the scale effect (Hijzen and Swaim, 2007). Table 3 presents an overview of the results of the panel data regression analysis conducted using the estimating equation (7).

Table 3 Panel regression estimations of model

Variable	Estimate	Standard Error	P-value
W	-0.269	0.103	0.009***
Wii	0.204	0.049	<0.001***
OFF	**0.041**	**0.008**	**<0.001*****
DO	-0.189	0.047	<0.001***
Y	0.104	0.049	0.036**
K	-0.209	0.067	0.002***
Fixed effects	YES	-	-
R-squared	0.271	-	-

Source: own elaboration
Note: : significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Breusch-Godfrey test – <0.001, Pesaran CD test – 0.0213, Breusch-Pagan test – 0.1512.

From the table above (Table 3) we can confirm that the wage coefficient is found to be negative and significant for employment share. The price of intermediates has a positive and significant relationship with employment. The employment share is decreasing in capital. One possible explanation for this phenomenon is that capital stock and employment often exhibit a negative relationship due to technological advancements and automation. When firms invest in capital, such as machinery or technology, it enables them to produce more output with fewer workers. Consequently, there may be a decrease in the demand for labor, which may result in potential job displacement or reduced hiring. Furthermore, as capital-intensive industries expand, they may absorb a smaller proportion of the workforce compared to labor-intensive sectors, thereby exacerbating the inverse relationship between capital stock and employment. The relationship between output and employment is positive and statistically significant.

The findings indicate that offshoring does not result in a reduction in employment shares. The evidence suggests that there is a statistically significant positive impact of offshoring on employment. Interestingly, there is a negative coefficient for domestic outsourcing. These findings are consistent with Hijzen and Swaim (2007). Consequently, the productivity gains resulting from offshoring are sufficiently large that the new jobs created entirely offset the jobs lost due to relocating specific stages of production.

5. Conclusion

While offshoring is not a recent phenomenon, its significance persists as it mirrors the global spread of production. Slovakia exemplifies this trend, reflecting a key aspect of globalization. Offshoring is frequently cited in the context of declining labor demand. Thus, our study aimed to explore the relationship between offshoring and labor market dynamics in Slovakia from 2008 to 2020.

In general, it can be stated that offshoring is increasing year by year. This is mainly due to the constantly increasing share of imported intermediate inputs. Slovakia is a country where the automotive industry is predominant and focuses on the production of final products, which requires a large number of imported intermediate inputs.

Based on the analysis, it can be concluded that offshoring has a positive effect on employment in Slovakia from a long-term point of view. Despite the common concerns that offshoring may lead to job losses, evidence points towards productivity gains and job creation that offset jobs lost due to the relocation of certain production stages.

These findings yield insights on both a macro and a micro level. On the one hand, the macro level refers to economic policy. On the other hand, the micro level relates to how firms employ this policy in their strategic planning and decision-making about future labor input needs. Moreover, the findings of our study can be applied as a case study for other countries undergoing a comparable transformation.

Therefore, conducting additional research on employment structure, considering the division of labor by educational attainment and professional groups, may be beneficial. Furthermore, it is crucial to analyze the effect of offshoring on labor demand at the firm level.

References

Berman, E., Bound, J., & Griliches, Z. (1994). Changes in the demand for skilled labor within U.S. manufacturing: Evidence from the annual survey of manufacturers. *Quarterly Journal of Economics*, *109*(2), 367–397. https://doi.org/10.2307/2118467

Bramucci, A., Cirillo, V., Evangelista, R., & Guarascio, D. (2017). Offshoring, industry heterogeneity and employment. *Structural change and economic dynamics*, *56*, 400-411. https://doi.org/10.1016/j.strueco.2017.09.002

Feenstra, R. C., & Hanson, G. H. (1996). Foreign investment outsourcing and relative wages. The political economy of trade policy: Papers in Honor of Jagdish Bhagwati, 89–127. https://doi.org/10.3386/w5121

Foster-McGregor, N., Stehrer, R., & De Vries, G. J. (2013). Offshoring and the skill structure of labour demand. Review of World Economics, 149, 631-662. https://doi.org/10.1007/s10290-013-0163-4

Grossman, G. M., & Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring. American Economic Review, 98(5), 1978-1997. https://doi.org/10.1257/aer.98.5.1978

Hijzen, A., & Swaim, P. (2007). Does offshoring reduce industry employment?. National Institute Economic Review, 201, 86-96. https://doi.org/10.1177/0027950107083053

Hijzen, A., Görg, H., & Hine, R.C. (2005). International outsourcing and the skillstructure of labour demand in the UK. The Economic Journal, 506(115), 860–878. https://doi.org/10.1111/j.1468-0297.2005.01022.x

Jansen, M., & Turrini, A. (2004). Job creation, job destruction, and the international division of labor. Review of International Economics, 12(3), 476-494. https://doi.org/10.1111/j.1467-9396.2004.00462.x

Miroudot, S., Lanz, R., & Ragoussis, A. (2009). Trade in Intermediate Goods and Services. OECD Trade Policy Working Papers. https://doi.org/10.1787/18166873

OECD. (2024). Glossary of Statistical Terms - Globalisation Definition. OECD. https://stats.oecd.org/glossary/detail.asp?ID=1121

Stehrer, R., & Stöllinger, R. (2015). The Central European Manufacturin Core: What is Driving Regional Production Sharing? FIW-Research Reports. https://ideas.repec.org/p/wsr/ecbook/2015ivi-002.html

Yang, Y., & Mallick, S. (2014). Explaining cross-country differences in exporting performance: The role of country-level macroeconomic environment. International Business Review, 23(1), 246–259. https://doi.org/10.1016/j.ibusrev.2013.04.004

Appendix 1

Table 3 Industry Classification by NACE Rev. 2

NACE Rev. 2 code	Industry name
A	Agriculture, forestry and fishing
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration and defense; compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities
TOT	Total - all NACE activities

Source: own elaboration

PRICE DETERMINATION FOR UNIQUE PRODUCTS: CAN THE STANDARD MICROECONOMIC APPROACH TO MONOPOLIES OFFER A SOLUTION?

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ABSTRACT

Purpose:
The purpose of this article is to investigate the challenges and strategies involved in determining prices for unique products. It states that step-like supply and demand functions have to be applied in order to describe the market. By examining the concepts of market failure, respectively monopolies for unique items, the article aims to shed light on the complexities of pricing in markets where production cost do not exist anymore. The article seeks to provide insights into the pricing dynamics of one-of-a-kind products in a monopolistic market environment and tries to find an answer if a classical microeconomic approach is insufficient and unsatisfying for price discovery.
Design/methodology:
This research employs a desk-based methodology, conducting a comprehensive systematic collection and analysis of existing data, information, and literature available from various sources without conducting primary research activities. The chosen approach involves a meticulous examination of existing literature, entailing a thorough search for pertinent information and academic sources. By analyzing and comparing the underlying material new conclusions are derived graphically and mathematically.
Findings:
The findings of the paper suggest that pricing unique products, such as Old Master paintings, presents challenges that deviate from traditional neoclassical economic models. The analysis indicates that the standard microeconomic approach to pricing, based on supply and demand equilibrium, may not directly apply to markets with indivisible and heterogeneous goods.
Research/practical implications:
Overall, the implications of the research findings underscore the importance of adopting a multidisciplinary approach to pricing unique products, taking into account economic theories, market dynamics, and behavioral insights to enhance decision-making and competitiveness in specialized markets. Stakeholders can benefit from understanding market behavior, managing risks, and exploring future research directions in pricing one-of-a-kind items.
Originality/value:
The originality and value of the paper lie in its exploration of pricing mechanisms for unique products within the context of market failure and monopolistic principles. The analysis of

divergent views on art market pricing and the consideration of alternative theories contribute to a deeper understanding of pricing dynamics for one-of-a-kind items. This unique approach provides valuable insights for stakeholders in the art industry and opens up new avenues for future research at the intersection of economics and behavioral science.

Keywords: unique products, pricing strategies, monopoly

JEL Classification: D43, D52

1. Introduction

When analysing a market for unique products, for example in the field of arts the market for Old Master paintings, one primarily encounters two major hurdles: firstly, the heterogeneity of the works, and secondly, their uneven trading, i.e. their purchase and sale (Mei & Moses, 2002, p. 1656). The question therefore arises as to how prices are set on such a market with one supplier and only one good on offer in each case. As the common neoclassical model for price formation assumes homogeneity of the traded goods (among other things) as well as many buyers and suppliers one might see the deficiencies of such an approach.

The puzzle of the formation of a price on a market for unique items is therefore rooted in the difficulty of applying the neoclassical theory of pricing for goods and services. This states that the price of a good or service is determined by the relationship between supply and demand. If the demand for a good is high while the supply is limited, the price will rise as buyers are willing to pay more to obtain the good. If the supply of a good is high while demand is limited, the price will fall as sellers are forced to lower the price to get rid of the good. The price formed in the market is called the equilibrium price. It is determined by the intersection of supply and demand (see figure 1).[4]

If the price is higher than the equilibrium price, i.e. there is excess supply on the market, the price will fall until supply and demand balance out again, i.e. the equilibrium level is reached again. If the price is lower than the equilibrium price, i.e. there is excess demand, the price will rise until the price has reached the equilibrium level again. It is assumed that buyers and sellers act rationally and know all available information, which means that the market

[4] Companies maximise their profit, which results, among other things, in the supply curves for goods; households maximise their utility, which results, among other things, in the demand curves for consumer goods.

functions perfectly and leads to efficient prices (Mankiw & Taylor, 2008, pp. 71ff.; Pindyck & Rubinfeld, 2009, pp. 50ff.). These relationships are shown in the following diagram (see figure 1).

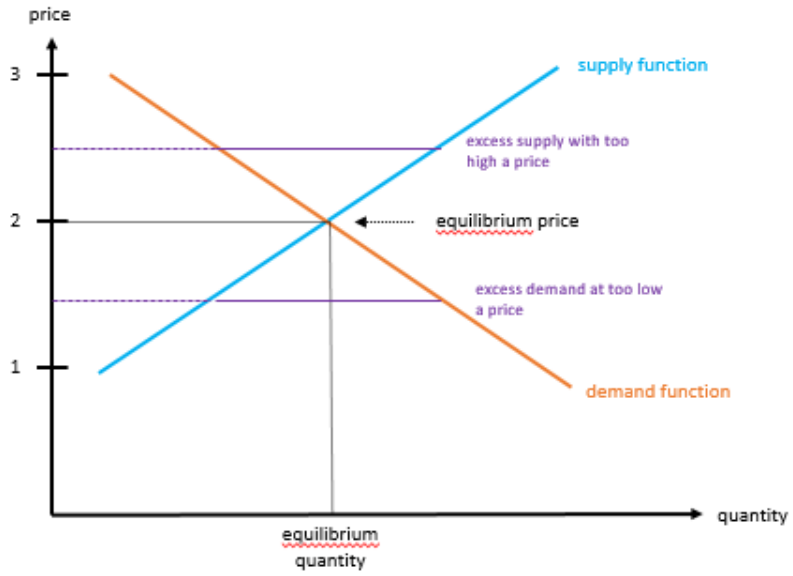

Figure 1: Pricing according to the neoclassical model
Source: own illustration adapted from Mankiw & Taylor (2008): pp. 88ff.

This mechanism was described as early as 1776 by Adam Smith using the metaphor of the "invisible hand" of the market: The invisible hand works through the price mechanism, which reflects the relative scarcity of goods and services and the willingness of buyers to pay (Smith, 2012). A functioning market therefore always leads to a balance between supply and demand and an equilibrium price at which the allocation of resources is optimal.

If we now consider a market for unique goods, as for example Old Masters paintings, with absolutely heterogeneous goods, the question arises as to whether this theory can be applied. There are undoubtedly multiple buyers who want to purchase a painting. Their willingness to pay and thus their demand must correspond to their individual benefit for the good. However, due to the nature of the traded good, the quantity demanded can only be one. On the supply side, the picture is completely different. Since only one supplier offers a single good for sale, this results in an absolutely inelastic supply function. In order to define these circumstances in more detail, the following chapter will first describe price sales functions.

2. Literature review/theoretical background

The basis for pricing in a perfect market is the price-sales function, which describes the relationship between price and demand for a product. In the simplest case, the independent variable *p stands* for the price and the variable *q*, which is dependent on *p*, stands for the sales volume: q = f(p) (Kaas, 2013, p. 2). In principle, the price-sales function for homogeneous goods has a decreasing curve, as it is assumed that lower prices initiate higher sales volumes:

$$q(p) = a - b * p \quad (2.1)$$

a denotes the demand at a price p = 0 (also called saturation quantity)

b denotes the slope of the price-sales function (reaction of sales to the price change)

The price-sales function of a market results from the aggregation of individual price-sales functions (see figure 2), whereby the latter only take into account a single buyer and its reaction to different prices. Aggregated price-sales functions, on the other hand, consider an entire group of buyers (Simon & Fassnacht, 2009, pp. 92ff.). Aggregation is performed vertically: if the quantities demanded by the individual price sales functions are added to each price, the aggregated price sales function is obtained (Mankiw & Taylor, 2008, pp. 76ff.).

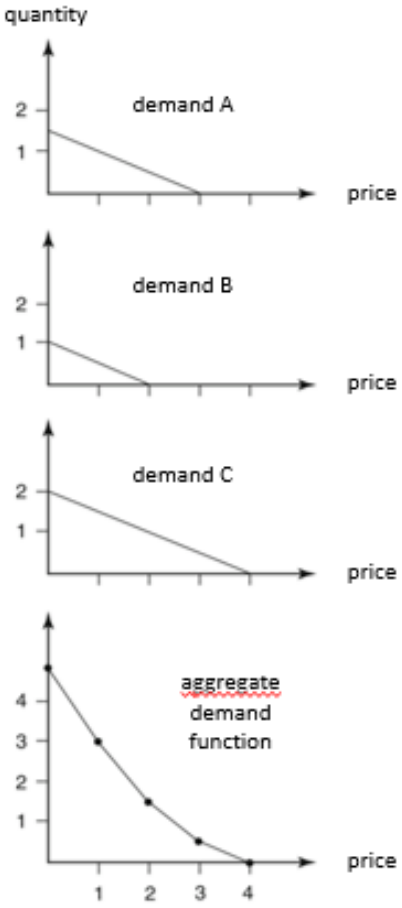

Figure 2: From the individual to the aggregated price-sales function in the variable-quantity case
Source: adapted from Simon & Fassnacht (2009): p. 94.

The case shown in figure 2 is also known as the *variable-quantity case.* It shows how the number of individually demanded quantities of a consumer good, such as ice cream, varies when the price changes (Roth, 2006, p. 16). Low prices result in high demand, while high prices result in little to no demand. In the variable-quantity case, customer A would demand 1.5 units if the price p = 0. At a price of p = 1, he would demand 1 unit. His demand is 0 units when the price reaches p = 3. Customer B would generate a demand of 1 unit at a price of p = 0 and steadily reduce his demand until the price reaches p = 2. At this point, he no longer has any demand and leaves the market. In the example, customer C would have the highest demand with 2 units at a price of p = 0. Only at a price of p = 4 would his willingness to buy fall to 0 units. In all three cases, the (here) linearly decreasing price sales functions can be recognised. The aggregated function is obtained by adding the three individual functions of buyers A, B

and C vertically. The figure shows that the aggregation of linear individual price-sales functions results in a non-linear PAF for the entire market.

In addition to the *variable-quantity case*, a distinction is also made between the *yes-no case*, which shows whether the buyer would buy the good in question at a given price or not. This applies to goods for which it only makes sense to purchase one unit. The additional benefit of another consumed unit of the same good would be zero, as is the case with a refrigerator, for example. It makes no sense to buy another good if the increase in utility (= marginal utility) is zero. Figure 3 shows such a market.

Demander A would purchase the good in a price range p = [0; 4], i.e. he would buy a unit up to a price of p = 4. Demander B, on the other hand, would only buy up to a price of p = 3 and demander C would only go up to p = 2 to obtain the good. These three individual demand functions are vertically added to produce the aggregated price sales function in the *yes-no case* (see Figure 3).

In the example, three units are demanded up to a price of p = 2, as all three demanders A, B and C are willing to pay this price. At a price of p = 3, two more units are demanded, namely by individuals A and B. Demander C has already left the market due to his lower willingness to pay ($p^{C}_{max} = 2$). At a market price of p = 4, only demander A would remain in the market, as individual B is also no longer participating in the market due to his maximum willingness to pay $p^{B}_{max} = 3$.

In the following, we will now discuss which of the price-sales functions described applies to a market for unique products and how a market equilibrium is or can be achieved in this particular case.

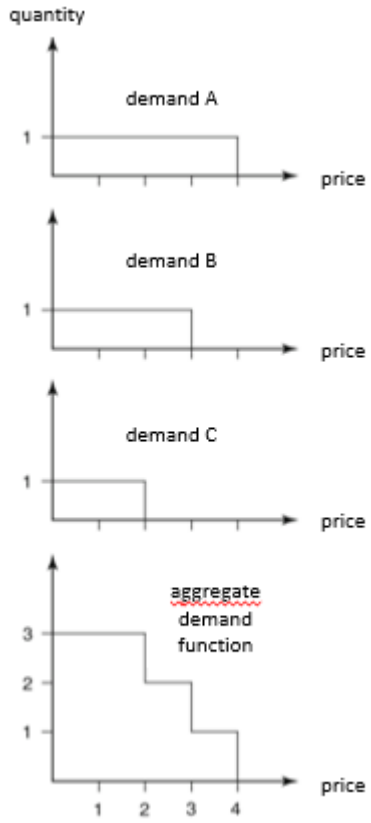

Figure 3: From the individual to the aggregated price sales function in the yes-no case
Source: adapted from Simon & Fassnacht (2009): p. 94.

3. Methods

In the market to be analysed, unique items are offered. A potential buyer can therefore only demand one unit of the good. Even if a buyer would derive positive marginal utility from further units of the absolutely identical item, this case must be ruled out due to the impossibility of fulfilment. A consideration of the price-sales function as in the *variable-quantity case* shown is therefore ruled out. Consequently, the *yes-no case* shown must be used to illustrate the relationship between price and demand for unique items (see figure 3).

In a model of a market, as already shown, a supply function must be set up in addition to the demand function. As only one good is offered by a supplier, he will only agree to a sale at a certain price. This must correspond to his minimum asking price. This means that the quantity offered will be zero up to a minimum price of p_{min} and will immediately increase to a maximum

of q = 1 once this limit is reached. [5] In other words, the seller will only agree to sell his good once his (minimum) asking price has been reached. If this is not reached, there will be no binding sale. Since the offered good cannot be divided, the supply function must therefore be discrete and have a step-like progression: until the minimum price is reached, the quantity offered is q = 0. Once this price threshold is reached, the supply must increase abruptly to q = 1 (see figure 4).

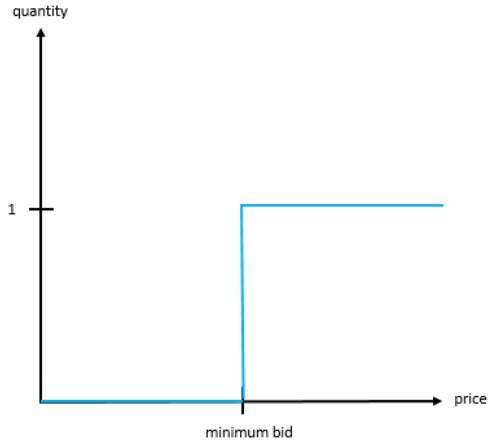

Figure 4: Supply function for unique items
Source: own elaboration

If we combine the demand and supply s for unique items (as derived above, we can distinguish three possible options for their intersections:

a. There is no intersection of the supply and demand function.
b. The intersection of the supply and demand function lies at the willingness to pay of exactly one demander.
c. The intersection of the supply and demand function lies at the price willingness of several buyers

In the first case, the demand and supply functions do not intersect (see Figure 5). This means that the willingness to pay of each individual buyer is below the minimum asking price of the seller. The lack of an intersection of the two functions means that there is no price formation on the market. In this case, one can speak of market failure. It must therefore be assumed that

[5] In the following, it is always assumed that the unique item will be offered at auction.

the minimum asking price of the supplier has been "calculated" incorrectly, as it has not even reached the maximum willingness to pay of the potential buyer with the highest benefit for the good.

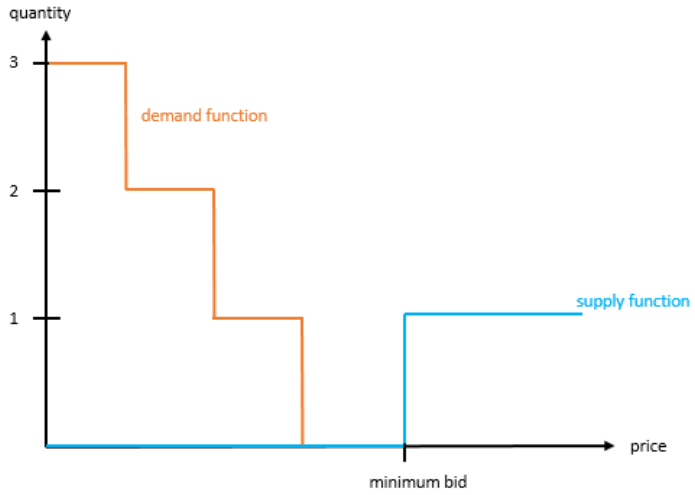

Figure 5: No intersection between demand and supply function
Source: own elaboration

If the supply and demand functions have exactly one intersection, as illustrated in figure 6, only one buyer has a maximum willingness to pay that is at least equal to the supplier's lower price limit. This results in a market price at the minimum bid. Even if the willingness to pay of the only remaining buyer is higher than the supplier's minimum asking price, the auction procedure used here (English auction) means that only the minimum price is reached.

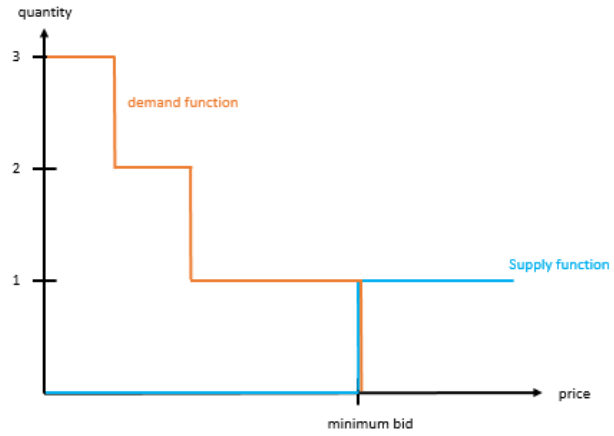

Figure 6: exactly one intersection between demand and supply function
Source: own illustration

In the third case, several buyers are willing to pay the minimum bid (see figure 7). In the example, there are exactly two potential buyers who are willing to buy at the seller's minimum asking price. A transaction, and consequently a market equilibrium, only occurs when the buyers gradually increase their willingness to pay until the price is reached at which only one bidder remains.

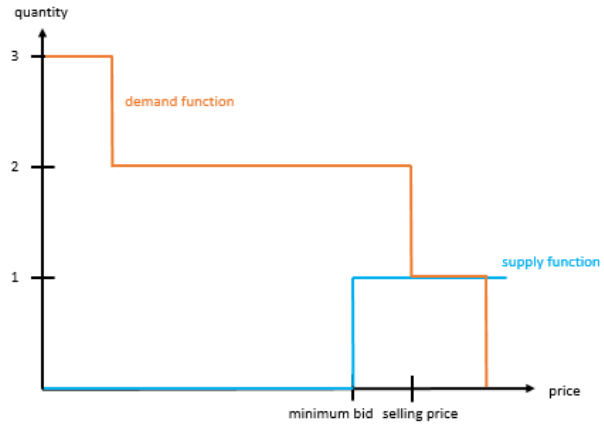

Figure 7: Several buyers show a willingness to pay the minimum bid
Source: own illustration

4. Results and discussion

Looking at the three cases presented, the question arises as to how the supplier forms his minimum price concept. In principle, it is assumed that the supplier of the unique product is a utility maximiser and that his utility is expressed in monetary units. Consequently, he wants to achieve the highest possible selling price.

The supplier's minimum price must now be chosen in such a way that market failure is avoided (see figure 5). It should also be set in such a way that at least one buyer is willing to pay the minimum bid and a transaction takes place as a result (see figure 6). Figure 7, in which several sellers are willing to pay the minimum bid, may appear optimal as the good is certain to be sold. In this case the process of price finding would best be done by an auction (in the case of art the so called English auction is usually applied). All buyers must be aware of their maximum willingness to pay for the goods on offer in order to make bids in an auction. The assumption here is that the potential buyers don’t change their valuation of the good even if they know the valuation of the other bidders - which is known as the *independent private values*

model (Steinberg, 2012, pp. 681f.). Accordingly, the question ultimately arises as to what a unique item is worth. This is expressed, on the one hand, in the seller's asking price in the form of the minimum bid and, on the other hand, in the maximum price the interested parties are willing to pay for the good. The value of a good at a given time t is therefore expressed as the maximum willingness to pay among the pool of buyers at that time, provided that the minimum bid has been reached at time t.

The question arises if such a market with only one supplier can be approached from a monopolistic perspective of price setting. In principle, a monopoly can be described as a market without competition. It is therefore a situation in which a specific person or a specific company is the only supplier of something. Breyer (2005, p. 88) states that due to the circumstances of the monopoly, an independent price or quantity policy can be pursued by the sole supplier. Since in the case of the unique items only one good is offered at a time (quantity q = 1), the quantity policy for maximising the monopolist's utility is therefore ruled out and only the price policy can be considered for him.

If the supplier assumes profit maximisation, i.e. he wants to skim off the greatest possible willingness to pay on the buyer's side, he must fall back on a price sales function and set his optimal price at the Cournot point. The following applies at the Cournot point: marginal revenue = marginal costs (Breyer, 2005, pp. 89f.).

$$E' = K' \tag{4.1.}$$

However, since a supplier of a unique item that isn’t produced any more (as it is the case with Old Master paintings or vintage cars) has no production costs and the products are unique, the marginal costs of production must be zero.

$$K' = 0 \tag{4.2.}$$

Figini and Onofri (2005, p. 381) express this fact by saying that production costs do not constitute a natural value underlying a painting.

We assume a linearly decreasing price sales function.

$$p = a - b * q \tag{4.3.}$$

The monopolist's revenue is calculated by multiplying the price-sales function by the quantity q.

$$E = p * q \tag{4.4.}$$

Since the quantity offered for unique items must always be 1 (q = 1), the seller's revenue from a unique item is the buyer's willingness to pay.

$$E = p \text{ (or also: } E = p * q^0) \quad (4.5.)$$

Since the derivative with respect to q is zero, the marginal revenue must be zero.

$$E' = 0 \quad (4.6.)$$

It can therefore be concluded that marginal revenue and marginal profit are zero in the monopolistic case of unique products. An intersection of the two lines (E' and K') cannot be seen as they are equally 0. The determination of a Cournot point that sets the optimal quantity and optimal price to maximise the monopolist's profit isn't given. Analysing the market from a neoclassical monopolistic point of view must therefore be ruled out.[6] A profit optimisation of the monopolist from the conventional calculation of the Cournot point can therefore not be derived in the case of heterogeneous goods.

5. Conclusion

To conclude, it can be said that the pricing of unique goods, just like works of art by Old Masters, cannot be analysed according to the familiar approaches in microeconomics. More precisely, due to the fact that they are unique - Baumol (1985, pp. 51f.) states that even two works on the same subject by the same artist are only imperfect substitutes - there are no equilibrium prices and no (conventional) demand and supply curves. Even if it is stated that the owner has a kind of monopoly on this good (Baumol, 1985, pp. 51f.; Frey & Pommerehne, 1989, pp. 122), the seller is not a monopolist in the classical sense. The question of how prices are set on the market for unique items like Old Masters paintings therefore remains open. Accordingly, other theories for pricing on this market must be used. Because even if an international market like the one for art is not perfect, it seems to function at least as well as many other markets (Frey & Pommerehne, 1989, p. 123).

Shedding light on the question of how prices are formed on markets that trade unique goods remains open. It seems reasonable to include alternative variables like macroeconomic indicators into a deeper analysis that might add to clear up the price formation on markets for

[6] The situation would be different for limited edition prints of artworks if these were in the hands of a single supplier.

unique goods. These indicators could provide crucial information for understanding price dynamics in the art market, particularly for high-value items like Old Master paintings. To start with GDP growth could be such an indicator. A strong economy (expressed in GDP growth) often correlates with increased demand for luxury goods (DFML, 2024), including fine art. In periods of robust GDP growth, one might expect upward pressure on art prices. Above that, the Consumer Price Index (CPI), as a measure of inflation, can indicate overall price trends in the economy. As collectors typically list inflation among the main motivations for buying art, prices of Old Masters might correlate with CPI (McAndrews, 2022, p. 192). Moreover, exchange rates can significantly impact international art sales. A weaker domestic currency might attract foreign buyers, potentially driving up prices. In addition to that global money supply and its effect on prices for art can be considered. A recent study has shown that e.g. Bitcoin, though not an object of art but also seen as an alternative investment asset, moves in the direction of global liquidity 83% of the time in any given 12-month period (Callahan, 2024). Last but not least there are interest rates to be mentioned. Low interest rates may encourage investment in alternative assets like art, potentially increasing demand and prices (McAndrews, 2022, p. 192).

Next to macroeconomic indicators it is behavioral economics that might significantly contribute to explaining price formation in markets for unique goods by accounting for several psychological factors that influence buyer and seller behaviour. By incorporating behavioral economic principles like anchoring, loss aversion, snob-effect, herding-effect and others (Beck, 2014, pp. 145ff.), one can better understand the complex and sometimes seemingly irrational price formation in such markets, which often deviates from traditional economic models of supply and demand.

To sum up, future research integrating these multifaceted approaches may provide a more nuanced and accurate model for understanding the intricate dynamics of price formation in markets for unique and highly valued goods such as Old Master paintings.

References

Baumol, W. J. (1985). Unnatural Value: Or Art Investment as Floating Crap Game. *Journal of Arts Management and Law, 15:3, pp. 47-60.*

Beck, H. (2014). Behavioral Economics. Eine Einführung. Springer Gabler, Wiesbaden.

Breyer, F. (2005). Mikroökonomik: Eine Einführung. 2. Auflage. Springer, Berlin.

Callahan, S. (2024). Bitcoin: A Global Liquidity Barometer. Online (2024, Nov, 28th): https://www.lynalden.com/bitcoin-a-global-liquidity-barometer/

DFML (2024). Luxury Consumption Grows Twice as Fast as GDP. Dominion Fund Management Ltd. Online (2024, Nov, 28th): https://dominion-funds.com/insights/2021/04/luxury-consumption-grows-twice-as-fast-as-gdp/

Figini, P. & Onofri, L. (2005). Old Master paintings: price formation and public policy implications. *Marciano, A. & Josselin, J.-M. (Hrsg.). In: Law and the State, chapter 14: pp. 381-398.*

Frey, B. S. & Pommerehne, W. W. (1989). Muses and Markets: Explorations in the Economics of the Arts. Blackwell Publishers.

Kaas, K. P. (2013). Empirische Preisabsatzfunktionen bei Konsumgütern. Springer, Berlin.

Mankiw, G. & Taylor, P. (2008). Grundzüge der Volkswirtschaftslehre. 4. Auflage. Schäffer-Poesel, Stuttgart.

McAndrews, C. (2022). The Art Basel and UBS Global Art Market Report 2022. Art Basel and UBS.

Mei, J. & Moses, M. (2002). Art as an Investment and the Underperformance of Masterpieces. *American Economic Review, 92 (5): pp. 1656-1668.*

Pindyck, R. & Rubinfeld, D. (2009). Mikroökonomie. 7. Auflage. Pearson, München.

Roth, S. (2006). Preismanagement für Leistungsbündel. Deutscher Universitätsverlag.

Simon, H. & Fassnacht, M. (2009). Preismanagement: Strategie – Analyse – Entscheidung – Umsetzung. 3. Auflage. Gabler, Wiesbaden.

Smith, A. (2012). Wealth of Nations. Ware, England: Wordsworth Editions. 17th ed.

Steinberg, R. (2012). Auction pricing. *Özer, Ö and Phillips, R.: The Oxford Handbook of Pricing Management. P. 679-712. (online edn., Oxford Academic, Nov. 21st, 2012. https://academic.oup.com/edited-volume/28115).*

CHANGE IN THE CENTER OF GRAVITY BY THE POPULATION AND INCOME IN THE EU

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ABSTRACT

Purpose:
The aim of the paper is to examine the changes in specific income and population center of gravity in the NUTS3 (county level) regions of the European Union over the last 15 years, particularly in the light of the impact of the various crises (economic and financial crisis, pandemic). This may also shed light on how far the spatial center of gravity of population and income are from each other, and whether different types of crises have led to convergence or divergence.
Design/methodology:
In my analysis, I use the method of spatial potential calculation to determine the center of gravity, and then plot their location and temporal changes using a geographic application. In addition, I investigate the degree of inequality using the Hoover index, which can be calculated as the correlation of the two indicators. This provides an opportunity to gain a deeper understanding of the differences revealed by the center-of-gravity analysis.
Findings:
For Europe as a whole, 22.31% of income would have to be transferred between NUTS3 regions in 2005 to achieve a distribution equal to the population share of the regions, while by 2020 the same value has slightly decreased. The results also show year-to-year variations, i.e. from the first wave of the economic and financial crisis to the end of the second wave, the Hoover index showed an increase in inequalities between regions, and this was also true to a small extent for the first year of COVID. However, different types of crises shifted both centers of gravity significantly, with different directions.
Research/practical implications:
With the results of this study, broader knowledge about spatial potential calculation. It can be used for detecting the intervention points of spatial development decisions. By tracking changes in the spatial potential, better forecast can be made in case of a new shock situation.
Originality/value:
One of the main added values of the study is that it highlights the differences in the spatial center of gravity of different types of indicators, and that shocks of different nature affect the trends and expected changes of some indicators to different degrees. It also shows that an economic shock can cause a shift of 30-40 kilometers in the spatial center of gravity over a period of up to one year.

Keywords: spatial inequalities, center of gravity, external shocks, Hoover index.

JEL Classification: R12, O18.

1. Introduction

The analysis of territorial inequalities is not a recent phenomenon; several researchers have already investigated the positive convergence prospects and catching-up potential of peripheral regions (e.g., the convergence process of nation states in Barro & Sala-i-Martin, 1992; Sala-i-Martin, 1995; Quah, 1996). Convergence between regions in the European Union has been the subject of study for a long time, as there are significant differences in income and living standards within countries and regions. In order to address this, the EU has set up a number of support programmes and is continuously measuring trends in territorial disparities (e.g. in the latest, 8th Cohesion Report). Although based on the different measurement indicators, there can be various viewpoints and results.

However, the development of economies (countries/regions) and the extent of territorial disparities are affected by trends that fundamentally reshape the already existing patterns of differences and usually are manifested e.g. in the form of crises (economic, financial, health, natural, etc.). Crises, like other external shocks, generally have a major impact on the development of countries and regions and sometimes also alter their development paths, and depending on their relative geographical position, the resilience of regions to crises and their growth potential may vary. The classical gravitational potential models show the magnitude of potential at given spatial points, which are affected by external shocks (Kincses & Tóth, 2013). Quah (2011) has stated in his work that the global centre of gravity is shifting to the East, towards BRIC countries from the Arab Gulf area until 2049. These gravity analysis can have a contribution to better understanding the changing income distribution across economies and predict the possible future tendencies (Quah, 2011).

The aim of the paper is to examine the changes in specific income and population centre of gravity in the NUTS3 (county level) regions of the European Union over the last 15 years, particularly in the light of the impact of the various crises (economic and financial crisis, pandemic situation). This may also shed light on how far the spatial centre of gravity of

population and income are from each other, and whether different types of crises have led to convergence or divergence process in the European Union.

2. Theoretical background

Territorial disparities are a critical issue in the EU. With the enlargement of the Union, disparities in economic and social indicators have increased at both national and regional level, in particular the changes in specific income reflect this which have occurred basically with the enlargement to the South and East (Neef & Sodano, 2022). The European Union's Structural Funds provide resources for the convergence of territorial units and monitor the convergence process in various reports. The EU's 8th Cohesion Report (2022), which focuses on the long-term evolution of regional disparities, highlights two major trends. The Eastern European region has shown a steady convergence with the rest of the EU since 2001, leading to a significant narrowing of the gap in GDP per capita in Europe. Their high economic growth is explained by their economic restructuring and the shift of production to higher value-added sectors. The other trend highlighted in the report is that of the southern regions, which have experienced economic stagnation or decline, leading to a development trap and lower growth than expected (European Commission, 2022).

Sometimes the distribution of different indicators shows significantly different results when assessing patterns in developed and underdeveloped areas (for example: concentration of population or economic activities). Gross value added is a key indicator of economic activity and performance, with significant differences in its distribution. There are huge disparities in GVA/capita among the NUTS3 areas of Europe. In some countries there are widening gaps among the top 1% income, although Europe is one of the least unequal region globally (World Inequality Database, 2023).

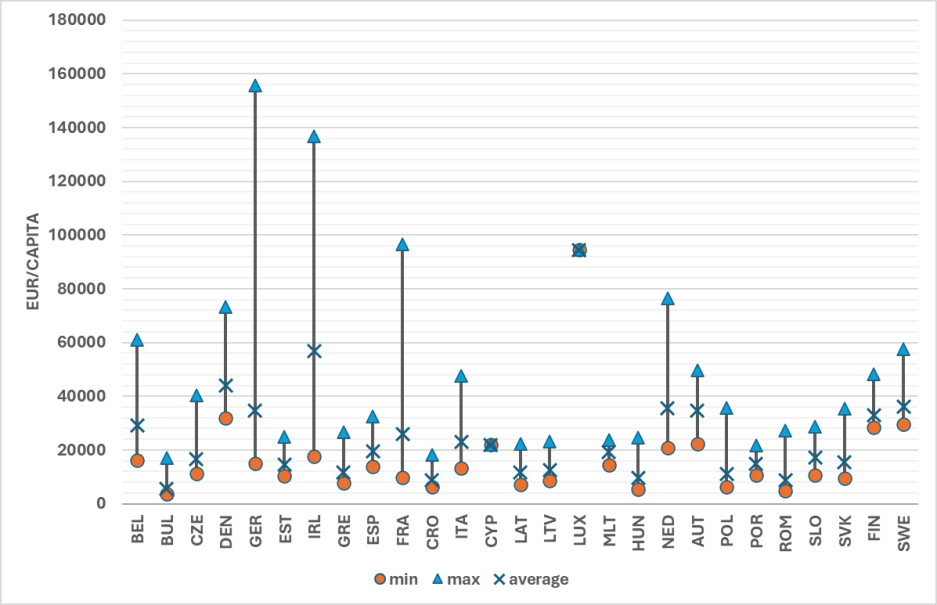

Figure 1. Differences in GVA/capita in Europe
Source: own compilation based on Eurostat data

Figure 1 shows that there are significant differences in gross value added between the best and worst performing regions in each country, but the extent of these differences varies across countries. The largest gaps can be found in Germany, Ireland, France, and the Netherlands, with differences of 9.6, 7.3, 8.7 and 3.9 times respectively. The smallest differences, excluding island countries and territories with 1 or 2 regions, are found in Croatia and Portugal (3.2- and 2.1-times differences respectively).

3. Data and methodology

In this current analysis, I have checked the gross value added and population distribution of the NUTS3 territories of the European Union, without island states (the area covered was continental Europe with a ∑1155 regions). By the selection of indicators, I have relied on, as mentioned above, two dimensions, the specific income, measured by GVA per capita and the population of the counties. The data sources were the Eurostat database to ensure comparability and repeatability of the analysis.

Through the examination, my aim was to present, whether the changes in specific income and population centre of gravity in the NUTS3 (county level) regions of the European Union over the last 15 years are following similar development paths, with special focus on the impact

of the various crises (economic and financial crisis, pandemic). First, I have used the spatial potential calculation methods to determine the centres of gravity and plot their location and temporal changes in the last 15 years.

By the calculation of the gravity points, we are using the spatial coordinates of the given geographical units and are assigning weights to them based on an indicator (GVA, population share, etc.). The weighted average of the coordinates of the points gives the spatial potential value of the area for that indicator. The equation used is as follows:

$$x = \frac{\sum_{i=1}^{n} x_i}{n} \text{ and } y = \frac{\sum_{i=1}^{n} y_i}{n} \quad (1)$$

where x and y are the two coordinates of the centre of gravity, while x_i and y_i are the coordinates of the base points, and f_i is the weight of the base points (Nemes Nagy, 1998; Tóth, 2013).

The other methodology used in the article was the Hoover index for computing the degrees of inequality. The index indicates "what percentage of the quantity of one socio-economic phenomenon/indicator needs to be reallocated in order to obtain a spatial distribution equal to the other indicator" (Molnár, 2017).

The values close to 0 imply a homogeneous distribution, i.e. the distribution of indicators is the same across territorial units, while values close to 100 indicate a completely different distribution (Nemes Nagy, 2005). The index can be computed with the below equation:

$$H = \frac{1}{2}\sum_{i=1}^{n}|x_i - f_i| \quad (2)$$

where: $\sum f_i = 100\%$ and $\sum x_i = 100\%$. A significant advantage of using the Hoover index is that it is less sensitive to the distorting effect of outliers, since outlier values distort the results of the analysis to a much lesser extent than standard deviation measures (Nemes Nagy, 2005). It is important, as e.g. there are some rarely populated areas in Northern Europe (Finland or Sweden), or areas with very high GVA/capita (some capital regions or major agglomerations), which could have a distorting effect on the results.

4. Results

In my analysis, the first step was to check, how closely the distribution of gross value added follows the distribution of population in the geographical areas, i.e. how homogeneous the dispersion of the two indicators is. As mentioned in the methodological chapter, I have made Hoover index measurement for the 1155 regions studied.

Table 1 Results of the Hoover index

	value		**value**
2005	22.31	2013	21.50
2006	21.87	2014	21.48
2007	21.28	2015	21.45
2008	20.61	2016	21.50
2009	20.81	2017	21.14
2010	21.08	2018	20.90
2011	21.29	2019	20.62
2012	21.37	2020	20.95
change 2005/2020		**decrease**	

Source: own calculations

Based on the results of the Hoover index, in 2005, 22.31% of gross value added would have had to be reallocated between NUTS3 areas to bring the distribution of value added in line with the population share of them. Until 2020 it happened a slight decrease in the value to 20.95%, which indicates convergence among the European counties, and a closing gap. A possible limitation of the measurement can be that it does not show which regions have improved their performance in terms of inequality, or whether there has been a positive or negative catching-up. After all, regional disparities can also decrease in the case of negative convergence, i.e. when the indicators of more advanced regions approach those of lagging regions (Szendi, 2016).

By analysing the temporal change of the index, we can see, that from the first wave of the economic and financial crisis to the end of the second wave (2009-2013), the Hoover index showed an increase in the inequalities among the areas, and this was also true to a small extent for the first year of COVID19. This may be because previously underdeveloped regions have been able to recover their pre-crisis development trajectories more slowly than previously more

developed regions, even though the 2008-09 economic and financial crisis affected centres (e.g. capital regions) in some regions of Europe much more severely than peripheral regions (see Central - Eastern Europe: Szendi, 2013).

I then outlined the population and gross value-added centre of gravity for continental Europe and looked at their distance from each other. In both cases, I have examined the change in the centre of gravity on an annual basis and indicated the changes that occur with a line (Figure 2). Both centres of gravity can be found in Germany, but while for value added the centre of gravity is concentrated in the Land of Baden Württemberg, for population it is in Bavaria. The spatial centre of continental Europe is different from that of the GVA and population, being located somewhere in the broader region of Prague.

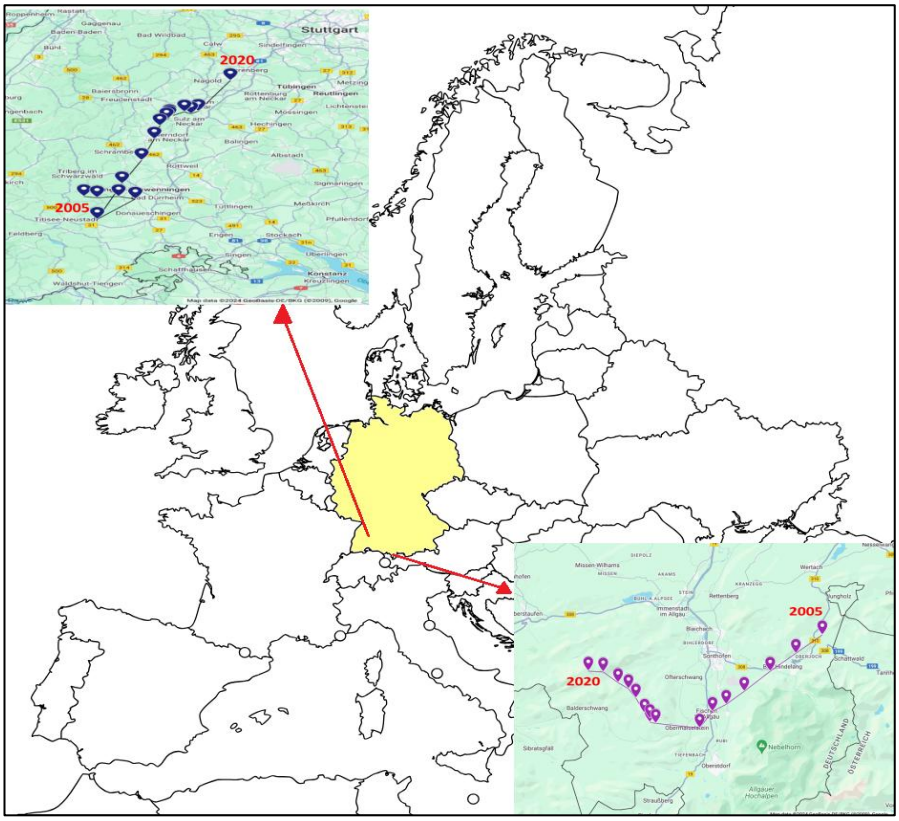

Figure 2. Centres of gravity in the continental Europe (population-right; GVA-left)
Source: own calculation based on Google maps

As the maps above show, there is less shift or dispersion in the population for each year, as the distance between the starting and the end point is 24.6 km as the crow flies, while the same value for value added is 68.7 km. The spatial changes and the trend in the shift of the centre of

gravity in each period confirm the main finding of the Hoover index, which was that there is a reduction in inequality overall. At the same time, the shift in centres of gravity also shows that different types of crises affect the spatial location of the gravity points differently, and that value-added indicators are more sensitive to changes in the impact of crises than changes in population. The 1st wave of the economic and financial crisis shifted the spatial centre of gravity of GVA more significantly in a southwest direction, changing its position by 13.3 km, while the 2nd wave did not change the position in its trend, but the 1st wave of the Covid caused a significant northeastward shift (18.5 km) in the gravity point.

In addition to the graphical test, I reviewed the spatial difference between the points of the two centres of gravity in each year, the results of which are summarised in the table below.

Table 2 Distance in the centres of gravity in km (2005-2020)

	Distance (km)		**Distance (km)**
2005	**171**	2013	158
2006	165	2014	157
2007	158	2015	156
2008	152	2016	155
2009	157	2017	155
2010	156	2018	152
2011	157	2019	148
2012	156	**2020**	**145**

Source: own calculation

The above also shows that the initial disparity of around 170km has been reduced to around 145km by 2020, which also implies a reduction in the degree of inequalities.

5. Conclusion

In this recent research I have checked the convergence tendencies of the European NUTS3 areas regarding their economic performance and population structure. The analysis was based on the Hoover index and both centre of gravity calculation. I found in the analysis that both the centre of gravity of gross value added and population is in southern Germany, separated by less than 200 km in space (by GVA in the state of Baden-Württemberg, while the population in Bavaria). Both the inequality indices and the spatial tests suggest convergence processes in the

specific changes of value added, which have been significantly affected by certain crisis situations.

Different types of crises (economic and financial of 2008-09, or the pandemics) shifted both centres of gravity significantly, with different directions. The changes were more severely in the case of the specific GVA, the population is not so sensitive for these shocks. The practical usefulness of this analysis can be the detection of the intervention points of spatial development decisions and better forecasts can be made in case of a new shock situation.

Also, an important statement that shocks of different nature affect the trends and expected changes of some indicators to different degrees. E.g. an economic crisis situation can result in a shift of 30-40 kilometres in the spatial centre of gravity over a period of up to one year, which indicates the need for deeper monitoring the spatial distribution of economic indicators.

References

Barro, R. J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy*, 100(2), 223- 251. http://dx.doi.org/10.1086/261816

European Commission (2022). *Cohesion in Europe towards 2050. Eighth report on economic, social and territorial cohesion*. Publications Office of the European Union, Luxembourg.

Kincses, Á., & Tóth, G. (2013). Investigation of spatial structure: modelling approach. *Regional Statistics*, 2013(3), 41–56. http://dx.doi.org/10.15196/RS03103

Molnár, T. (2017). *Empirikus területi kutatások és módszerek*. [Empirical spatial research and methods], Akadémiai Kiadó. https://doi.org/10.1556/9789634540229

Neef, T., & Sodano, A. (2022). *Inequality Trends in Europe*. World Inequality Lab-Issue Brief 2022/04.

Nemes Nagy, J. (1998). A tér a társadalomkutatásban (Bevezetés a regionális tudományba). [Space in Social Research (Introduction to Regional Science)], Hilscher Rezső Szociálpolitikai Egyesület, Budapest, 261.

Nemes Nagy, J. (2005). Regionális elemzési módszerek. [Methods of regional analysis.], Regionális tudományi tanulmányok 11., ELTE Regionális Földrajzi Tanszék, MTA-ELTE Regionális Tudományi Kutatócsoport, Budapest, 313.

Quah, D. T. (1996). Empirics for economic growth and convergence. *European Economic Review*, 40, 1353-1375. http://dx.doi.org/10.1016/0014-2921(95)00051-8

Quah, D. T. (2011). The Global Economy's Shifting Centre of Gravity. *Global Policy*, 2, 3-9. https://doi.org/10.1111/j.1758-5899.2010.00066.x

Sala-i-Martin, X. (1995). The Classical Approach to Convergence Analysis. Economics *Working Papers* 117, Department of Economics and Business, Universitat Pompeu Fabra, 18.

Szendi, D. (2013). The convergence process and the effects of the economic crisis in Central-Eastern Europe. Romanian Review of Regional Studies: *Journal of the Centre for Regional Geography*, 9(1), 79–84.

Szendi, D. (2016). Perifériák felzárkózásának esélyei, különös tekintettel a Kelet-Közép-Európa két térségére. [Opportunities for catching up peripheral regions, with a special focus on the two regions of Central and Eastern Europe.] PhD dissertation, University of Miskolc, 227.

Tóth, G. (2013). Bevezetés a területi elemzések módszertanába. [Introduction to the methodology of territorial analysis], Miskolci Egyetemi Kiadó, Miskolc, Magyarország, 165.

World Inequality Database (2023). What's New About Inequality in Europe in 2023? https://wid.world/news-article/2023-wid-update-europe/ (downloaded: 22.04.2024)

COMPARATIVE ANALYSIS OF TRANSPORTATION SYSTEMS: SUSTAINABILITY AND INNOVATION IN CHINA, USA, AND EUROPE

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ABSTRACT

Purpose:
Aim of this paper is to provide a comprehensive overview of the emissions problem in the transportation sector and to evaluate international measures to reduce these emissions on an international level. It compares the transport systems in China, the USA and Europe in order to identify best practices and innovative solutions. The goal is to gain insights into how the transport sector can be made more sustainable and how emissions can be reduced in order to reduce environmental pollution and contribute to climate protection.
Design/methodology:
The mixed-methods approach includes literature research, expert interviews, and data analysis. Relevant scientific articles, reports, and studies were reviewed, and insights from expert interviews informed the findings. Quantitative data from authoritative sources, such as the IEA and UNEP, were collected and compared to benchmark the transport systems across China, the USA, and Europe.
Findings:
The study reveals that Europe excels in sustainable public transport through renewable energy integration and multimodal platforms like Helsinki's Mobility as a Service (MaaS). China has rapidly electrified its transport system, deploying 99% of the world's electric buses and expanding high-speed rail networks, reducing CO_2 emissions by up to 80% per passenger-kilometer. The US demonstrates selective innovation, such as Los Angeles' electrified bus lines and Seattle's cycling initiatives, but private vehicle reliance hinders nationwide progress. Benchmark comparisons identify actionable strategies for addressing regional challenges, promoting scalable innovations, and advancing global efforts to reduce emissions and improve urban mobility.
Research/practical implications:
This analysis provides practical guidance for policymakers, transport authorities, and industry stakeholders by identifying effective strategies to reduce emissions and promote sustainable mobility. Governments can leverage best practices highlighted in the study to improve public transport systems and integrate innovative solutions into policy frameworks. Organizations can adapt the findings to implement context-specific strategies, fostering efficiency and sustainability in urban mobility. By benchmarking the transport systems of China, the USA, and Europe, this work offers actionable insights that address regional challenges and facilitate

the transfer of best practices. These recommendations aim to enhance collaboration and accelerate the transition toward greener, more equitable transport solutions globally.

Originality/value:

The value of this work lies in the comprehensive analysis and international comparison of transport systems in China, the USA and Europe. By integrating literature studies, expert interviews, and data analyses, it provides unique insights into the diverse approaches to promoting sustainable mobility. This paper makes a significant contribution to understanding how different regions respond to the challenges of reducing emissions and advancing environmentally friendly transport solutions.

Keywords: sustainable transport, international comparison, benchmark, public transport

JEL Classification: R42, Q54, H54

1. Introduction

Increasing urbanization, rising mobility, and environmental pollution, exacerbated by shifting demand dynamics and the coronavirus pandemic, present significant challenges to global economic systems. The transport sector, responsible for approximately 25% of global greenhouse gas emissions (IEA, 2021), plays a pivotal role in addressing climate change and fostering sustainable development. The sharp rise in energy consumption and CO_2 emissions, as noted in recent UNEP reports (2022), underscores the urgent need for innovative and sustainable transport solutions. These challenges are further complicated by the diverse regional contexts in which transport systems operate, each shaped by differing priorities, levels of development, and policy frameworks. Comparing approaches to sustainable transport across regions like China, the USA, and Europe is complex, as these systems are influenced by distinct political, economic, and infrastructural factors. Despite these differences, benchmarking provides a structured methodology to identify best practices and scalable solutions, fostering mutual learning and innovation. This thesis benchmarks the transport systems of China, the USA, and Europe—three regions that exemplify unique strengths, challenges, and strategies in advancing sustainable mobility. By examining their approaches to electrification, intelligent transport systems, and multimodal solutions, this work aims to uncover actionable measures that contribute to reducing emissions, enhancing urban mobility, and addressing global climate challenges. Through the identification and adaptation of best practices, this analysis seeks to promote the development of cleaner, more efficient, and equitable transport systems worldwide.

2. Literature review/theoretical background

Benchmarking is a key research tool widely used across sectors, including public transport, to evaluate performance against industry leaders or comparable systems.7 It identifies weaknesses, highlights best practices, and uncovers improvement opportunities, making it essential for enhancing efficiency and competitiveness. In sustainable public transport, benchmarking is particularly valuable for analyzing measures to reduce CO_2 emissions, improve accessibility, and foster innovation. It enables comparisons of investment levels, financial models, technological advancements, and multimodal solutions across regions, providing critical insights for transferable and scalable solutions.[8] The transport sector accounts for 25% of global CO_2 emissions and faces increasing pressure from urbanization, population growth, and mobility needs.[9] Benchmarking addresses these challenges by objectively evaluating transport systems, assessing emission reduction strategies, and identifying innovative solutions. Key focus areas such as electrification and intelligent transport systems are chosen for their proven role in reducing emissions and optimizing operational efficiency.[10] [11] This study employs a mixed-methods approach, integrating qualitative expert interviews and quantitative data analysis. Interviews with transport experts provided insights into sustainability drivers, successful technologies, and implementation challenges. Quantitative data from IEA, UNEP, and national authorities were analyzed to compare CO_2 emissions, investments, and user satisfaction. Two benchmarking methodologies were applied: index benchmarking for numerical performance indicators and peer-group benchmarking to compare specific technologies like electric buses across regions. Index benchmarking was selected for its ability to provide quantitative, standardized comparisons across key performance indicators such as emissions and efficiency, enabling objective assessments of regional strengths and weaknesses (Smith & Brown, 2021). Peer-group benchmarking, on the other hand, allows for a detailed analysis of specific technologies or strategies, capturing context-specific adaptations and their

[7] comp. (Smith & Brown, 2021, S. 123-140)
[8] comp. (Green, Miller, & &, 2022, S. 87-102)
[9] comp. (Xiao Luo, 2024)
[10] comp. (Johnson, Fischer, & & Yates, 2020, S. 54-68)
[11] comp. (Li, Zhang, & &, 2021, S. 205-223)

effectiveness (Johnson et al., 2020). These methodologies were preferred over SWOT analysis and DEA due to their combined capacity to balance quantitative rigor with qualitative depth, aligning with the study's goals of evaluating transferable and scalable solutions. By integrating insights from literature, expert interviews, and quantitative data, this study develops a robust benchmarking framework for analyzing sustainable transport systems and evaluating the transferability of best practices. It highlights regional differences in China, the USA, and Europe, evaluates the transferability of best practices, and introduces a combined benchmarking approach. This comprehensive analysis aims to support decision-making and contribute to global efforts in advancing sustainable mobility.[12]

3. Methods

This study employs a robust mixed-methods approach, combining qualitative expert interviews with quantitative data analysis to provide a comprehensive evaluation of sustainable public transport systems. By integrating these methods, the study captures both the nuanced, context-specific insights of practitioners and the empirical evidence required for rigorous benchmarking. This approach ensures that findings are not only grounded in real-world practices but also validated by measurable data.[13]

The qualitative component involved semi-structured interviews with 15 experts from diverse fields, including transport planning, policy development, urban sustainability, and technology innovation. Experts were selected based on their experience in sustainable mobility, their regional expertise (China, the USA, or Europe), and their contributions to relevant projects or policies. This selection ensured a wide range of perspectives and insights into region-specific practices and emerging trends in sustainable mobility. The semi-structured format balanced guided questioning to ensure comparability with open-ended responses to capture detailed insights on sustainability drivers, the effectiveness of innovative technologies, and the practical challenges of implementing emission reduction measures. The quantitative analysis utilized data from authoritative sources such as the International Energy Agency (IEA), the United Nations Environment Programme (UNEP), and national transport authorities. Metrics analyzed

[12] comp. (Jeyaseelan, 2022)
[13] comp. (Karen Lucas, 2021)

included CO_2 emissions, investment levels in sustainable transport initiatives, system capacity, and user satisfaction ratings. Challenges in data collection, such as discrepancies in reporting standards across regions, were addressed through normalization techniques to ensure comparability. This data provided a robust empirical foundation for benchmarking and highlighted key disparities and commonalities across the regions under study: China, the United States, and Europe.[14]

Two benchmarking methodologies were employed to structure the analysis:[15] Index benchmarking employed numerical performance indicators such as emissions, efficiency ratios and customer satisfaction ratings to provide a standardized assessment of transport system performance. By focusing on measurable performance, this method provides an objective basis for comparing the performance of individual regions with world best practice. It highlighted key differences and similarities in the performance of transport systems and provided a clear evaluation of regional progress towards achieving sustainable mobility goals. Peer group benchmarking, on the other hand, centered on the evaluation of specific technologies or strategies within and between regions. For example, the use of electric buses in Shenzhen, China, was compared with similar initiatives in European cities such as Amsterdam and major US cities such as Los Angeles. This approach provided a valuable insight into the adaptation of innovations to different political, economic and infrastructural contexts. It also identified critical factors that influence the scalability and effectiveness of these technologies and shed light on their potential for wider application in different environments. By combining these methodologies, the study provided a balanced and integrative analysis of regional strengths and weaknesses. The qualitative insights contextualized the quantitative findings within socio-economic and policy frameworks unique to each region. This comprehensive framework not only validated the research outcomes but also enabled the identification of transferable best practices. The findings offer actionable insights for policymakers, transport authorities, and industry stakeholders, contributing to the advancement of sustainable mobility globally.

[14] comp. (Benchmarking European Sustainable Transport)
[15] comp. (Jürgen Weber, 1999, S. 298-319)

4. Results and discussion

In densely populated regions worldwide, public transport is essential for the mobility of millions of people. It plays a central role in reducing traffic congestion, mitigating environmental pollution, and enhancing urban quality of life. A comparative analysis of China, the USA, and Europe reveals not only the challenges but also the diverse approaches to achieving sustainable mobility. China faces significant challenges in its transport sector, including rising traffic congestion, air pollution, and increasing urban mobility demands. Rapid urbanization and population growth have strained transport systems, particularly in megacities like Beijing and Shanghai. The transport sector contributes approximately 15% of national greenhouse gas emissions, highlighting the need for comprehensive solutions.[16] In response, China has implemented large-scale modernization and sustainability initiatives.[17] [18] Key projects include the deployment of over 99% of the world's electric buses, with Shenzhen achieving a fully electrified fleet, reducing CO_2 emissions by 48%.[19] Electrified rail systems in cities like Guangzhou and Beijing have cut particulate matter emissions by 30%, while the expansion of high-speed rail offers an eco-friendly alternative to short-haul flights, reducing CO_2 emissions by up to 80% per passenger-kilometer.[20] Additionally, China has embraced intelligent transport systems, incorporating real-time information and digital payment platforms to increase efficiency and reduce travel times by up to 20%.[21] Multimodal solutions, such as bike-sharing programs, are also gaining traction, although further integration is needed.[22] [23] In the United States, public transport is highly fragmented, with significant disparities between cities. While metropolitan areas like New York and San Francisco have well-established systems, smaller cities like Cleveland struggle with inadequate infrastructure and limited resources. Public transport accounts for only 5% of trips nationwide, reflecting the dominance

[16] comp. (Xiao Luo, 2024)
[17] comp. (Global Economic Prospects: Heightened Tensions, Subdued Investment, 2019)
[18] comp. (China Academy of Transportation Sciences, 2021)
[19] comp. (China Tackles Climate Change with Electric Buses, 2018)
[20] comp. (Xiao Luo, 2024)
[21] Comp. (Liyuan Zhou, 2024)
[22] comp. (Lin Su, 2023)
[23] comp. (China, 2023)

of private vehicles and the resulting high emissions.24 Despite these challenges, several cities are making strides toward sustainability.25 Los Angeles, for instance, has transitioned its G Line (Orange) to an all-electric bus fleet and plans to electrify its entire bus fleet by 2030, aiming for a 60% reduction in emissions by that year. Similarly, Seattle is advancing efforts to electrify its bus fleet, contributing to regional emission reduction goals.[26] Smaller cities have also achieved notable successes. Cleveland's HealthLine Bus Rapid Transit (BRT) system has reduced CO_2 emissions by 30%, serving as a model for sustainable transit solutions in mid-sized urban areas.[27] [28] Active mobility initiatives, such as Seattle's Bike Master Plan, have increased cycling rates by 50% since 2015, thereby reducing urban emissions and promoting healthier lifestyles. Intelligent transport systems like New York's "MTA Bus Time" have enhanced operational efficiency and customer satisfaction by providing real-time bus tracking information. These examples demonstrate that, despite systemic challenges, both large and small U.S. cities are implementing innovative strategies to promote sustainable and efficient public transportation.[29] [30] Europe is distinguished by its reliable and multimodal public transport systems that adhere to high environmental standards. Initiatives such as the Grand Paris Express—a project adding 200 kilometers of new metro lines and 68 stations to the Paris metropolitan area—aim to enhance accessibility while reducing emissions. Similarly, Berlin is planning significant expansions to its U-Bahn network to improve connectivity and sustainability.[31] Rail transport in Europe is notably efficient, emitting approximately 35 grams of CO_2 per passenger-kilometer, which is about 20% of the emissions produced by cars. This makes rail travel a cornerstone of the continent's sustainability efforts. Cities like Copenhagen and Amsterdam have successfully integrated cycling into their mobility strategies, with bicycles

[24] comp. (APTA, APTA leads public transportation in a new mobility era, advocating to connect and build thriving communities., 2023)
[25] comp. ((DOT), 2024)
[26] comp. (APTA, the last 10 reports; public transport in the USA, 2024)
[27] (Record, 2024)
[28] (APTA, the last 10 reports; public transport in the USA, 2024)
[29] comp. (APTA, APTA leads public transportation in a new mobility era, advocating to connect and build thriving communities., 2023)
[30] comp. (L.A. Metro Now Running all Zero-Emission Electric Buses on the G (Orange) Line in the San Fernando Valley, 2021)
[31] comp. (Leffler, 2024)

accounting for up to 40% of urban transport.[32] However, challenges persist, including inadequate rural connectivity and funding disparities, particularly in Eastern Europe. Addressing these issues is crucial to achieving comprehensive and equitable sustainable mobility across the continent. Comparing the three regions reveals shared goals but differing approaches to sustainability. China leads in large-scale electrification with its extensive electric bus fleet and high-speed rail systems, while Europe emphasizes renewable energy integration and multimodal transport solutions. The United States focuses on decentralized projects and innovative solutions in select cities. Intelligent Transport Systems (ITS) play a crucial role across all regions: Europe excels with multimodal platforms like Helsinki's Mobility as a Service (MaaS); China advances digital payment systems; and the U.S. leverages real-time tracking technologies in cities like New York. Despite these advancements, long-term challenges remain. China's reliance on coal-based electricity limits the environmental benefits of electrification, while urban sprawl and a cultural preference for private vehicles hinder progress in the U.S. Europe must enhance rural mobility and address funding inequalities to ensure comprehensive sustainability.[33]

This analysis underscores the importance of a balanced evaluation that includes both major metropolitan areas and smaller cities to provide a complete picture of sustainable mobility. Critical reflections on long-term challenges and the viability of initiatives strengthen the findings and offer actionable recommendations for advancing sustainable public transport globally.[34] [35]

Comparing public transport approaches in China, the US, and Europe reveals notable regional differences in strategies, challenges, and priorities, yet highlights shared goals of sustainability and innovation. China's approach is characterized by significant investments in large-scale infrastructure projects, such as the world's largest electric bus fleet and extensive high-speed rail networks, supported by centralized state-driven policies. These efforts have substantially improved urban mobility and reduced emissions in key areas. However, challenges remain, including reliance on coal-based electricity for powering electrified systems

[32] comp. (Which form of transport has the smallest carbon footprint?, 2023)
[33] comp. (VDV)
[34] comp. (Jahresbericht VDV & Roland Berger; Leistungskostengutachten, 2019/2020)
[35] comp. (BMVI, 2023)

and the high upfront costs of infrastructure development, which could limit scalability in smaller cities. The US presents a fragmented landscape with significant regional disparities. Cities like Los Angeles and New York have invested in rail expansions and electric bus fleets, demonstrating localized progress. Yet, smaller cities often face funding constraints and lack comprehensive public transport systems, limiting broader adoption. The heavy reliance on private vehicles exacerbates emissions and creates barriers to transitioning toward public transport solutions. Europe, by contrast, stands out for its well-established and integrated multimodal systems. Cities like Copenhagen and Amsterdam are global leaders in combining cycling infrastructure with public transport, while countries like France and Germany excel in rail electrification and network expansion. However, Europe also faces its share of challenges, such as connectivity gaps in rural areas and disparities in funding, particularly between Western and Eastern Europe. Despite these differences, the regions converge on key pillars of sustainable mobility, notably electrification and intelligent transport systems (ITS). China leads globally in electric bus deployment, with Shenzhen serving as a benchmark for operational efficiency and emissions reductions. Europe integrates renewable energy into electrification projects, enhancing their sustainability, while the US is advancing fleet transitions in cities like Seattle and Los Angeles. However, urban sprawl and cultural dependence on private vehicles pose significant challenges in the US. ITS innovations further underscore shared priorities. Examples such as Helsinki's Mobility as a Service (MaaS) platform and New York's "MTA Bus Time" highlight the transformative potential of digital technologies to improve efficiency, multimodal connectivity, and passenger experience. These systems offer valuable lessons for broader adoption and cross-regional learning. The transferability of best practices depends heavily on governance structures, funding mechanisms, and infrastructural readiness. China's centralized approach enables rapid implementation of large-scale projects but may be less applicable in decentralized systems like those in the US. Europe's collaborative funding frameworks, supported by EU programs, offer scalable solutions for fostering multimodal and sustainable mobility but are influenced by regional economic disparities and varying urban densities. By leveraging benchmarking as a tool to identify and adapt effective solutions, these regions have the potential to advance the global transition toward cleaner, more efficient, and equitable transport systems.

Table 1 assessment by region

Region	Scope of Invest	Customer Benefits	Efficiency & Capacity	Innovative Approaches	Sustainable Approaches	Total score
China	3	2	3	3	2	13
USA	2	2	2	2	1	9
Europe	2	3	1	3	3	12

Source: own elaboration

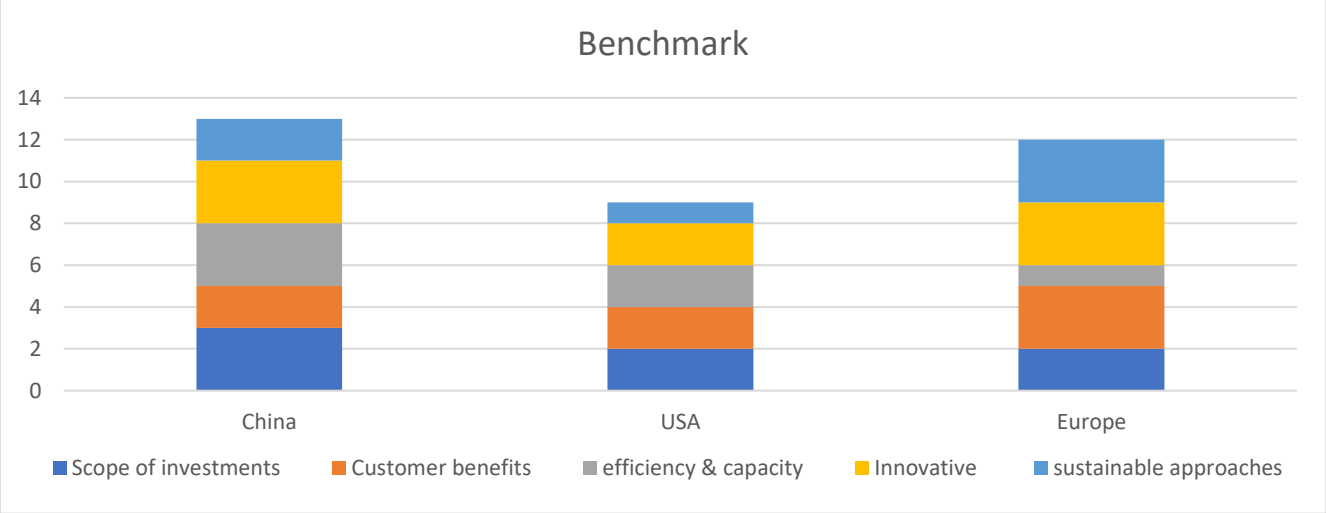

Figure 1 Summarizing chart
Source: own elaboration

5. Conclusion

The exchange and transfer of best practices in the transport sector are pivotal in addressing contemporary challenges and achieving sustainable mobility on a global scale. Success in this endeavor depends on key factors such as political commitment, adequate funding, and robust infrastructure. Each region—China, the US, and Europe—offers unique strengths and lessons that can inspire and inform global progress. China demonstrates how substantial state-led investments and large-scale projects can drive transformative changes in transport systems. Its leadership in the electrification of buses and the expansion of high-speed rail provides a model for achieving efficiency and reducing emissions on a massive scale. Europe, with its focus on sustainability, customer-centric solutions, and multimodal approaches, highlights the importance of integrating active transport modes such as cycling and walking while ensuring

reliability and accessibility. The US showcases its capacity for localized innovation, with cities adopting creative initiatives like Bus Rapid Transit (BRT) systems, intelligent transport technologies, and electrification projects to tackle urban mobility challenges. Collaboration between these regions is essential to bridging gaps in knowledge, resources, and capabilities. By leveraging benchmarking to identify transferable solutions, regions can adopt tailored approaches that address local needs while drawing on global insights. Integrating innovative technologies, strengthening governance frameworks, and prioritizing equitable access to public transport are key steps in this direction. Ultimately, the path to sustainable mobility requires continuous learning, cross-regional cooperation, and a shared commitment to reducing environmental impacts and enhancing quality of life. Through collective efforts, the global transport sector can transition toward cleaner, more inclusive, and efficient systems that benefit both people and the planet.

References

(DOT), U. D. (2024). *initiatives, projects and programmes in the field of public transport in the USA.*

APTA, A. P. (2023). *APTA leads public transportation in a new mobility era, advocating to connect and build thriving communities.* Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.apta.com/wp-content/uploads/APTA-2022-Public-Transportation-Fact-Book.pdf?utm_source=chatgpt.com

APTA, A. P. (2024). *the last 10 reports; public transport in the USA.* Retrieved from https://www.apta.com/research-technical-resources/key-issues/

(n.d.). *Benchmarking European Sustainable Transport.* Retrieved 2024, from https://trimis.ec.europa.eu/project/benchmarking-european-sustainable-transport?utm_source=chatgpt.com

BMVI. (2023). *Bericht des öffentlichen Verkehrs 2022.*

Bundesministerium für Wirtschaft und Klimaschutz. (2022, 01 20). Finale Klimabilanz 2020: Emissionen sanken um 41 Prozent gegenüber 1990. Berlin, Deutschland. Retrieved 01 28, 2023, from https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2022/01/20220120-finale-klimabilanz-2020-emissionen-sanken-um-41-prozent-gegenuber-1990.html

China Academy of Transportation Sciences. (2021). *Report on Sustainable Transport in China.* Retrieved from https://xxgk.mot.gov.cn/2020/jigou/gjhzs/202112/P020211214343055452953.pdf

(2018). *China Tackles Climate Change with Electric Buses.* Retrieved from https://itdp.org/2018/09/11/electric-buses-china/?utm_source=chatgpt.com

China, M. o. (2023). Retrieved from https://wialon.com/en/hw-manufacturers/ministry-of-transport-of-the-peoples-republic-of-china

(2020). *Global Economic Prospects.* A Second Year of Sharply Slowing Growth. The World Bank. Retrieved from https://www.worldbank.org/en/publication/global-economic-prospects

(2019). *Global Economic Prospects: Heightened Tensions, Subdued Investment.* World Bank. Retrieved from https://www.worldbank.org/en/publication/global-economic-prospects

Green, L., Miller, T., & &. C. (2022). Sustainable Transport Solutions: A Comparative Analysis. *Environmental Policy Journal, 29*(2).

greenfdc. (2019). *Green-public-transport-innovation-in-china-an-opportunity-for-bri-countries.* Retrieved from https://greenfdc.org/green-public-transport-innovation-in-china-an-opportunity-for-bri-countries/

(2019/2020). *Jahresbericht VDV & Roland Berger; Leistungskostengutachten.* Köln: Verband Deutscher Verkehrsunternehmen e.V. (VDV). Retrieved 04 22, 2023, from https://www.vdv.de/verkehrswende-gestalten-gutachten-zur-finanzierung-der-leistungskosten-der-oeffentlichen-mobilitaet.aspx

Jeyaseelan, T. (2022). *A comprehensive review on the current trends, challenges and future prospects for sustainable mobility.* Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S136403212200003X

Johnson, R., Fischer, M., & & Yates, K. (2020). Multimodal Transport Innovations in Europe: Case Studies and Lessons. *European Transport Research Review, 12*.

Jürgen Weber, R. A. (1999). *Benchmarking als Instrument empirischer Forschung — Erfahrungen aus dem Benchmarking von Controllerbereichen.* Springer. Retrieved from https://link.springer.com/chapter/10.1007/978-3-322-85231-1_10?utm_source=chatgpt.com

Karen Lucas, I. P. (2021). *A mixed methods approach to the social assessment of transport infrastructure projects.* Springer. Retrieved from https://link.springer.com/article/10.1007/s11116-021-10176-6?utm_source=chatgpt.com

(2021). *L.A. Metro Now Running all Zero-Emission Electric Buses on the G (Orange) Line in the San Fernando Valley.* Los Angeles. Retrieved from https://www.metro.net/about/l-a-metro-now-running-all-zero-emission-electric-buses-on-the-g-orange-line-in-the-san-fernando-valley/?utm_source=chatgpt.com

Leffler, B. (2024). Vorbild für Berlin? Metropolregion Paris baut Metro-Netz massiv aus. Retrieved from https://entwicklungsstadt.de/vorbild-fuer-berlin-metropolregion-paris-baut-metro-netz-massiv-aus/?utm_source=chatgpt.com#google_vignette

Li, X., Zhang, H., & &. W. (2021). The Role of Intelligent Transport Systems in China's Urban Development. *Urban Mobility Journal*, *18*(3). Retrieved from https://www.unescap.org/sites/default/d8files/Ch02-Role%20of%20Intelligent%20Transport%20Systems%20%28ITS%29%20applications%20in%20the%20uptake%20of%20mobility%20on%20demand%20services_0.pdf

Lin Su, J. J. (2023). *New-type urbanization efficiency measurement in Shanghai under the background of industry city integration.* Springer. Retrieved from https://link.springer.com/article/10.1007/s11356-023-27933-y?utm_source=chatgpt.com

Liyuan Zhou, Q. L. (2024). *Online characterization of primary and secondary emissions of particulate matter and acidic molecules from a modern fleet of city buses.* Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://acp.copernicus.org/articles/24/11045/2024/acp-24-11045-2024.pdf?utm_source=chatgpt.com

Record, T. R. (2024). *Challenges and solutions in US public transport.* Retrieved from https://journals.sagepub.com/home/trr

Smith, J., & Brown, P. (2021). Benchmarking in Public Transport: A Tool for Efficiency and Competitiveness. *Journal of Transport Studies*, *35*(4).

VDV. (2023). *Projekte im ÖPNV.* Retrieved from https://www.vdv.de/nachhaltigkeit-im-oepnv.aspx

Which form of transport has the smallest carbon footprint? (2023). Retrieved from https://ourworldindata.org/travel-carbon-footprint?utm_source=chatgpt.com

Xiao Luo, Y. Y. (2024). *Factor decomposition analysis of urban transport CO2 emissions in Chinese mega cities: case study of Beijing, Shanghai, Guangzhou and Shenzhen.* Springer. Retrieved from https://link.springer.com/article/10.1007/s10668-024-05239-4?utm_source=chatgpt.com

Annexes

Analysed criteria; literature and evaluation through interviews

Criteria	China	USA	Europe
Electrification	99% of global electric buses; high scalability; limited by coal reliance (Zhou et al., 2020)	Gradual adoption; focus on city-level fleets like Los Angeles (LAMTA Report, 2022)	Extensive rail electrification; integration with renewable energy (UIC, 2022)
Intelligent Transport Systems (ITS)	Real-time data, digital payments, reduced travel times (Chen et al., 2020)	Real-time tracking (MTA Bus Time); limited scalability	Advanced multimodal platforms (Helsinki's MaaS)
Multimodal Solutions	Emerging bike-sharing programs (Liu & Zhang, 2021)	Limited; efforts in select cities like Seattle's cycling plan	Well-developed; high integration of cycling and public transport (Cycling Embassy, 2021)
Funding Models	Centralized; state-driven (Zhang et al., 2020)	Decentralized; often reliant on federal grants (APTA, 2022)	Collaborative; supported by EU funds (European Commission, 2021)
Rural Connectivity	Focus on urban areas; limited in smaller cities	Sparse; rural areas underserved	Moderate; rural regions less prioritized
Scalability	Rapid implementation in urban centers; high cost for small cities	Fragmented; urban sprawl limits efficiency	High scalability in dense urban areas
Environmental Impact	Reduced emissions in urban areas; coal dependence a barrier	Emissions reduced in select cities; nationwide impact limited	Significant reductions in emissions via rail and cycling integration (UIC, 2022)
Challenges	High costs, coal reliance, scalability in smaller cities	Urban sprawl, funding gaps, cultural reliance on cars	Funding disparities, rural focus, energy mix decarbonization

Criteria	China	USA	Europe
Scope of Invest	**3** - Large-scale investments in electric buses and high-speed rail (Zhou et al., 2020).	**2** - Decentralized investments in select cities; reliance on federal grants.	**2** - Collaborative EU funding; emphasis on rail expansion (European Commission, 2021).
	- State-driven funding enables rapid implementation (Zhang et al., 2020).	- Limited scope outside major cities (LAMTA Report, 2022).	- Strong focus on public-private partnerships and long-term planning.
Customer Benefits	**2** - Improved urban air quality and travel times through ITS and high-speed rail.	**2** - Enhanced passenger experience in major cities but limited nationwide impact.	**3** - High customer satisfaction with multimodal integration and seamless connectivity.
	- Reduced emissions via electrification (Zhou et al., 2020).	- Real-time tracking improves reliability (MTA Bus Time, 2021).	- Increased urban mobility through cycling-public transport integration (Cycling Embassy, 2021).
Efficiency & Capacity	**3** - High-speed rail reduces congestion; electric buses improve urban mobility (Xu et al., 2021).	**2** - BRT systems and energy-efficient trains increase efficiency locally.	**1** - Dense rail networks with low emissions and MaaS platforms optimize multimodality.
	- Focus on urban mobility in megacities.	- Limited impact outside urban centers.	- Comprehensive capacity solutions in urban regions (UIC, 2022).
Innovative Approaches	**3** - Advanced ITS and emerging bike-sharing programs (Chen et al., 2020).	**2** - Innovations in ITS and BRT systems; limited multimodality focus.	**1** - Advanced multimodal platforms like Helsinki's MaaS and integrated cycling networks.
	- Large-scale deployment of digital transport solutions.	- Localized adoption without nationwide strategies.	- Leading in multimodal solutions across multiple cities.
Sustainable Approaches	**2** - Electrification of buses and rail; limited by coal reliance (Zhou et al., 2020).	**1** - Gradual transition to electric buses; urban sprawl challenges sustainability.	**3** - Integration of renewable energy and active transport modes reduces emissions (UIC, 2022).

- Significant reductions in urban emissions but energy mix limits impact.	- Cycling initiatives like Seattle's Bike Master Plan contribute locally (Seattle DOT, 2022).	- Comprehensive and consistent focus on emissions reduction across sectors.

ONLINE COMMUNITIES DEDICATED TO DISSEMINATING INFORMATION ON TOURISM OFFERINGS

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ABSTRACT

Purpose:

Online communities have become ubiquitous across various age groups, not limited to the younger demographic. The purpose of these communities is the facilitation of a platform for the exchange and dissemination of opinions, advice, experiences, and recommendations among the integrated members of a particular community. Such information is posited to potentially influence consumer behavior and decision-making processes preceding, during, and subsequent to purchases, as evidenced by eWOM feedback. Moreover, recent scholarly work (e.g., Zhou et al., 2021; Marx et al., 2021; Peng et al., 2022) has been directed towards understanding the specific impact of online communities on consumer behavior within the tourism sector. The aim is to present a contemporary review of the academic discourse surrounding online communities in the context of tourism.

Design/methodology:

A literature review conducted from December 2023 to January 2024 utilized the snowball method. Using keywords like "online communities," "online communities in tourism," "online travel communities," "virtual communities," and "virtual communities in tourism", databases including Research Gate, Science Direct, and Google Scholar were searched. This yielded 114 studies on online communities, with 40 specifically exploring those relevant to tourism.

Findings:

The survey results reveal that the prevailing focus of the current scientific literature is on the examination of consumer behavior among online community members, particularly regarding their loyalty to online communities, participation and interaction, information sharing, and the identification of members' needs. The current overview of studies has been augmented through an analysis of the research methodologies employed in the examination of online communities offering tourism-related information. Findings indicate a preference among authors for mathematical-statistical methods in the study of online communities within the tourism sector, with Structural Equation Modelling (SEM) identified as the most utilized approach.

Research/practical implications:

Considering the scholarly interest in exploring online communities within the tourism context, the present state of research on online communities disseminating tourism-related information was delineated. The findings of this contribution are positioned to serve as a foundational

reference for other scholars' keen on delving into the realm of online communities in tourism. Nonetheless, this survey is not without its limitations. A primary constraint is the focus on merely 40 studies that pertain to online communities within the tourism domain. An additional limitation stems from the confinement of the search to only three databases. The value of the survey could have been enhanced had the search encompassed a broader range of databases and included studies published in languages beyond English.

Originality/value:

The originality of the paper is attributed to the observation that no prior studies have concentrated on compiling a literature review of research examining online communities that furnish information about tourism offerings. Consequently, the aspiration of this manuscript is to bridge this research lacuna, aiming to underscore not only the domains within which online communities in tourism are studied but also the methodologies employed in such investigations.

Keywords: online communities, online communities in tourism, virtual communities.

JEL Classification: M30, Z33, Z39.

1. Introduction

The acceleration of technological development due to the COVID-19 pandemic has been markedly observed in the advancement of digital technologies. Enabled by these technologies, direct interactions among individuals, irrespective of geographical distances, have facilitated the emergence of online communities. These communities function as social systems where members frequently engage within the framework of shared interests and goals.

In the domain of social media and the broader online environment, numerous communities explicitly related to tourism have emerged. These online communities are currently instrumental in providing essential information concerning travel, tourist destinations, tourism services, and activities engaged in during participation in both domestic and international tourism. The primary objective of these communities is to fulfill the needs of their members and to forge spaces for the valuable exchange and sharing of opinions, advice, experiences, and suggestions among integrated community members (Agostini, Mechant, 2019). Such information has the potential to influence consumer behavior and decision-making processes before, during, and after a purchase, exemplified by feedback mechanisms such as electronic word of mouth (reviews) (Wallace et al., 2014).

2. Theoretical background

Online communities are generally perceived as entities comprising multiple members who engage in communication through electronic means, with the sharing of common interests serving as a characteristic feature of these communities (Agostini, Mechant 2019). It is observed that the integration of individuals within online communities also involves the sharing of a certain identity. However, the identity of members in online communities is characterized as reterritorialized, implying that "the virtual unit is capable of producing several specific manifestations at different specified times and places, and may not be bound to an exact place and time" (Beutler, Teixeira, 2015, p. 514). Echoing this perspective, Muryanto et al. (2023) assert that online communities exhibit a distinctive property of independence from the geographical distances of their members, in contrast to traditional communities, whose mutual interactions and communications are dependent on geographical proximity and precisely defined timing.

In contemporary scientific discourse, several terms frequently surface as synonyms for online communities. These entities are often referred to as virtual communities (Lee, Suh, 2015; Luo, Zhang, 2016; Rolls et al., 2016; El-Manstrly et al., 2020). Some scholars (e.g., Ferreday, 2009; Korzh et al., 2016; Korobiichuk et al., 2017; Zannettou et al., 2017; Zannettou et al., 2018; Agostini, Mechant, 2019, etc.) prefer the term internet community, which is defined almost identically to online or virtual communities. An internet community can generally be delineated as a collective of individuals unified by a common interest, purpose, and goal, with interactions occurring exclusively via the internet, thus reinforcing the notion that an internet community is synonymous with an online or virtual community.

3. Methods

The aim of this paper is to present a contemporary review of the academic discourse surrounding online communities, particularly in the context of tourism. To achieve this, a systematic literature review was conducted over the period from December 2023 to January 2024, employing the snowball sampling method to ensure comprehensive coverage of the existing literature.

The initial search for scientific articles was executed using a set of specific keywords: "online communities," "online communities in tourism," "online travel communities," "virtual communities," and "virtual communities in tourism." This search strategy was designed to capture the broad spectrum of research focusing on the intersection of online community dynamics and the tourism sector. Research databases such as Research Gate, Science Direct, and Google Scholar were utilized extensively to gather and analyze relevant studies.

This meticulous search process resulted in the identification of 114 studies that address various aspects of online communities. Among these, 40 studies were found to specifically investigate the role of online communities in disseminating information pertinent to tourism.

In synthesizing the findings from the reviewed studies, this paper aims to delineate the current academic understanding of online communities in tourism, highlighting both established results and areas requiring further investigation. This review not only contributes to academic knowledge but also offers practical implications for stakeholders in the tourism industry seeking to leverage online communities to enhance the tourist experience.

4. Results and discussion

Among the numerous scholars dedicated to exploring online communities from a variety of perspectives, a select group of authors has placed a particular emphasis on the study of online communities that exclusively provide information related to travel, tourist destinations, tourism services, and activities associated with both domestic and international tourism. These authors focus on distinct research areas within this context (Table 1).

Table1 Research areas of online communities in tourism

Area of investigation	Authors
consumer behavior members of online communities	Corigliano, Baggio, 2003; Casaló et al., 2010b; Illum et al., 2010; Ku, 2012; Elliot et al., 2013; Bui et al., 2014; Gao et al., 2014; Lee, Hyun, 2016; Joen et al., 2017; Fang et al., 2018a; Fang et al., 2018b; Lee, Hyun, 2016; El- Manstrly et al., 2020
sharing information (reviews - eWOM)	Lueg, 2006, Lee et al., 2011; Wang et al., 2014; Lee et al., 2016b ; Yuan et al., 2016; Belanche et al., 2019; Li et al., 2019
needs members of online communities	Wang et al., 2013; Najafipour et al., 2014; Stepaniuk , 2015
participation and interaction of members of online communities	Kamboj, Rahman, 2017; Chen et al., 2021; Peng et al. 2022
intention membership	Lee, Hyun, 2015; Agag, El-Masry, 2016, Marx et al., 2021a
commercial use of online communities by businesses and tourism organizations	Baglieri, Consoli, 2009; Casaló et al., 2010a
mutual relationships between members of online communities	Kunz, Seshadri, 2015; Luo, Zhang, 2016
Satisfaction of members of online communities	Choi et al., 2019
content and quality contributions	Nimrod, 2012; Dencheva, 2013
integration of new members	Casaló et al., 2013; Marx et al., 2021b
type of online communities	Dippelreiter et. al., 2008
literature review	Zhou et al., 2021

Source: own, 2024.

In the field of studying online communities within the context of tourism, early research predominantly relied on theoretical frameworks to analyze the dynamics of virtual interactions. However, in recent years, there has been a significant methodological shift toward the application of advanced mathematical and statistical approaches. This reflects a growing interest in examining the detailed impact of key variables, such as trust, reciprocity, and reputation, on consumer behavior within these virtual networks.

The overview presented in Table 2 provides a systematic summary of the methodological approaches and key findings of various relevant studies. For instance, Lueg (2006) and

Dippelreiter et al. (2008) utilized theoretical methods to analyze the role of online communities in facilitating the sharing of information related to tourism, identifying their critical function in disseminating practical data about destinations, services, and activities. Conversely, modern studies, such as those by Xu et al. (2016) and El-Manstrly et al. (2020), employed structural equation modeling (SEM) and confirmatory factor analysis (CFA) to investigate the complex relationships between community members' loyalty, interaction quality, and mediating factors such as the trustworthiness of the community.

Table 2 Key Findings from Selected Studies on Online Communities in Tourism

Source	Research methods	Key findings
Lueg (2006)	- theoretical research methods: comparison of information provided through online communities	- online communities provide the mediation of additional information about tourism
Dippelreiter et al., (2008)	- theoretical research methods: Comparison of online communities in the broader internet environment.	- identification of online communities in the broader internet environment related to travel, tourism destinations, tourism services, and activities carried out during participation in tourism based on their characteristics (number of members, date of establishment, name of the website, etc.)
Nimrod (2012)	- data analysis from the internet: Netnography	- explanation of specific topics related to age and the redistribution of content in online communities into three main categories (exchange of practical information, search for contacts, travel stories) - online communities for seniors provide space for expressing issues related to age and travel to destinations, which represents the main difference between online communities in tourism for seniors and online communities for all age groups of tourism visitors
Najafipour et al., (2014)	- theoretical research methods: Comparison and generalization of definitions of virtual communities	- definition of the needs of online community members: functional needs, social needs, and psychological needs
Yun et al., (2016)	- mathematical-statistical research methods:	- members of the selected online community in China are positively influenced by personal

	Structural equation modeling (SEM) – method: PLS (Partial Least Squares)	factors (subjective knowledge, consumer innovativeness), which lead to a change in the consumer behavior of their members related to the increase in information sharing in the studied online community - the growth of shared information in online communities is also influenced to some extent by technical factors, i.e., perceived ease of use and usefulness of online communities
El-Manstrly et al., (2020)	- mathematical-statistical research methods: Structural equation modeling (SEM) – method: CFA (Confirmatory Factor Analysis).	- identification of direct influences and effects on consumer behavior (loyalty to online communities) of online community members in tourism: social factors (age, gender), economic factors (income level), and community factors (community trustworthiness and commitment to the community) - identification of the indirect effect on the loyalty of online community members: community factor (quality of interaction in the community) - identification of mediators (community trustworthiness and commitment to the community) through which the quality of interaction in the community indirectly influences member loyalty

Source: own, 2024.

This approach is further developed in other studies that focus on various methodological techniques within SEM. Different methodological approaches have been employed in this context, including Partial Least Squares-SEM (PLS-SEM) (Gao et al., 2014), Confirmatory Factor Analysis-SEM (CFA-SEM) (Elliot et al., 2013; Bui et al., 2014; El-Manstrly et al., 2020), and Multiple Linear Regression-SEM (MLR-SEM) (Casaló et al., 2011). Other studies use SEM in general (Ku, 2014; Lee and Hyun, 2015, 2016), though the specific methodologies are not always delineated (Table 3).

Table 3 Used methods of researching online communities in the tourism industry according to continent

Continent	Quantitative methods		Qualitative methods	
	research methods used	number of studies	research methods used	number of studies
Asia	PLS - SEM CFA - SEM MLR - SEM SEM logarithmic regression	3 2 1 2 1	configuration analysis	1
America	CFA - SEM	1	comparison, generalization	1
Europe	CFA - SEM MLR - SEM SEM correlation	1 1 1 2	comparison, generalization analysis data from the Internet	1 3
Africa	PLS - SEM	1	-	0
Australia	-	0	-	0
no country	CFA - SEM MLR - SEM SEM mediation analysis cluster analysis	5 1 3 1 1	comparison, generalization snowball netnography	5 1 1
Sum		27		13

Source: own, 2024.

Moreover, SEM-based methodologies have been instrumental in exploring various aspects of online tourism communities. These aspects encompass information sharing (Lee et al., 2012; Wang et al., 2014; Yuan et al., 2016; Belanche et al., 2019; Li et al., 2019), membership intention (Lee and Hyun, 2015; Agag and El-Masry, 2016), relationship building among members (Kunz and Seshadri, 2015; Luo and Zhang, 2016), member participation and interaction (Kamboj and Rahman, 2017; Chen et al., 2021), identifying avenues for influencing consumer behavior through online communities—especially for tourism businesses (Casaló et al., 2010), member integration (Casaló et al., 2013), and member satisfaction (Choi et al., 2019).

Research on online communities within the tourism domain has also applied diverse mathematical and statistical methodologies beyond SEM. These include logistic regression (Fang et al., 2018b), correlations (Marx et al., 2021a; Marx et al., 2021b), mediation analysis (Joen et al., 2017), and cluster analysis (Lee et al., 2011) (see Table 2 for more details). Each of these methodologies contributes to a deeper understanding of the structure, dynamics, and

implications of online communities within tourism, allowing researchers to derive more precise and actionable insights for the industry (Table 3).

Researchers conducting studies on online communities within the tourism sector have utilized a range of qualitative methods to delve into these complex social systems. Among these methods are comparison and generalization techniques, which have been employed to draw broader conclusions from specific case studies and trends (Wang et al., 2002; Lueg, 2006; Dippelreiter et al., 2008; Baglieri and Consoli, 2009; Illum et al., 2009; Najafipour et al., 2014; Fang et al., 2018a). Configurational analysis has also been adopted to explore the underlying patterns and configurations in online communities (Peng et al., 2022), while the snowball method has facilitated the identification of additional sources and key connections within these networks (Zhou et al., 2021).

In addition to traditional theoretical research methodologies, studies investigating online tourism communities have incorporated broader internet data analysis, which involves collecting and examining large datasets from online platforms (Corigliano and Baggio, 2003; Dencheva, 2013; Stepaniuk, 2015). Netnography, a qualitative research method derived from ethnography but adapted for online contexts, has been utilized to gain in-depth insights into the behaviors, interactions, and cultures within online tourism communities (Nimrod, 2012). These diverse qualitative approaches offer researchers a robust toolkit for exploring the dynamics of online communities in the tourism domain, providing nuanced perspectives and deeper understanding of how these virtual spaces influence consumer behavior and tourism-related activities (Table 3).

5. Conclusion

In this paper, a systematic overview of the scholarly literature pertaining to online communities, particularly those that facilitate the dissemination of tourism-related information, was provided. An analysis was conducted on 114 studies focusing on online communities, of which 40 specifically examined those relevant to tourism. This examination elucidated various thematic areas explored by researchers. Predominantly, attention was directed toward delineating consumer behavior patterns within online tourism communities, elucidating the dynamics of information sharing, assessing member needs, and analyzing the dynamics of

interaction and participation. Additionally, marginal attention was given to inquiries regarding membership intention, strategies for influencing consumer behavior via online platforms that are advantageous to tourism businesses, fostering interpersonal relationships among community members, gauging member satisfaction, evaluating the quality and content of user-generated content, integrating newcomers, and categorizing the typologies of online tourism communities.

A methodological review was also conducted, revealing a preference among scholars for sophisticated mathematical and statistical approaches, with Structural Equation Modeling (SEM) emerging as the predominant method.

However, this survey is not without its limitations. Chiefly, the scope of studies exclusively focused on online tourism communities is relatively narrow, comprising only 40 studies. Furthermore, the search was confined to a select few databases and restricted to the English language. An exhaustive exploration encompassing a broader array of databases and linguistic realms could yield a more comprehensive understanding of the subject matter. Nonetheless, this synthesis furnishes valuable insights for prospective researchers seeking to further investigate online communities dedicated to disseminating tourism-related information.

References

Agag, G., & El-Masry, A. (2016). Understanding consumer intention to participate in online travel community and effects on consumer intention to purchase travel online and WOM: An integration of innovation diffusion theory and TAM with trust. *Computers in Human Behavior*, *60*, 97–111. https://doi.org/10.1016/j.chb.2016.02.038

Agostini, S., & Mechant, P. (2019). Towards a definition of virtual community. *Signo Y Pensamiento*, *38*(74). https://doi.org/10.11144/javeriana.syp38-74.tdvc

Baglieri, D., & Consoli, R. (2009). Collaborative innovation in tourism: managing virtual communities. *the TQM Journal*, *21*(4), 353–364. https://doi.org/10.1108/17542730910965065

Belanche, D., Casaló, L. V., Flavián, C., & Guinalíu, M. (2019). Reciprocity and commitment in online travel communities. *Industrial Management + Data Systems/Industrial Management & Data Systems*, *119*(2), 397–411. https://doi.org/10.1108/imds-03-2018-0098

Beutler, D. L., & Teixeira, A. C. (2015). As complexidades da cibercultura em Pierre Lévy e seus desdobramentos sobre a educação. *Anais Do Workshop De Informática Na Escola*. https://doi.org/10.5753/cbie.wie.2015.51

Bui, T. et al. (2014). The importance of attribution: Connecting online travel communities with online travel agents. *Cornell Hospitality Quarterly, 56(3)* 285–297. https://doi.org/10.1177/1938965514530491

Casaló, L. V., Flavián, C., & Guinalíu, M. (2010a). Relationship quality, community promotion and brand loyalty in virtual communities: Evidence from free software communities. *International Journal of Information Management*, *30*(4), 357–367. https://doi.org/10.1016/j.ijinfomgt.2010.01.004

Casaló, L. V., Flavián, C., & Guinalíu, M. (2010b). Determinants of the intention to participate in firm-hosted online travel communities and effects on consumer behavioral intentions. *Tourism Management*, *31*(6), 898–911. https://doi.org/10.1016/j.tourman.2010.04.00

Casaló, L. V., Flavián, C., & Guinalíu, M. (2013). New members' integration: Key factor of success in online travel communities. *Journal of Business Research*, *66*(6), 706–710. https://doi.org/10.1016/j.jbusres.2011.09.00

Chen, T., Lai, W., & Yu, T. (2021). Participating in Online museum Communities: an empirical study of Taiwan's undergraduate students. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.565075

Choi, S., Kim, I., Cha, K., Yong-Kun, S., & Kim, K. (2019). Travelers' parasocial interactions in online travel communities. *Journal of Travel & Tourism Marketing*, *36*(8), 888–904. https://doi.org/10.1080/10548408.2019.165705

Corigliano, M. A., & Baggio, R. (2003). Italian Tourism Virtual Communities: Empirical research and model building. In *International Conference on Information Technology and Travel and Tourism* (pp. 86–95). https://doi.org/10.1007/978-3-7091-6027-5_10

Dencheva, S. (2013). ANALYSIS OF VIRTUAL COMMUNITIES IN TOURISM. *EcoForum Journal*, *2*(2), 3. https://econpapers.repec.org/article/scmecofrm/v_3a2_3ay_3a2013_3ai_3a2_3ap_3a3.htm

Dippelreiter, B., Grün, C., Pöttler, M., Seidel, I., Berger, H., Dittenbach, M., & Pesenhofer, A. (2008). Online tourism Communities on the path to Web 2.0: an evaluation. *Information Technology & Tourism*, *10*(4), 329–353. https://doi.org/10.3727/109830508788403132

Elliot, S., Li, G., & Choi, C. (2013). Understanding service quality in a virtual travel community environment. *Journal of Business Research*, *66*(8), 1153–1160. https://doi.org/10.1016/j.jbusres.2012.03.011

El-Manstrly, D., Ali, F., & Steedman, C. (2020). Virtual travel community members' stickiness behaviour: How and when it develops. *International Journal of Hospitality Management*, *88*, 102535. https://doi.org/10.1016/j.ijhm.2020.10253

Fang, J., Chen, L., Wang, X., & George, B. (2018a). Not all posts are treated equal: An empirical investigation of post replying behavior in an online travel community. *Information & Management*, *55*(7), 890–900. https://doi.org/10.1016/j.im.2018.04.003

Fang, J., Li, J., & Prybutok, V. R. (2018b). Posting-related attributes driving differential engagement behaviors in online travel communities. *Telematics and Informatics*, *35*(5), 1263–1276. https://doi.org/10.1016/j.tele.2018.02.008

Ferreday, D. (2009). *Online belongings: fantasy, affect and web communities*. https://openlibrary.org/books/OL23174737M/Online_belongings

Gao, L., Bai, X., & Park, A. (2014). Understanding Sustained Participation in Virtual Travel Communities from the Perspectives of is Success Model and Flow Theory. *Journal of Hospitality & Tourism Research*, *41*(4), 475–509. https://doi.org/10.1177/1096348014563397

Illum, S. F., Иванов, С., & Liang, Y. (2010). Using virtual communities in tourism research. *Tourism Management*, *31*(3), 335–340. https://doi.org/10.1016/j.tourman.2009.03.012

Jeon, H., Jang, J., & Barrett, E. (2016). Linking website interactivity to consumer behavioral intention in an online travel community: the mediating role of utilitarian value and online trust. *Journal of Quality Assurance in Hospitality & Tourism*, *18*(2), 125–148. https://doi.org/10.1080/1528008x.2016.1169473

Kamboj, S., & Rahman, Z. (2017). Measuring customer social participation in online travel communities. *Journal of Hospitality and Tourism Technology*, *8*(3), 432–464. https://doi.org/10.1108/jhtt-08-2016-0041

Korobiichuk, I., Федушко, С., Juś, A., & Syerov, Y. (2017). Methods of determining information support of web community user personal data verification system. In *Advances in intelligent systems and computing* (pp. 144–150). https://doi.org/10.1007/978-3-319-54042-9_1

Ku, E. C. (2012). Distributed fascinating knowledge over an online travel community. *International Journal of Tourism Research/the International Journal of Tourism Research*, *16*(1), 33–43. https://doi.org/10.1002/jtr.1895

Kunz, W. H., & Seshadri, S. (2015). From virtual travelers to real friends: Relationship-building insights from an online travel community. *Journal of Business Research*, *68*(9), 1822–1828. https://doi.org/10.1016/j.jbusres.2015.01.009

Lee, H. "., Law, R., & Murphy, J. (2011). Helpful reviewers in TripAdvisor, an online travel community. *Journal of Travel & Tourism Marketing*, *28*(7), 675–688. https://doi.org/10.1080/10548408.2011.61173

Lee, J., & Suh, A. (2015). How do virtual community members develop psychological ownership and what are the effects of psychological ownership in virtual communities? *Computers in Human Behavior*, *45*, 382–391. https://doi.org/10.1016/j.chb.2014.12.002

Lee, K., & Hyun, S. S. (2015). A model of behavioral intentions to follow online travel advice based on social and emotional loneliness scales in the context of online travel communities: The moderating role of emotional expressivity. *Tourism Management*, *48*, 426–438. https://doi.org/10.1016/j.tourman.2014.12.012

Lee, K., & Hyun, S. S. (2016a). The effects of tourists' knowledge-sharing motivation on online tourist community loyalty: the moderating role of ambient stimuli. *Current Issues in Tourism*, *21*(13), 1521–1546. https://doi.org/10.1080/13683500.2016.1145197

Lee, K., & Hyun, S. S. (2016b). A model of value-creating practices, trusting beliefs, and online tourist community behaviors. *International Journal of Contemporary Hospitality Management*, *28*(9), 1868–1894. https://doi.org/10.1108/ijchm-01-2015-0002

Lee, H. et al., (2012). Understanding knowledge sharing in online travel communities: Antecedents and the moderating effects of interaction modes. *Journal of Hospitality & Tourism Research, 38 (2),* 222–242. https://doi.org/10.1177/1096348012451454

Li, L. et al., (2019). Exploring the effect of heuristic factors on the popularity of user-curated 'Best places to visit'recommendations in an online travel community. *Information Processing & Management, 56(4),* 1391–1408. https://doi.org/10.1016/j.ipm.2018.03.009

Lueg, C. (2006). Mediation, expansion and immediacy: how online communities revolutionize information access in the tourism sector. *The Fourteenth European Conference on Information Systems*, *1*, 1616–1626. http://ecite.utas.edu.au/40239

Luo, Q., & Zhang, H. (2016). Building interpersonal trust in a travel-related virtual community: A case study on a Guangzhou couchsurfing community. *Tourism Management*, *54*, 107–121. https://doi.org/10.1016/j.tourman.2015.10.003

Marx, S., Flynn, S., & Kylänen, M. (2021a). Digital transformation in tourism: Modes for continuing professional development in a virtual community of practice. *Project Leadership and Society*, *2*, 100034. https://doi.org/10.1016/j.plas.2021.100034

Marx, S., Freundlich, H., Klotz, M., Kylänen, M., Niedoszytko, G., Swacha, J., & Vollerthum, A. (2021b). Towards an Online Learning Community on Digitalization in Tourism. *Universitätsverlag Potsdam.* https://doi.org/10.25932/publishup-51598

Muryanto, M. A., Nuzula, I. F., & Venkatesan, T. (2023). Online communities, brand recovery, consumer relationships, and repurchase intention. *Journal of Management Studies and Development*, *2*(01), 50–73. https://doi.org/10.56741/jmsd.v2i01.102

Najafipour, A. A., Heidari, M., & Foroozanfar, M. H. (2014). Describing the Virtual Reality and Virtual Tourist Community : Applications and implications for tourism industry. *Deleted Journal*, *3*(12.a), 12–23. https://doi.org/10.12816/0018842

Nimrod, G. (2012). The benefits of and constraints to participation in seniors' online communities. *Leisure Studies*, *33*(3), 247–266. https://doi.org/10.1080/02614367.2012.697697

Корж, P., Peleshchyshyn, A., Syerov, Y., & Федушко, С. (2016). University's information image as a result of university web communities' activities. In *Advances in intelligent systems and computing* (pp. 115–127). https://doi.org/10.1007/978-3-319-45991-2_8

Peng, J., Yang, X., Poon, P., & Xie, L. (2022). Enhancing users' well-being in virtual medical tourism communities: A configurational analysis of users' interaction characteristics and social support. *Technology in Society*, *71*, 102084. https://doi.org/10.1016/j.techsoc.2022.102084

Rolls, K., Hansen, M., Jackson, D., & Elliott, D. (2016). How health care professionals use social media to create virtual communities: An Integrative review. *JMIR. Journal of Medical Internet Research/Journal of Medical Internet Research*, *18*(6), e166. https://doi.org/10.2196/jmir.531

Stepaniuk, K. (2015). The model of tourist virtual community members engagement management. *Verslas: Teorija Ir Praktika*, *17*(1), 74–79. https://doi.org/10.3846/btp.2016.566

Wang, X., Butler, B. S., & Ren, Y. (2013). The impact of membership overlap on growth: An Ecological competition view of online groups. *Organization Science*, *24*(2), 414–431. https://doi.org/10.1287/orsc.1120.0756

Yuan, D., Lin, Z., & Zhuo, R. (2016). What drives consumer knowledge sharing in online travel communities?: Personal attributes or e-service factors? *Computers in Human Behavior*, *63*, 68–74. https://doi.org/10.1016/j.chb.2016.05.019

Zannettou, S., Caulfield, T., Blackburn, J., De Cristofaro, E., Sirivianos, M., Stringhini, G., & Suárez-Tangil, G. (2018). On the Origins of Memes by Means of Fringe Web Communities. *Internet Measurement Conference*. https://doi.org/10.1145/3278532.3278550

Zannettou, S., Caulfield, T., De Cristofaro, E., Kourtelris, N., Leontiadis, I., Sirivianos, M., Stringhini, G., & Blackburn, J. (2017). The web centipede. *The IMC '17: Internet Measurement Conference*. https://doi.org/10.1145/3131365.3131390

Zhou, Y., Kim, W. G., Okumuş, B., & Çobanoğlu, C. (2021). Understanding online travel communities: a literature review and future research directions in hospitality and tourism. *Journal of Travel & Tourism Marketing*, *38*(2), 194–212. https://doi.org/10.1080/10548408.2021.1887052

TERRITORIAL INEQUALITY IN SLOVAKIA

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ABSTRACT

Purpose:
The aim of my research is to highlight those NUTS3-level areas of Slovakia that have been able to "successfully" catch up in the last twenty years. The 2008-2009 financial crisis is at the center of the research topic. I divided the research period into shorter periods for more accurate results. From 2000 to 2007: the period before the crisis; from 2008 to 2013: the outbreak of the crisis; from 2014 to 2019: the recovery from the crisis and the last „year of peace".
Design/methodology:
The three types of convergence are sigma, beta and gamma convergence. Sigma convergence refers to the change in the average GDP per capita; beta convergence is the regression relationship between initial GDP per capita and annual economic growth; while the gamma convergence shows the ranking change of the areas compared to a base year.
Findings:
Based on the results of sigma and beta convergence, there is a decrease in territorial disparities from 2008 to 2013 and from 2014 to 2019, and an increase in territorial disparities from 2000 to 2007. The results of gamma convergence show no change in order from 2000 to 2007 and 2014 to 2019, while there is a little change in position from 2008 to 2013.
Research/practical implications:
In Slovakia, the 2008-2009 crisis affected the capital region less compared to the countries of the Visegrad region. As future research, it is conceivable to investigate how neighbourhood relations evolve using spatial econometric methodology.
Originality/value:
The main added value of the research is the impact of an external shock - in this case the 2008-2009 crisis - on the regions of Slovakia and how they can return to their original equilibrium path in the post-crisis period.

Keywords: territorial inequality, convergence calculation, crisis

JEL Classification: R10, R11

1. Introduction

Territorial disparities are a basic aspect of spatial economics. No two points in space have the same resources (Nemes Nagy, 1990; Nagyné Molnár, 2007; Benedek & Kurkó, 2011), because there is differentiation due to changes in economic, social, and environmental factors (Szendi, 2016). Differences between regions vary in space and time, but the spatial structure is based on the centre and periphery relations. Positive trends are concentrated in the centres, while negative trends are concentrated in the peripheries (Nemes Nagy, 2005; Nagyné Molnár, 2007; Szendi, 2016). The centre-periphery relationship is best illustrated by Wallerstein and Friedmann's models.

The focus of territorial inequality and convergence studies is on economic growth (Szendi, 2016), which suggests that "catching-up is positive when less developed regions catch up with more developed ones, while catching-up is negative when the index of developed regions shifts towards less developed ones" (Nagyné Molnár, 2007, p. 171). The Solow model is the basic pillar of convergence, and the empirical study of convergence has been focused on since the 1960s (Szendi, 2016).

The research goal of this study is to highlight those NUTS3-level areas of Slovakia that have been able to successfully catch up in the last twenty years. I divided the research period into shorter periods for more accurate results. From 2000 to 2007: the period before the crisis; from 2008 to 2013: the outbreak of the crisis; from 2014 to 2019: the recovery from the crisis for the the last „year of peace”. Processes are explained using the convergence calculations and GDP per capita as most frequently used indicator to measure territorial disparities.

2. Theoretical background

The theoretical focus of the research is on regional growth. The literature sources suggest different models to explain spatial growth, including territorial polarisation, territorial equalisation, growth pole theory and the centre-periphery model. Among these models, the centre-periphery models are emphasised.

The definition of the centre-periphery is attributed to Friedmann (1966) and Wallertstein (1974). According to Friedmann (1966), economic growth and territorial polarisation lead to imbalances, because the periphery is not a single territory, as it is divided into an interior and

an exterior part. The positive impact of the centre is reflected in economic growth in the interior, but the centre has no direct impact on the periphery.

However, according to Wallerstein's (1974) systemic definition, the effects of economic relations cannot be defined by spatial boundaries. Economic, social and political factors can be seen as elements of a so-called global system.

The centre region is characterised by a high density of innovation; a high share of exported innovation; active participation in international trade; an exporter of capital; high wage levels; high labour productivity levels; and a diverse production structure in services, industry, and the political system (Wallerstein, 1993).

The periphery is characterised by low innovation density; a higher share of imported innovation; passive participation in international trade; capital importers; low wage levels; low labour productivity levels; and a lack of diversification in the production structure in areas of agriculture and unstable political systems.

The hierarchical space based on a system of centre-periphery relations is constantly changing in time and space. The interdependencies of the regions in a neighbourhood can be used to explain how the economic space changes, with some regions becoming centres or peripheries (Benedek, 2016).

2.1 Theoretical background of convergence

Today, the analysis of territorial inequalities is necessary because of the effects of crises, wars, and globalisation. Studies focus on regions that have an extremely high or low economic performance.

Convergence is a frequently used term in regional science and aims at achieving a so-called reference point (Gáspár & Ferkelt, 2008). However, it implies cohesion and catching up in the living standards of territorial units (Szanyi, 2018).

The magnitude and temporal variation of spatial inequalities (Kotosz, 2016) has also brought to the fore the possibility of measuring convergence (Gáspár & Ferkelt, 2008).

Baumol's (1986) study is one of the main stages in the evolution of convergence. The study examined the relationship between initial GDP per capita and economic growth over a period of almost 100 years in industrialised countries. Contrary to Baumol's study, Quah (1996) argues

that catching up is not possible for countries with lower income levels (Alexiadis, 2013). Beta convergence is related to the theory of Barro and Sala-i Martin (1992).

Convergence can be divided into three theoretical types. For absolute convergence can be characterized undeveloped spatial endowment; a multiplicity of independent factors; the same equilibrium condition; no correlation between control variables; the difference between spatial units is constant; the measurement instrument is sigma and beta convergence. Conditional convergence includes a multitude of dependent factors; different equilibrium states; control variables requiring correlation; constant difference between regions; while beta convergence and econometric tests as the measurement tools.

Measures of club convergence include the important of initial conditions; a multiplicity of dependent factors; a club-specific equilibrium condition; a constant difference between territorial and beta convergence can be the measurement tool.

3. Methodology

The convergence calculation is based on parametric and non-parametric methods, which include beta and sigma convergence (Kotosz & Ferenci, 2010). Beta and sigma convergence are based on a distribution. Sigma convergence is achieved with decreasing CV (coefficient of variation) (Kotosz, 2016; Szendi, 2016). Sigma convergence focuses on the "similarity" among the territories under study compared to other ones (Szendi, 2016).

The sigma convergence calculation (CV):

$$\mathrm{CV} = \frac{\text{standard deviation}}{\text{mean}}$$

The category of conditional convergence includes beta convergence. Beta convergence is a regression model to measure the rate of catching up (Kotosz, 2016). The regression model is used to analyse the relationship between the annual economic growth rate and the initial GDP per capita over the period. Beta convergence is achieved when the coefficient is negative and a significant relationship between the variables is found (Ferkelt, 2005).

Gamma convergence explores the changes in the ranking of areas relative to a so-called base year (Szendi, 2016). Using gamma convergence, areas that are successfully catching up or lagging are highlighted.

$$y = \frac{\mathrm{var}(\mathrm{RGDPC}_{ti} + \mathrm{RGDPC}_{t0})}{\mathrm{var}(\mathrm{RGDPC}_{t0} * 2)}$$

where RGDPC = GDP per capita number, t = year under analysis, t = base year (Szendi, 2016).

4. Convergence results in Slovakia

Based on previous research and convergence studies, Slovakia's catching-up process after the 2008 crisis is well balanced. Slovakia's GDP per capita (PPP) increased compared to the EU15 average from 2000 to 2015. However, the crisis led to a decline between 2008 and 2009 (Lengyel & Kotosz, 2018). According to research by Győrffy (2021), Slovakia did not catch up with the EU15 average between 2010 and 2015. According to Kotosz & Lengyel's (2018) sigma convergence study, Slovakia's regional inequalities increased from 2000 to 2014.

In the following, my convergence results are presented for NUTS3 level territorial units in Slovakia from 2000 to 2019. The first part of this paper focuses on the beta convergence results, illustrated in Figure 1. Beta convergence was not achieved between 2000 and 2007, but it was achieved from 2008 to 2013 and from 2014 to 2019. The correlation between them is R^2=0.3463 from 2000 to 2007; R^2=0.6349 from 2008 to 2013; R^2=0.05 from 2014 to 2019. My beta convergence results show a decline in regional inequality in Slovakia over the last 20 years.[36]

[36] Due to the distortion effect, Bratislava was not part of the study.

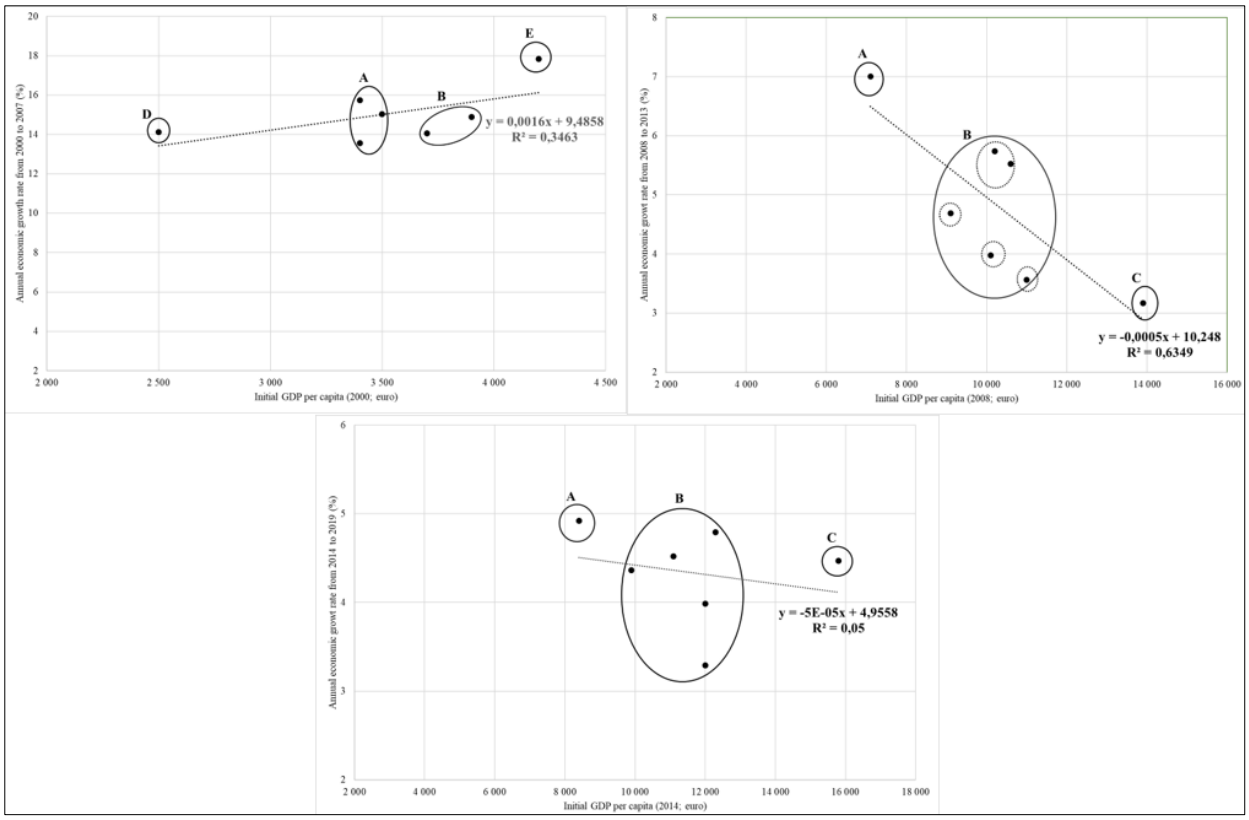

Figure 1: Beta convergence in Slovakia; NUTS3; (2000-2007, 2008-2013, 2014-2019)

Source: own elaboration

The spatial distribution of beta convergence is shown in Figure 2. From 2000 to 2007, the catch-up group (A) includes Zilinsky kraj, Nitriansky kraj and Banskobystricky kraj; the stagnant group (B) includes Kosicky kraj and Trenciansky kraj; the underperformance group (D) includes Presovsky kraj; the stabil performance group (E) includes Trnavsky kraj. The clustering of the regions is similar for the periods from 2008 to 2013 and 2014 to 2019, with Presovsky kraj in the catching-up group (A); Trenciansky kraj, Nitriansky kraj, Zilinsky kraj, Banskobystricky kraj and Kosicky kraj in the stagnant group (B); and Trnavsky kraj in the outstanding group (C).

Figure 2: Spatial distribution of beta convergence in Slovakia; NUTS3; (2000-2007, 2008-2013, 2014-2019)

Source: own elaboration

Sigma convergence was not achieved from 2000 to 2007 (CV increased from 0.14 to 0.22), but it was fulfilled; from 2008 to 2013 (CV decreased from 0.18 to 0.17); from 2014 to 2019 (CV decreased from 0.18 to 0.17). [37] Based on the results of the sigma convergence, it can be shown that in the pre-crisis period, territorial inequalities increased, but that in the period before and after the crisis, territorial inequalities decreased in Slovakia's NUTS3 level areas.

Table 1: Gamma convergence in Slovakia

	sequence 2000 = base period		**sequence 2008**		**sequence 2014**		**sequence 2019**
Trnavský kraj	1	Trnavský kraj	○	Trnavský kraj	○	Trnavský kraj	○
Trenciansky kraj	2	Trenciansky kraj	○	Zilinský kraj	⇧	Zilinský kraj	○
Kosický kraj	3	Zilinský kraj	⇧	Nitriansky kraj	⇧	Nitriansky kraj	○
Nitriansky kraj	4	Nitriansky kraj	○	Trenciansky kraj	⇩	Trenciansky kraj	○
Zilinský kraj	5	Kosický kraj	⇩	Kosický kraj	○	Kosický kraj	○
Banskobystrický kraj	6	Banskobystrický kraj	○	Banskobystrický kraj	○	Banskobystrický kraj	○
Presovský kraj	7	Presovský kraj	○	Presovský kraj	○	Presovský kraj	○
Gamma convergence value:		From 2000 to 2007: 0,98-0,92 From 2008 to 2013: 0,92-0,85 From 2014 to 2019: 0,83-0,83					

Source: own elaboration

[37] Including Bratislava's values, sigma convergence was not achieved from 2000 to 2007 (CV increased from 0.47 to 0.52); from 2008 to 2013 it was not achieved (CV increased from 0.55 to 0.56); from 2014 to 2019 it was achieved (CV decreased from 0.54 to 0.49).

The results of the gamma convergence (table 1.) show the changes in the ranking of Slovakia's NUTS3 regions in terms of GDP per capita. The gamma convergence from 2000 to 2007 is 0.98-0.92; from 2008 to 2013 0.92-0.85; from 2014 to 2019 0.83-0.83. [38]

Table 2: Results of convergence calculations in Slovakia; NUTS3; (2000-2007, 2008-2013, 2014-2019)

Period		Sigma		Beta			Gamma	
		CV		Equation	R^2		Variance value	
2000-2007	Including the capital's values	0,47-0,52	X	Y=0,0008x+9,9467	0,1227	X	0,98-0,95	✓
	Without the capital's values	0,14-0,22	X	Y=0,0016x+9,4858	0,3463	X	0,98-0,92	✓
2008-2013	Including the capital's values	0,50-0,54	X	Y=9E-05x+3,2618	0,1144	X	1-0,95	✓
	Without the capital's values	0,18-0,16	✓	Y=-0,0005x+10,248	0,6349	✓	1-0,92	✓
2014-2019	Including the capital's values	0,54-0,49	✓	Y=1E-06x+3,5984	6E-0,5	X	0,98-1	X
	Without the capital's values	0,18-0,17	✓	Y=-5E-05x+4,9558	0,05	✓	0,98-1	X
2000-2019	Including the capital's values	0,47-0,49	X	Y=0,0003x+6,018	0,0682	X	0,98-089	✓
	Without the capital's values	0,14-0,17	X	Y=0,0028x-2,0842	0,467	X	0,98-083	✓

Source: own elaboration

Table 2 shows the results of the convergence calculations. In the period before and after the crisis, territorial disparities have decreased and there are positive changes in the ranking of regions.

5. Conclusion

The theoretical part of the paper focuses on the centre-periphery models, with a special emphasis on the Friedmann and Wallerstein models. According to the centre-periphery models, positive processes develop in the centre and negative processes in the periphery.

I investigated the spatial inequalities at NUTS3 level in Slovakia over the last 20 years using sigma, beta and gamma convergence calculations. The results of the sigma and beta convergence show that from 2008 to 2019, territorial inequalities decreased, while in the pre-crisis period, territorial inequalities increased. However, the results of gamma convergence show that spatial inequalities have decreased over the whole period examined.

In summary, the 2008 crisis has had a deeper impact on the Trnavsky kray region, where the sectors that are necessary for the economy to function are located. In the post-crisis period,

[38] Including Bratislava values, the gamma convergence value is 0.98-0.95 from 2000 to 2007; 1.00-0.98 from 2008 to 2013; 0.98-1.00 from 2014 to 2019.

this region has not been able to get back on track. In the start of the crisis and in the period that followed, the basic assumption of beta convergence is being realised, as lower income regions have shown more dynamic economic growth.

References

Alexiadis, S. (2013). Convergence clubs and spatial externalities. In Advances in spatial science. https://doi.org/10.1007/978-3-642-31626-5

Barro, R.J. & Sala-i-Martin, X. (1992). Convergence. Journal of Political Economy, 100:2, pp. 223-251.

Baumol, W. J. (1986). Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show? American Economic Review, Vol. 76. No. 5., pp. 1072–108

Benedek, J. (2016). Centrum-periféria elméletek. Észak-magyarországi Stratégiai Füzetek, 13(1), pp. 4-17.

Benedek, J. & Kurkó, I. (2011). Evolution and Characteristics of Territorial Economic Disparities in Romania Theory Methodology and Practice, Vol. 7 (1), pp. 5-15.

Boyle, G.E. & McCarthy, T.G. (1997). Simple measures of convergence in per capita GDP: a note on some futrther international evidence Applied Economic Letters, Vol. 6 (6), pp. 343-347.

Ferkelt, B. (2005). Konvergencia az eurozónában a közös pénz bevezetése előtt és után, EU working papers, Nr. 4, pp. 3–15.

Friedmann, J. (1966). Regional development policy: a case study of Venezuela. MIT Press, Cambridge MA.

Gáspár, A. & Ferkelt, B. (2008). Konvergencia-vizsgálatok az Európai Unióban. EU Working papers, (1. sz.), pp. 35-44.

Győrffy, D. (2021). Felzárkózási pályák Kelet-Közép-Európában két válság között. Közgazdasági Szemle, 68(1), 47-75.

Kotosz, B. (2016). A konvergencia területisége és lokális szintű mérése: elméleti áttekintés. Területi Statisztika, 56, 2, pp.: 139–157, DOI: 10.15196/TS560203

Kotosz, B. & Ferenci, T. (2010). Nemnormális, parametrizált eloszlású valószínűségi változók. Statisztikai Szemle, 88, 7-8, pp.: 803–832.

Kotosz, B. & Lengyel, I. (2018). Térségek konvergenciájának vizsgálata a V4-országokban. Statisztikai Szemle, 96 (11-12): 1069-1090. Go to original source.

Lengyel, I. & Kotosz, B. (2018). Felzárkózás és/vagy távolságtartó követés? A visegrádi országok térségeinek fejlődéséről. Tér és Társadalom, 32(1), 5-26.

Liddle, B. (2010). Revisiting world energy intensity convergence for regional differences Applied Energy, Vol. 87 (10), pp. 3218-3225.

Nagyné Molnár, M. (2007). A területi egyenlőtlenségek főbb összefüggései: In: Regionális gazdaságtan. Szerkesztette: Káposzta József, DE Kiadó, Debrecen, pp. 166-205.

Nemes Nagy, J. (1990b). Területi egyenlőtlenségek dimenziói – Adalékok egy „kvázi-elmélethez", Tér és Társadalom, 4. évf., pp 15-30.

Nemes Nagy, J. (2005). Regionális elemzési módszerek, Regionális tudományi tanulmányok 11., ELTE Regionális Földrajzi Tanszék, MTA-ELTE Regionális Tudományi Kutatócsoport, Budapest

Quah, D. (1996). Regional convergence clusters across Europe. European Economic Review, 40(3–5), 951–958. https://doi. org/10.1016/0014-2921(95)00105-0

Szanyi, M. (2018). Az eltűnt regionális konvergencia nyomában. Változó Európa a változó világban, 187-202

Szendi, D. (2016). Perifériák felzárkózásának esélyei, különös tekintettel Kelet-Közép-Európa két térségére, Miskolc

Vertakova, Y. et al. (2015). The formation of the propulsive industries of economic development acting as the growth poles of regions. Procedia economics and finance, 24, pp. 750-759.

Wallerstein, I. (1974). The Modern World-System. Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century. New York, Academic Press.

Wallerstein, I. (1993). Sistemul mondial modern.Vol. III–IV, Bucureşti, Ed. Meridiane.

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