Comparative Economic Research

Central and Eastern Europe

Volume 27 No. 1/2024

WYDAWNICTWO UNIWERSYTETU ŁÓDZKIEGO

WYDZIAŁ EKONOMICZNO-SOCJOLOGICZNY Uniwersytet Łódzki

COPE Member since 2018 JM13708

Institute of Economics • University of Łódź

Comparative Economic Research

Central and Eastern Europe

Volume 27 No. 1/2024

WYDAWNICTWO UNIWERSYTETU ŁÓDZKIEGO
Łódź 2024

WYDZIAŁ EKONOMICZNO-SOCJOLOGICZNY
Uniwersytet Łódzki

COPE
Member since 2018
JM13708

INITIATING EDITOR
Sylwia Mosińska

TECHNICAL EDITOR
Aleksandra Przybył

COVER DESIGN
Katarzyna Turkowska
efectoro.pl agencja komunikacji marketingowej

Printed directly from camera-ready materials provided to the Lodz University Press

Journal affiliated with the Faculty of Economics and Sociology of the University of Lodz

Published by Lodz University Press
First Edition. W.11365.24.0.C
Printing sheets 23.75

ISSN 1508-2008
e-ISSN 2082-6737

Lodz University Press
90-237 Łódź, 34A Matejki St.
www.wydawnictwo.uni.lodz.pl
e-mail: ksiegarnia@uni.lodz.pl
tel. +48 42 635 55 77

BOARD OF MANAGING EDITORS

Contents

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.01

The Impact of Innovation on Business Development. The Example of Moderate Innovators and the Visegrad Group Countries

Małgorzata Jabłońska https://orcid.org/0000-0003-1465-8818
Ph.D., University of Lodz, Faculty of Economics and Sociology, Department of Finance and Accounting of SMEs
e-mail: malgorzata.jablonska@eksoc.uni.lodz.pl

Abstract

The paper analyzes the relationship between innovation dimensions, according to the European Innovation Scoreboard, and the entrepreneurship rate in a group of moderate innovator countries. Using the Pearson linear correlation, the author conducted a data analysis based on an empirical study using open data from the Summary Innovation Index – European Innovation Scoreboard (SII-EIS) and Eurostat for 2013–2019. This period covers the moment when all the countries of the Visegrad Group (i.e., the Czech Republic, Hungary, Poland, and Slovakia – the V4) were classified into the same innovation group according to EIS. However, due to the volume limitations of the article, it was decided that Moderate Innovators from 2019 would be included in the comparative analysis, i.e., when the V4 were last collectively classified as Moderate Innovators. The results of the research positively verify the initial research hypothesis that the EIS indicators show a different strength of relationships with the entrepreneurship rate in the V4 and among other economies classified as Moderate Innovators (according to SII–2020).
The variables that describe the quantity and quality of entrepreneurs' innovations strongly and positively impact the V4 countries' entrepreneurship rate. In other countries, the variables derived from the investment attractiveness of economies show a significant and positive correlation with the entrepreneurship rate. Based on the analysis of the results, it can be concluded that there is a strong positive correlation between the entrepreneurship rate and the total innovation index, which is compiled each year based on a set of variables for the European Union countries. The study showed that the entrepreneurship rate in these countries is strongly impacted by indicators representing the following groups: Innovators (small and medium-sized enterprises (SMEs) with product or process innovations; SMEs with marketing or organizational innovations,

Received: 8.03.2023. Verified: 22.08.2023. Accepted: 23.01.2024

and SMEs innovating in-house), Attractive research systems (international scientific co-publications), Finance and support (Venture capital expenditures), Firm investments (Enterprises that provide training to develop or upgrade their personnel's ICT skills), and Linkages (Innovative SMEs that collaborate with others). The impact of these factors on the development of entrepreneurship in the V4 means that pro-innovative activities undertaken in operating enterprises strongly correlate with deciding to start one's own business. Therefore, it can be concluded that entrepreneurship in these countries has an entirely different development basis than in other countries that are Moderate Innovators, where the factors mentioned above were irrelevant.

Keywords: innovations, entrepreneurship, moderate innovators, the Visegrad Group, economic development, finance

JEL: G30, G10, K40, O16

Introduction

The literature on the subject continues to try to explain the impact of innovation on new business ventures. Research on the innovativeness of economies is conducted on a large scale in the European Union (EU). One of the main reports showing the state of innovation among European countries is the European Innovation Scoreboard (EIS). The summary innovation index is based on 27 indicators grouped into ten main categories that demonstrate significant innovation differences among the EU countries. These countries are divided into Innovation Leaders, Strong Innovators, Moderate Innovators, and Emerging Innovators. The report for 2020 shows that Visegrad Group countries (i.e., the Czech Republic, Hungary, Poland, and Slovakia – the V4) were Moderate Innovators, along with Cyprus, Croatia, Spain, Lithuania, Latvia, Malta, Slovenia, and Italy. Grouping the V4 into the same category of innovators creates a unique opportunity to conduct a comparative analysis between the dimensions of innovation according to the EIS and the entrepreneurship index. In 2021 and 2022, the V4 countries were in different groups in the innovation ranking. In both years, only the Czech Republic was among the Moderate Innovators; the others had been downgraded to Emerging Innovators (European Commission 2022, pp. 6–7).

The paper analyzes the relationship between the dimensions of innovation (according to the EIS) and the entrepreneurship rate in the group of Moderate Innovators, with the V4 separated for analytical purposes. Using the Pearson linear correlation, the author conducted a data analysis based on an empirical study using open data from the Summary Innovation Index – European Innovation Scoreboard (SII-EIS) and Eurostat for 2013–2019. Based on the preliminary analysis of the research problem, a research hypothesis was formulated. It states that the EIS variables have a different impact on the development of entrepreneurship in the V4 than in other countries classified as Moderate Innovators, according to EIS–2020.

The paper is divided into three parts. Part one presents a short analysis of the literature on the subject describing the impact of innovation on entrepreneurship, understood as the ability to create new business ventures. Part two presents the research method and the results of the Pearson linear correlation between the SII components and the entrepreneurship rate in 2013–2019. Part three presents the conclusions.

Literature review

There are many definitions of innovation (Polverari 2018, p. 5), and innovations can be classified and subdivided into different types in different ways (Wach, Maciejewski, and Głodowska 2022, p. 1048). There is a growing recognition that entrepreneurial employees, or intrapreneurs, are part of the main cast in the story of innovation and economic growth (Elert and Stenkula 2022, p. 1423). Customers' growing expectations drive improvements in products and services, not only in the commercial sector but also in the public sector, provided by local and regional authorities. This contributes to the growing importance of the concepts of innovation and innovativeness (Czupich 2018, p. 17).

Recently, the evolution of economies has accelerated considerably, and Europe is struggling with many problems. The driving force behind further development is innovations that are the best means to put the European economy on the right track and solve social issues in the global economy (Będzik and Gołąb 2021, p. 1). Innovation and identifying its main determinants have been of interest at the EU level since its inception as the European Community. Numerous analyses of European economies have identified innovation as a defining factor in the progress that has enabled the transition to a knowledge-based economy. Many of these studies identified the R&D sector as a vector of economic development because it ensures the transfer of technological innovations to the economy (Dobrota et al. 2019, pp. 174–184) and influences entrepreneurship development, which is stimulated through innovation.

In today's economic reality, entrepreneurship is the key to creating innovation (Pangsy-Kania and Stobiecka 2018, pp. 30–43). In terms of economic practice, innovation means implementing a new or significantly improved product, service or process that has an impact on the development of entrepreneurship (Avram and Hysa 2022, pp. 181–206). Innovation and entrepreneurship are not the same phenomenon, though they may overlap (Kahn 2022, p. 468). A country or region's innovative capacity can be considered its ability to produce and commercialize innovations to drive long-term economic growth and wealth creation (Hudec and Prochádzková 2015, p. 56).

The ongoing economic growth has contributed to changes in the perception of innovation, especially concerning small and medium-sized enterprises, which are its main

carrier. Innovative development is the basis of the competitiveness of modern economies (Ressin 2022, p. 190). Innovation is currently understood as development based on new challenges, particularly regarding changes in technology and workmanship. In a broader sense, innovativeness should be considered the continuous search for solutions whose implementation will contribute to the success of the company in the form of increased sales, increased market share, or increased efficiency. By innovating, companies achieve a competitive advantage in the market.

In recent years, the role of innovations and innovativeness in the development of the economy of the region has been increasingly appreciated compared to that of the country. They are the factors that play a special role in a region's development policy, and their importance is visible in policy documents that set out government policy in the context of a region's long-term development, as well as in EU policy documents.

Innovation and innovativeness are major factors that determine the social and economic development of regions. On a regional level, innovation plays a particularly important role. In recent years, regions have become more important in shaping the socio-politico-economic development of the country. The increasing significance of regions as distinct economic entities is one of the most important phenomena of modern economy (Jabłońska and Fila 2021, p. 44). At a regional level, it seems to be more appropriate to create pro-innovative policies that are correlated with specific conditions of the region. Innovations in the regions are the result of associating information with knowledge and transforming it into new products, services, and market solutions.

Innovation is the driving force of regional development (Klomp and Roelandt 2004, pp. 365–374), contributing to general growth and international competitiveness (Dziuba 2014, p. 225). Therefore, in recent years, entrepreneurship has become one of the most important issues related to the economic growth of regions, alongside competitiveness and innovation (Jabłońska, Dziuba, and Hurak 2018, p. 58). The most important sources of competitive advantage are new and innovative products, services, and production processes (Hudáková and Maroš 2019, p. 147).

These processes would not take place without entrepreneurship, i.e., the creation of new economic entities. Entrepreneurship develops where there are appropriate conditions for it. One of them is the ability to create innovation and transfer it quickly to the economy. A new look at innovation is necessary, and its impact on the development of entrepreneurship should be analyzed from different points of view. For example, if a region is rich in technology, discerning customers, and an educated workforce, it will be suitable for companies to develop new products and services (Teece 2000, pp. 35–54). There is a good chance of stimulating entrepreneurial behavior. The development of entrepreneurship may also be fostered by creating local networks that comprise enterprises, research and development centers, and local and regional business environment institutions (Pater and Lewandowska 2015, p. 32). Science and access to knowledge help

enterprises cooperate, creating conditions conducive to developing knowledge and innovation (Copus, Skuras, and Tsegenidi 2015, pp. 51–82). Another important issue that should be addressed when analyzing the relationship between innovation and entrepreneurship is the differences in economies' regional development (Gossling and Rutten 2007, pp. 253–270). It means that there is a specific space for the development of innovation, regardless of its scale. Consequently, innovation can lead to the dissemination of knowledge.

Over the last three decades, the Visegrad countries have undergone a transformation (Turro, Urbano, and Persi-Oritz 2014, pp. 360–369; Holienka, Pilková, and Ostapenko 2016, pp. 54–63) by strengthening local enterprise, improving the quality of infrastructure, and initiating regional cooperation aimed at strengthening the Central and Eastern European countries economically on the international stage (Będzik and Gołąb 2020, p. 163). The selection of countries in which the investigated regions are located was determined by several factors: all are located in Central and Eastern Europe, and all transformed from a centrally planned economy to a market economy in the early 1990s. They all joined the EU on 1 May 2004, thus becoming beneficiaries of assistance from the Structural Funds or the EU Cohesion Fund, which encouraged the development of entrepreneurship at many levels. It can, therefore, be concluded that all these countries were in a similar situation as regards the conditions for the construction and development of the small and medium-sized enterprises (SME) sector. They are also a separate area of support from the perspective of the EU regional policy (Jabłońska and Fila 2021, p. 2).

The group of Moderate Innovators includes the V4, which are similar in terms of political, legal, and economic convergence due to their membership in the EU. They have common historical features, i.e., they belong to the former Eastern Bloc and have undergone a political transformation. They are also similar in terms of the area they cover on the map of Europe, as they are medium-sized countries. These countries show a relatively high level of entrepreneurship, which may be a lever for developing this region in the future. The increase in R&D expenditures in the V4 in the last five years and the increase in labor costs, combined with still-low productivity, stimulate innovative solutions in the region. However, analysis of the EIS data shows that they still rank relatively low in international innovation rankings compared to the rest of the EU.

Between 2013 and 2019, all V4 countries were classified as Moderate Innovators in the annual innovation report. This situation changed only in 2021 when only the Czech Republic remained a moderate innovator while the other countries were demoted to Emerging Innovators, i.e., among the least innovative countries.

Table 1. V4 countries by innovation level, 2013–2022

Classification Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Emerging Innovators	PL								PL HU SK	PL HU SK
Moderate Innovators	HU SK CZ	PL HR SK CZ	PL HU SK CZ	PL HU SK CZ	PL HU SK CZ	PL HU SK CZ	PL HU SK CZ	PL HU SK CZ	CZ	CZ
Innovation Followers	–	–	–	–	–	–	–	–	–	–
Innovation Leaders	–	–	–	–	–	–	–	–	–	–

Note: CZ – Czech Republic, HU – Hungary, PL- Poland, SK – Slovakia.
Source: own elaboration based on European Commission, Directorate-General for Enterprise and Industry, 2013; 2014; European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2015; 2016; 2017; 2018, 2019; 2020, 2021; European Commission, 2022.

Building a modern economy requires the development of a complete ecosystem of innovation. It provides the ability not only to transfer but primarily to create new technologies, thereby increasing productivity. Meanwhile, both the level of economic productivity that results from technological advancements and the level of capital are relatively low in the Central European countries. This is the legacy of the intermittent history of their statehood, the times of communism, and the relatively brief period of economic transformation in the region (Polska Agencja Rozwoju Przedsiębiorczości 2017, pp. 1–3).

Innovations need an innovative environment supported by the private and public sectors. This includes investment in research and development generated primarily by the private sector, the presence of research institutions and universities, their collaboration with industry, and the protection of intellectual property (Golejewska 2012, p. 98; Levie et al. 2014, pp. 434–444; Holienka, Gál, and Kovačičová 2017, pp. 54–63). Therefore, we should verify which innovation aspects should be strengthened in the V4 to accelerate the generation of new business ventures in the shortest possible time and return to the Moderate Innovators group, which the V4 left two years ago after a lengthy seven-year membership.

Methodology

Theoretical framework

The study uses analytical and descriptive research methods based on the correlation index analysis between 27 EIS indicators aggregated in 10 groups and the entrepreneurship rate from 2013–2019 in countries classified as Moderate Innovators[1]. The analysis uses EIS and Eurostat data, which are complete and comparable in the adopted research period. Table 2 presents a synthetic description of the indicators covered by the study.

Table 2. Indicators that determine the level of the SII index according to the EIS

Groups of indicators	Innovation dimension	Description
	Attractive research systems	This dimension measures the international competitiveness of the science base and includes three indicators: a) International scientific co-publications (per million population); b) Scientific publications among the 10% most cited publications in the world as a percentage of all scientific publications in the country; c) Foreign doctorate students as a percentage of all doctorate students.
	Human resources	a) New doctorate graduates; b) Percentage population aged 25–34 having completed tertiary education; c) Population aged 25–64 participating in lifelong learning.
	Innovation-friendly environment	a) Broadband penetration; b) Opportunity-driven entrepreneurship (years shown refer to three-yearly averages).
	Finance and support	a) R&D expenditure in the public sector; b) Venture capital expenditures.
	Firm investments	a) R&D expenditure in the business sector; b) Non-R&D innovation expenditures; c) Enterprises providing training to develop or upgrade ICT skills of their personnel.
	Innovators	a) SMEs introducing product or process innovations; b) SMEs introducing marketing or organizational innovations; c) SMEs innovating in-house.
	Linkages	a) Innovative SMEs collaborating with others; b) Public-private co-publications; c) Private co-funding of public R&D expenditures.
	Intellectual assets	a) PCT patent applications; b) Trademark applications; c) Design applications.
	Employment impacts	a) Employment in knowledge-intensive activities; b) Employment in fast-growing enterprises in innovative sectors.
	Sales impacts	a) Medium and high technology product exports; b) Knowledge-intensive services export; c) Sales of new-to-market and new-to-firm innovations.

Source: own elaboration based on European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs 2020, p. 8.

1 Group of moderate innovators according to EIS 2020.

The methodology for calculating this indicator is detailed below.

Step 1: Identifying and Replacing Atypical Values (Outliers)

Positive outliers are identified as relative scores that are greater than the mean of all countries plus two standard deviations. Negative outliers are defined as those relative outcomes that are less than the all-country mean minus two standard deviations. These outliers are replaced with the maximum and minimum values observed over all years and for all countries, respectively.

Step 2: Establish a reference year

For each indicator, the reference year is identified based on data availability of at least 75% for all countries.

Step 3: Replace values that are missing.

If there are no data for an intermediate year, we can substitute the value from the previous year. If data for the year at the beginning of the time series are not available, we can replace the missing value with one from the last available year.

Step 4: Determine the maximum and minimum scores

The maximum score is the highest relative score found for the entire period among countries minus any positive outliers. Similarly, the minimum score is the relatively lowest score found for the entire period among all countries, disregarding negative outliers.

Step 5: Data transformation in case of high skewness.

Most of the indicators are fractional indicators ranging from 0% to 100%. For the above indices, the skewness is greater than 1, and the data were transformed using the square-root transformation. The square root transformation uses the square root of the indicator value instead of its original value (European Commission, Directorate-General for Enterprise and Industry 2013, p. 65).

Step 6: Calculating the resized results

The re-scaled values of the relative results for all years are calculated by first subtracting the minimum result from the relative result before dividing the difference between the two by the difference between the maximum and minimum results. The maximum scaled result is then equal to 1, and the minimum scaled result is equal to 0. For positive and negative outliers and small countries, where the value of the relative results is above the maximum result or below the minimum result, the value of the scaled result is set to 1 and 0, respectively.

Step 7: Calculating composite indexes of innovation SII index for each year.

They are calculated as the unweighted average of the re-scaled results for all indicators (Mikołajczyk 2016, p. 113).

The European economies selected for the study were divided into two subgroups. Thus, the following research hypothesis was formulated:

H0: The Innovation Union Scoreboard variables have a different impact on the development of entrepreneurship in the Visegrad Group countries than in other countries included in the group of Moderate Innovators, according to EIS–2020.

The first group includes the V4. The second one comprises other economies classified as Moderate Innovators according to the 2020 EIS ranking (i.e., Cyprus, Greece, Spain, Croatia, Italy, Lithuania, Latvia, Malta, and Slovenia). Entrepreneurship in the surveyed countries was measured using a basic entrepreneurship measure, i.e., entrepreneurship rate (the rate of involvement in new economic ventures). The entrepreneurship rate is the ratio of active enterprises to the number of working-age people.

$$\text{Entrepreneurship rate} = \frac{\text{number of active enterprises}}{\text{number of working} - \text{age people}} \times 100\%$$

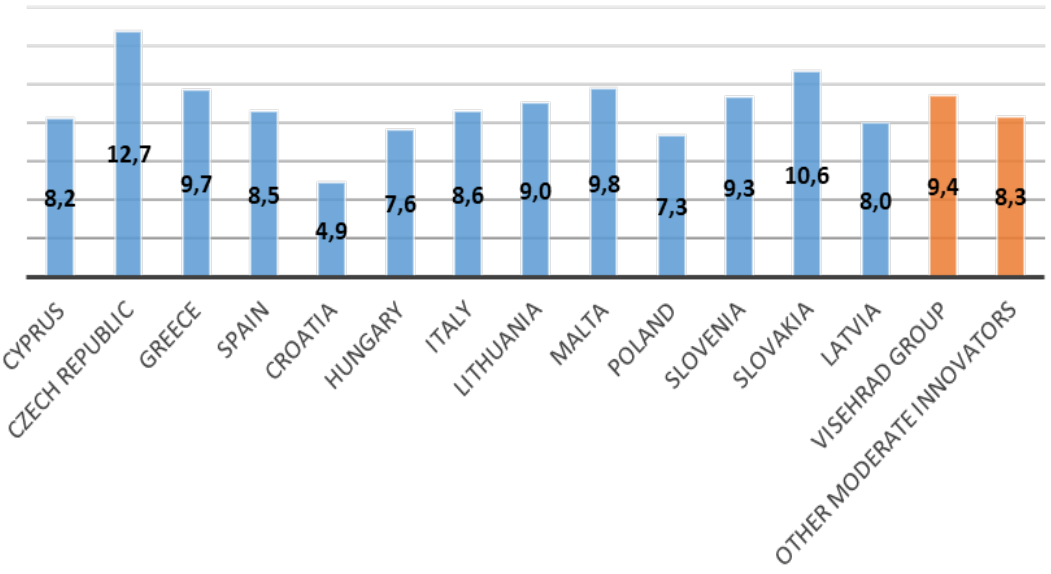

Chart 1. Average level of entrepreneurship rate 2013–2019 and the average for Moderate Innovators (%)

Source: own elaboration based on European Commission 2023; Eurostat n.d., *Population and Demography...*

The chart shows how the average level of the indicator in individual countries developed in 2013–2019. The Czech Republic, Slovakia, and Malta had the highest level among Moderate Innovators. Croatia, Poland, and Latvia are the least enterprising countries. In the analyzed years, the level of entrepreneurship in the V4 was above the average

for Moderate Innovators, at 9.5%. It means that as many as 95 people (on average) per 1000 working-age inhabitants run their own businesses. The rate of entrepreneurship in the other group of Moderate Innovators is significantly lower, at 8.3%, indicating that, on average, 83 people per 1,000 working-age people run their own businesses.

Correlation analysis is commonly used in economic sciences because it answers the following questions: a) Are there any dependencies between the analyzed variables? b) What is their strength? and c) What is their form and direction? The Pearson correlation coefficient describes the rectilinear relationships between the investigated variables of measurable features. This linear correlation implies that an increase in the value of one variable causes a proportional change, either increase or decrease, in the mean values of the other variable across the entire range of variability. The correlation coefficient is a unitless quantity, i.e., independent of the units used for variables X and Y (Skrabek 2013, p. 133). The strength of the linear relationship between two variables is the correlation coefficient from sample R. It assumes values from the closed interval <–1; 1>. A value of –1 indicates a perfect negative correlation (the points are exactly on the downward straight line). A value of 1 indicates a perfect positive correlation (the points are exactly on an upward straight line). A value of 0 means there is no linear correlation.

The formula used to calculate the correlation coefficient is as follows:

$$R = \frac{\sum\left(X_i - \overline{X}\right)\cdot\left(Y_i - \overline{Y}\right)}{\sqrt{\left(x_i - \overline{X}\right)^2 - \left(Y_i - \overline{Y}\right)^2}}.$$

X_i and Y_i denote the values of the variables x and y, respectively, while $\overline{X}$ and $\overline{Y}$ are their mean values.

The correlation scale used in the study is given in Table 3.

Table 3. Correlation scale used in the data analysis

The level of the Pearson correlation coefficient	Strength of the correlation
Rxy = – 1 Rxy = 1	Perfect negative correlation Perfect positive correlation
–1 ≥ Rxy ≥ – 0.9 1 ≤ Rxy ≤ 0.9	Very high negative Very high positive
–0.7 ≥ Rxy ≥ –0.5 0.7 ≤ Rxy ≤ 0.5	High negative High positive
–0.5 Rxy ≥ – 0.3 0.5 ≤ Rxy ≤ 0.3	Negative significant Positive significant

The level of the Pearson correlation coefficient	Strength of the correlation
−0.3 ≥ Rxy ≥ 0 0.3 ≤ Rxy ≤ 0	Negative weak Positive weak
Rxy = 0	No correlation

Source: Skrabek 2013, p. 133.

Empirical data and analysis

The analysis of the correlation between the factors that directly affect the level of innovation in the surveyed countries (according to the EIS) and the entrepreneurship index revealed significant differences between the V4 and the other Moderate Innovators. We will now focus on the most important differences that result from the analysis of the Pearson linear correlation index between the previously described variables in the V4 and the other Moderate Innovators.

Firstly, attention should be paid to the strength and direction of the correlation between the entrepreneurship rate and the innovation index value calculated annually for each country. In general, there is a significant and positive correlation between the innovation index (SII) and the entrepreneurship rate in the Moderate Innovators. In the V4 countries, this correlation is stronger, at 0.89. In other countries, this parameter is slightly lower at 0.61. The obtained indicators, with t (70) = 6.8 for countries outside the V4 and t (30) = 8.15613 for the V4, both with a two-sided critical area of p = 0.0000, indicate a high level of significance. These results indicate with a high probability that the entrepreneurship rate increases along with the total innovation index. It is reflected in the literature on the subject. Numerous studies and analyses indicate a strong connection between innovation and entrepreneurship. The main relationships between the entrepreneurship rate and the SII indicators will be described later in the article.

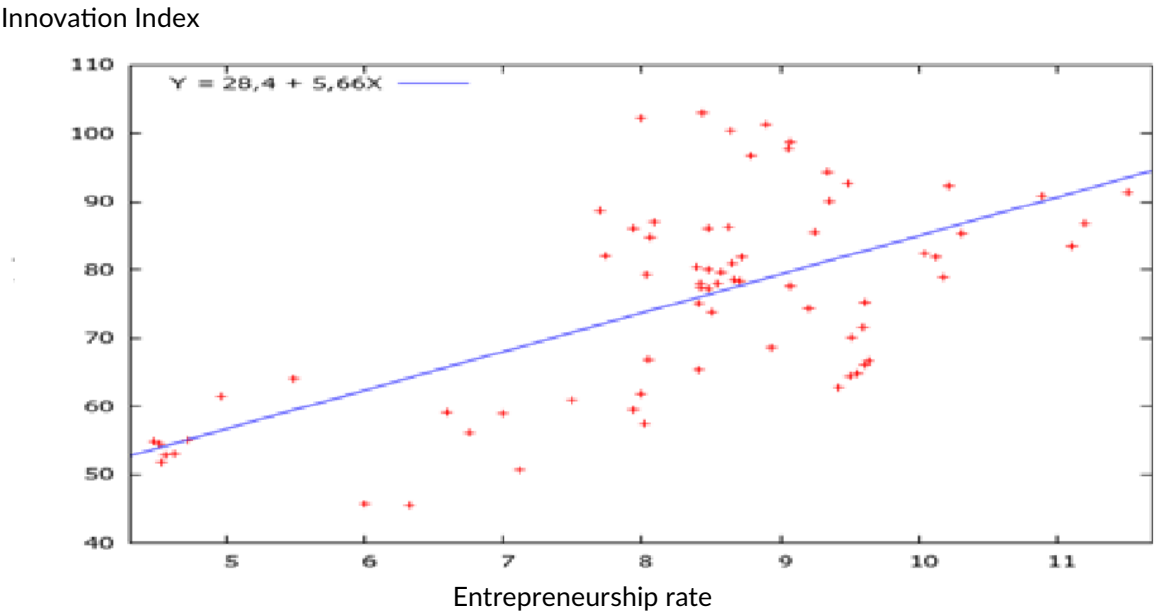

Chart 2. The spread between the entrepreneurship rate and the innovation index in Cyprus, Greece, Spain, Croatia, Lithuania, Latvia, Malta, Italy, and Slovenia. On the chart: Innovation Index and Entrepreneurship rate (with linear regression), 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., *Population and Demography*..., using the GRETL program.

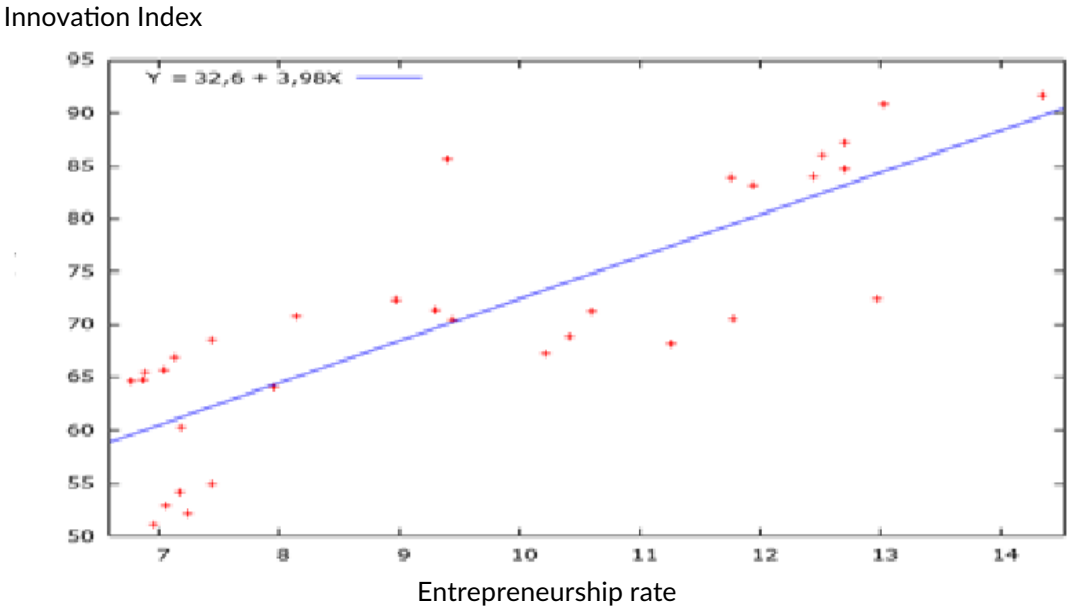

Chart 3. The spread between the entrepreneurship rate and the innovation index in the Visegrad countries. On the chart: Innovation Index and Entrepreneurship rate (with linear regression), 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., *Population and Demography*..., using the GRETL program.

Secondly, among the non-V4 Moderate Innovators, there is a significant and positive correlation between the entrepreneurship rate, but only with employment impact (0.62) and design application index (0.51). In both cases, the established significance level is high (design application – t (70) = 3.73005, with the two-sided critical area p = 0.0004 and employment impact – t (70) = 5.44963, with the two-sided critical area p = 0,0000). In the remaining cases, the correlation, both negative and positive, is weak and insignificant.

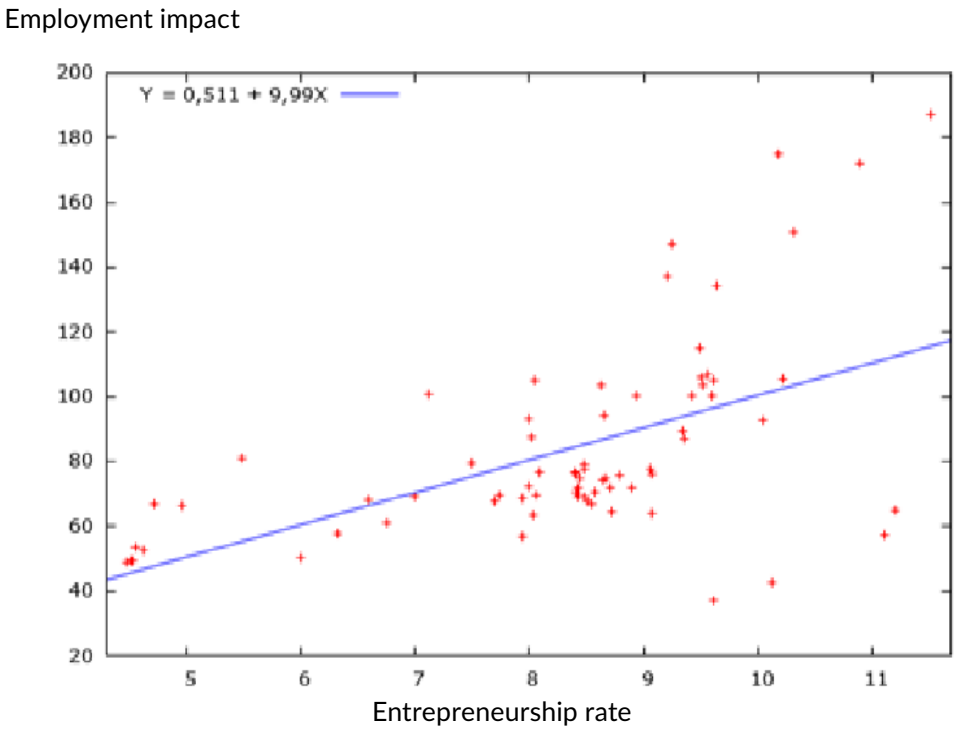

Chart 4. The spread between the entrepreneurship rate and the employment impact in Cyprus, Greece, Spain, Croatia, Lithuania, Latvia, Malta, Italy, and Slovenia; 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., *Population and Demography...*, using the GRETL program.

In the V4, other variables that determine innovation have an impact on the level of entrepreneurship. The following factors show a very strong positive correlation with the entrepreneurship rate: Enterprises that provide ICT training (0.94), Innovative SMEs that collaborate (0.95), Innovators (0.95), International co-publications (0.90), and Marketing or organizational innovators (0.93). By contrast, there is a strong negative correlation between the entrepreneurship rate and the Venture Capital variable (–0.87). The scatterplots for each variable are shown below. All variables are significant (Venture Capital – t (30) = –6.00103, with the two-sided critical area p = 0.0000; Enterprises that provide ICT training – t (30) = 6.84629, with the two-sided critical area p = 0.0000; Innovative SMEs that collaborate – t (30) = 10.2497, with a two-sided critical area p = 0.0000; Innovators – t (30) = 6.79268, with a two-sided critical

area p = 0.0000; International co-publications – t (30) = 9.94413, with a two-sided critical area p = 0.0000; Marketing or organizational innovators – t (30) = 3.82877, with a two-sided critical area p = 0.0006).

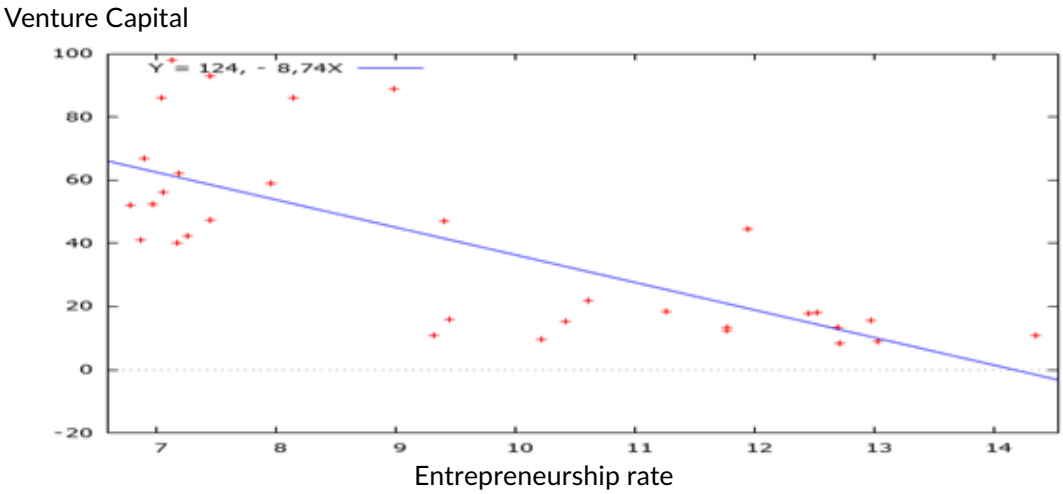

Chart 5. The spread between the entrepreneurship rate and the variable venture capital in the Visegrad countries; 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., *Population and Demography*..., using the GRETL program.

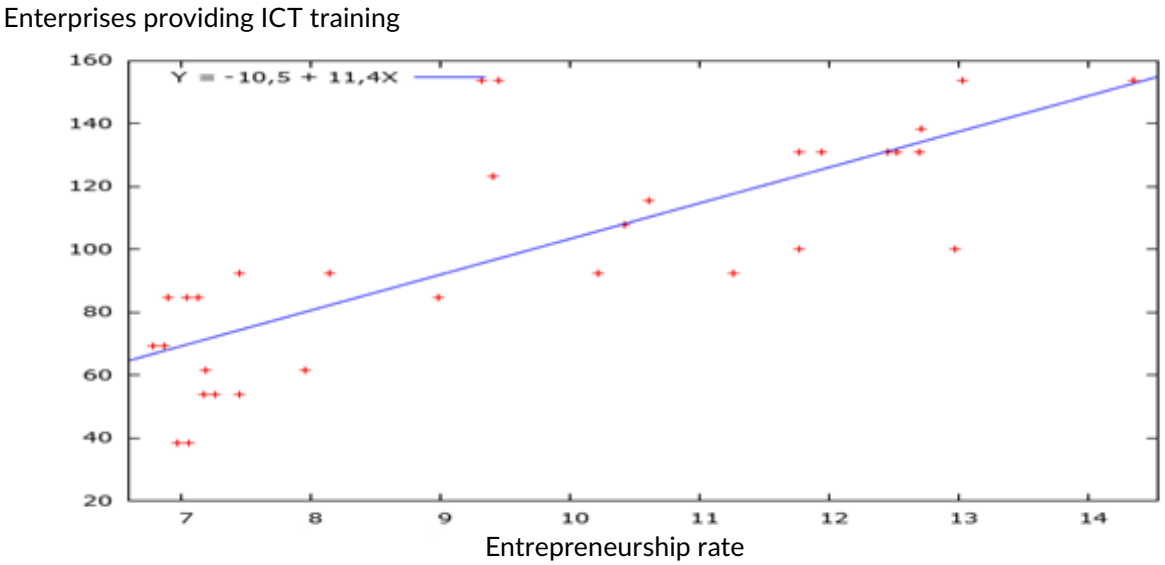

Chart 6. The spread between the entrepreneurship rate and the variable enterprises that provide ICT training in Visegrad countries; 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., Population and Demography..., using the GRETL program.

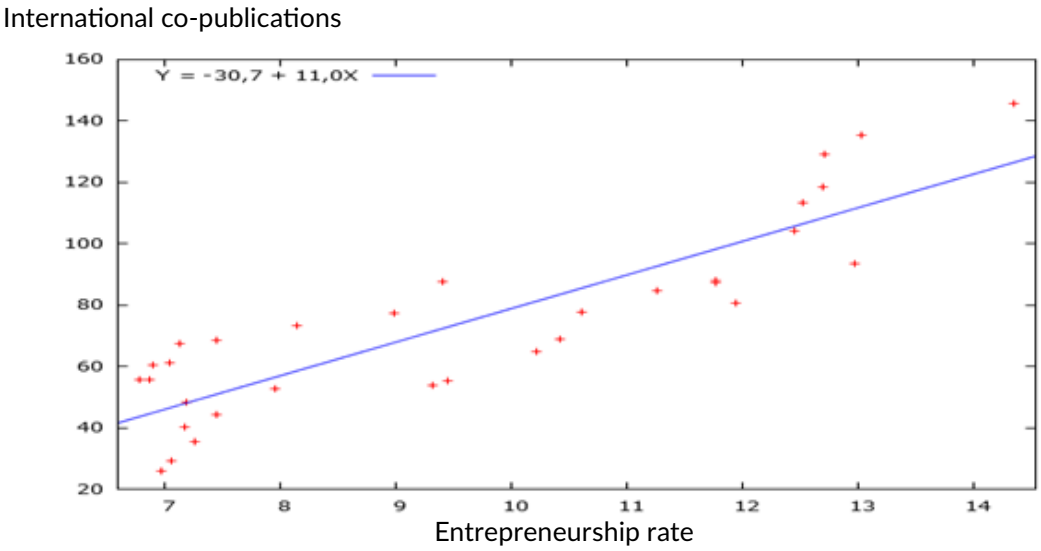

Chart 7. The spread between the entrepreneurship rate and the variable international co-publications in the Visegrad countries, 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., *Population and Demography*..., using the GRETL program.

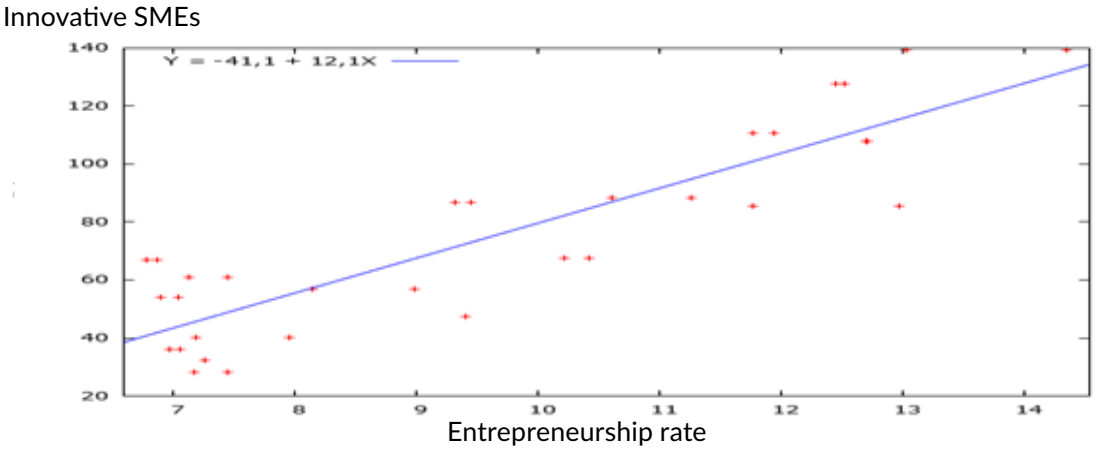

Chart 8. The spread between the entrepreneurship rate and the variable innovative SMEs that collaborate in the Visegrad countries; 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., Population and Demography..., using the GRETL program.

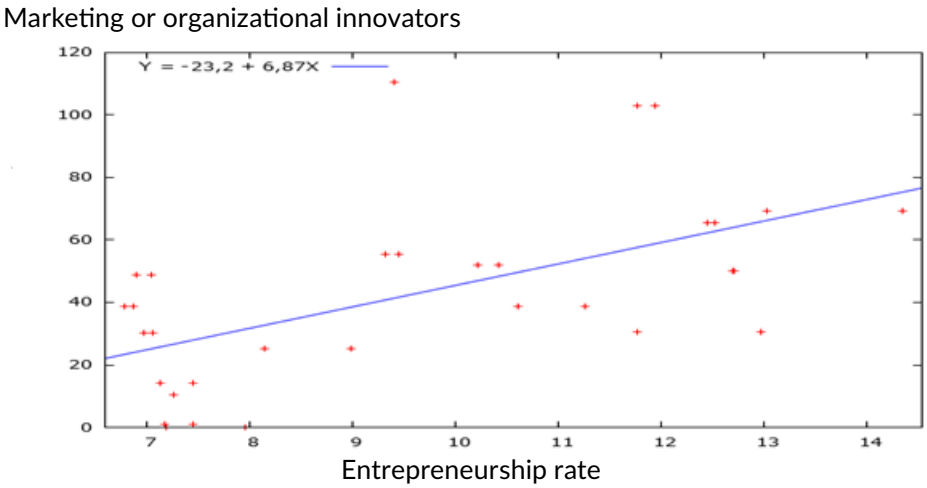

Chart 9. The spread between the entrepreneurship rate and the variable marketing or organizational innovators in the Visegrad Group countries; 2013–2019

Source: own elaboration based on European Commission 2023; Eurostat n.d., *Population and Demography…*, using the GRETL program.

The correlations showed that in the V4, entrepreneurship develops the fastest when the indicators from the "innovators" group increase (SMEs with product or process innovations, SMEs with marketing or organizational innovations, SMEs that innovate in-house). Knowledge-based entrepreneurship, using tools such as innovation, is now an indispensable factor in companies' success. In this context, reference should be made to the achievements of Schumpeter, one of the precursors of considerations on innovation. He points out that when creating "new combinations" of means of production, the entrepreneur is of key importance because his ingenuity allows him to organize a new enterprise. The following have a slightly weaker (positive) influence on the entrepreneurship index: attractive research systems (international scientific co-publications, top 10% most cited publications, foreign doctorate students); firm investments (R&D expenditure in the business sector, non-R&D innovation expenditures, enterprises that provide training to develop or upgrade their personnel's ICT skills), human resources (new doctorate graduates, population aged 25–34 with tertiary education, lifelong learning) and linkages (innovative SMEs that collaborate with others, public-private co-publications, private co-funding of public R&D expenditures).

The values of these correlation indicators are certainly influenced by global competition. They simultaneously shorten product life cycles while using more and more advanced technologies. The functions of enterprises, especially those reliant on extensive knowledge, are experiencing increasing internationalization. The following key indicators are relatively weak in the countries under study: employment impacts (Employment in knowledge-intensive activities, Employment in fast-growing enterprises in innovative sectors), finance and support (R&D expenditure in the public sector, Venture capital expenditures), an innovation-friendly environment (Broadband penetration,

Opportunity-driven entrepreneurship), and sales impacts (Medium and high-tech product exports, Knowledge-intensive services exports, Sales of new-to-market and new-to-firm product innovations).

The above indicators' weak impact on entrepreneurship in the V4 countries is because those economies basically have no high-technology sectors. They are among the countries with the highest share of basic research in the structure of current expenditure on R&D, which is characteristic of less developed countries, where R&D is largely state-financed. The last analyzed group of indicators is intellectual assets (PCT patent applications, Trademark applications, Design applications). Their impact on entrepreneurship was negatively insignificant (–0.10). Despite the increase in patents, the V4 countries still have among the highest shares of basic research in the structure of current expenditure on R&D.

As previously stated, the SII measures have a different impact on entrepreneurship in countries outside the V4. The article highlights the significance of "employment impact" factors on entrepreneurship within the remaining Moderate Innovator countries. Nevertheless, Cyprus, Greece, Spain, Croatia, Lithuania, Latvia, Malta, Italy, and Slovenia saw entrepreneurship increase with a moderate increase in the following SII variables: Attractive research systems, Human resources, Innovation-friendly environment, Intellectual assets and sales impacts. All indicators for Moderate Innovators are below the EU average, except for overall R&D innovation expenditure in the SME sector. However, companies in these regions are innovative not thanks to the development of their own innovative products and technologies but the use of innovations developed elsewhere. This is indicated by low expenditure on research and development itself and high expenditure on innovative products. The following factors show virtually no correlation: Finance and support, Linkages, and Firm investments. Investments in sectors related to computer production, electronics, biotechnology, medicine, and industrial automation are burdened with high risk, which makes it difficult to find an investor. Nevertheless, they are important sectors that stimulate economic growth and innovation.

Conclusions

The correlation analysis investigated the strength of relationships between EIS indicators and the entrepreneurship rate between 2013 and 2019 in moderate innovator countries. The V4 countries were separated for analytical purposes, it made it possible to positively verify the main research hypothesis that the EIS variables have a different impact on the development of entrepreneurship in the V4 than in other countries classified as Moderate Innovators according to IUS–2020.

Based on the analysis of the results, it can be concluded that:

- The correlation between the entrepreneurship rate and the total innovation index, which is compiled each year based on a set of variables for the EU countries, is positive and strong. Particularly strong relationships can be observed in the V4, characterized by a higher level of entrepreneurship than other Moderate Innovators. The relationship between the entrepreneurship rate and the innovation index at the regional level is particularly interesting because a high entrepreneurship rate characterizes countries with regions classified as strong innovators (e.g., the Prague region in the Czech Republic in the V4, and in the remaining Moderate Innovators, the Kriti region in Greece, and the Venice region in Italy).
- The relationship between the entrepreneurship rate and the variables defined by the EIS in the V4 is significantly different than in other Moderate Innovators.
- The entrepreneurship rate in these countries is strongly impacted by indicators representing the following groups: Innovators (SMEs with product or process innovations; SMEs with marketing or organizational innovations and SMEs innovating in-house), Attractive research systems (international scientific co-publications, Finance and support (Venture capital expenditures), Firm investments (Enterprises that provide training to develop or upgrade their personnel's ICT skills), and Linkages (Innovative SMEs that collaborate with others). The impact of these factors on the development of entrepreneurship in the V4 means there is a strong correlation between pro-innovative activities undertaken in operating enterprises and deciding to start one's own business. Therefore, it can be concluded that entrepreneurship in these countries has an entirely different development basis than in other moderate innovator countries, where those factors were irrelevant.
- It is justified to accept the argumentation that the development of entrepreneurship in the Visegrad countries is based on knowledge to a greater extent than in other Moderate Innovators. Physical and financial capital plays a minor role, and the key resource is knowledge combined with the ability to adapt and cooperate quickly (as indicated by a strong negative correlation with the Venture Capital variable).
- The responsible development of entrepreneurship needs many changes in the innovation support system in the V4. An active economic policy is required to build a competitive and innovative economy. The priority should be high-quality education and science, a friendly regulatory environment for business, a complete financial market, and direct public financing or incentives for the private sector to invest in research and development and new technologies.
- In other moderate innovator countries (i.e., Cyprus, Spain, Croatia, Lithuania, Latvia, Malta, Italy, and Slovenia), a significant and positive correlation between the variables mentioned in the previous parts of the study and the entrepreneurship rate occurs

only in Intellectual assets (Design applications variable) and employment impact (variables: Employment in knowledge-intensive activities[2] and Employment in fast-growing enterprises in innovative sectors.

- The development of entrepreneurship in these countries may largely depend on their investment attractiveness, i.e., on the possibility of attracting large innovative ventures from fast-developing sectors of the economy. In any case, new technologies and the creation of a supporting ecosystem of a modern economy are indispensable for creating new economic ventures. Five essential perspectives must also be included: science and research, entrepreneurs, investment funds, human resources, and a transparent legal environment.
- Differences in the approach to entrepreneurship may result from economic differences in the analyzed countries. The Visegrad countries, unlike other innovators, are not focused on tourism. Therefore, innovations that stimulate entrepreneurship in these countries arise "inside" enterprises, initiating the development of entrepreneurship "outside". The other Moderate Innovators (e.g., Croatia, Italy, Spain, Malta, Cyprus) are dominated by the tourism sector. Innovation is not a domain of the tourism sector. Therefore, creating new enterprises in these economies will only be weakly correlated with innovation.
- The Czech Republic maintained a stable Moderate innovators position in the ranking due to the improvement of SME performance through product and business process innovations and venture capital spending.

Performance for SMEs with business process innovations and employment in innovative enterprises – these indicators largely determine the return of Poland, Hungary and Slovakia to Moderate Innovators in the following years.

References

Avram, G., Hysa, E. (2022), *Education, Knowledge and Data in the Context of the Sharing Economy*, [in:] V. Česnuitytė, A. Klimczuk, C. Miguel, G. Avram (eds.), *The Sharing Economy in Europe. Developments, Practices, and Contradictions*, Palgrave Macmillan, Cham, pp. 181–206, https://doi.org/10.1007/978-3-030-86897-0_9

Będzik, B., Gołąb, S. (2020), *Selected determinants of innovation potential in the agricultural sector in the Visegrad Countries*, "Zagadnienia Ekonomiki Rolnej/Problems of Agricultural Economics", 364 (3), pp. 162–179, https://doi.org/10.30858/zer/126152

Będzik, B., Gołąb, S. (2021), *Social Capital and Innovation in the Countries of the Visegrad Group*, https://doi.org/10.36689/uhk/hed/2021-01-006

2 Employment in knowledge-intensive activities – Employment in knowledge-intensive activities (percentage of total employment).

Copus, A., Skuras, D., Tsegenidi, K. (2015), *Innovation and Peripherality: An Empirical Comparative Study of SMEs in Six European Union Member Countries*, "Economic Geography", 84 (1), pp. 51–82, https://doi.org/10.1111/j.1944-8287.2008.tb00391.x

Czupich, M. (2018), *The innovative potential of the Visegrad Group regions*, "University Economic Bulletin", 38, pp. 14–22, https://doi.org/10.31470/2306-546X-2018-38-14-22

Dobrota, C.E., Marcu, N., Siminica, M., Netoiu, L.M. (2019), *Disparities, gaps and evolution trends of innovation, as a vector of economic development, in the countries of the European Union*, "Romanian Journal of Economic Forecasting", 22 (4), pp. 174–184.

Dziuba, R. (2014), *Rola innowacyjności i konkurencyjności w rozwoju regionu Bałkanów Zachodnich na przykładzie Czarnogóry*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin.

Elert, N., Stenkula, M., (2022), *Intrapreneurship: Productive and Non-Productive*, "Entrepreneurship Theory and Practice", 46 (5), https://doi.org/10.1177/1042258720964181

European Commission, Directorate-General for Enterprise and Industry (2013), *Innovation Union Scoreboard 2013*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2769/72530 (accessed: 19.11.2022).

European Commission, Directorate-General for Enterprise and Industry (2014), *Innovation Union Scoreboard 2014*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2769/88936 (accessed: 19.11.2022).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2015), *Innovation Union Scoreboard 2015*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2769/247779 (accessed: 19.11.2022).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2016), *European Innovation Scoreboard 2016*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2873/84537 (accessed: 19.11.2022).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2017), *European innovation scoreboard 2017,* Publications Office, Luxemburg, https://ec.europa.eu/docsroom/documents/24829 (accessed: 19.11.2022).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2018), *European innovation scoreboard 2018*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2873/66501 (accessed: 19.11.2022).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2019), *European innovation scoreboard 2019*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2873/877069 (accessed: 19.11.2022).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2020), *European innovation scoreboard 2020*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2873/6063 (accessed: 19.11.2022).

European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2021), *European innovation scoreboard 2021*, Publications Office, Luxemburg, https://data.europa.eu/doi/10.2873/725879 (accessed: 19.11.2022).

European Commission (2022), *Innovation Union Scoreboard Report 2022*, Luxemburg, https://data.europa.eu/doi/10.2777/572275 (accessed: 20.09.2023).

European Commission (2023), *EIS 2023 – RIS 2023*, https://ec.europa.eu/research-and-innovation/en/statistics/performance-indicators/european-innovation-scoreboard/eis (accessed: 21.08.2023).

Eurostat (n.d.), *Population and Demography. Database*, https://ec.europa.eu/eurostat/web/population-demography/demography-population-stock-balance/database (accessed: 21.08.2023).

Golejewska, A. (2012), *Innowacyjność a konkurencyjność regionalna krajów Grupy Wyszehradzkiej w latach 1999–2008*, "Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego", 19, pp. 93–115, https://doi.org/10.24917/20801653.19.7

Gossling, T., Rutten, R. (2007), *Innovation in Regions*, "European Planning Studies", 2 (15), pp. 253–270, https://doi.org/10.1080/09654310601078788

Holienka, M., Gál, P., Kovačičová, Z. (2017), *Drivers of Student Entrepreneurship in Visegrad Four Countries: Guesss Evidence*, "Central European Business Review", 6 (2), pp. 54–63, https://doi.org/10.18267/j.cebr.180

Holienka, M., Pilková, A., Ostapenko N. (2016), *Entrepreneurial Environment and Economic Growth: What Affects the Productiveness of Business Activity at Macro Level?*, [in:] T. Dudycz, G. Osbert-Pociecha, B. Brycz (eds.), *The Essence and Measurement of Organizational Efficiency*, Springer International Publishing, Switzerland, pp. 79–95, https://doi.org/10.1007/978-3-319-21139-8

Hudáková, J., Maroš, M., (2019), *Innovation and competitiveness in regions of the Slovak Republic*, Sborník příspěvků, Velké Bílovice 12–14.06.2019, https://doi.org/10.5817/CZ.MUNI.P210-9268-2019-18

Hudec, O., Procházdzková, M. (2015), *Visegrad Countries and Regions: Innovation Performance and Efficiency*, "Quality Innovation Prosperity/Kvalitainovacia Prosperita", 19 (2), https://doi.org/10.12776/qip.v19i2.593

Jabłońska, M., Fila, J. (2021), *Conditions for development of entrepreneurship in regions of Visegrad Group countries*, "Prague Economic Papers", 30 (4), pp. 470–488, https://doi.org/10.18267/j.pep.777

Jabłońska, M., Dziuba, R., Hurak, I. (2018), *Czynniki rozwoju przedsiębiorczości w Polsce Wschodniej*, "Wiadomości Statystyczne", 10 (689), GUS, Warszawa.

Kahn, K.B., (2022), *Innovation is not entrepreneurship, nor vice versa*, "Journal of Product Innovation Management", 39 (4), pp. 467–473, https://doi.org/10.1111/jpim.12628

Klomp, L., Roelandt, T. (2004), *Innovation Performance and Innovation Policy: The Case of the Netherlands*, "De Economist", 152 (3), pp. 365–374, https://doi.org/10.1023/B:ECOT.0000036576.40882.13

Levie, J., Autio, E., Acs, Z., Hart M. (2014), *Global entrepreneurship and institutions: an introduction*, "Small Business Economics", 42, pp. 437–444, https://doi.org/10.1007/s11187-013-9516-6

Mikołajczyk, B. (2016), *Obraz innowacyjności gospodarek w krajach UE mierzony wskaźnikiem SII*, "Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach", No. 282.

Pangsy-Kania, S., Stobiecka, J. (2018), *The impact of the selected determinants of creating entrepreneurship and innovation in EU countries on economic growth*, "European Union.pl/Unia Europejska.pl", 249 (2), pp. 30–43.

Pater, R., Lewandowska, A. (2015), *Human capital and innovativeness of the European Union regions*, "The European Journal of Social Science Research", 28 (1), pp. 31–51, https://doi.org/10.1080/13511610.2014.962487

Polska Agencja Rozwoju Przedsiębiorczości (2017), *Visegrad Group countries as a European centre of innovationan ecosystem and financing*, Warszawa.

Polverari, L. (2018), *Innovation as a regional development driver: Necessary shift or policy misdirection?*, "European Policy Research Paper", 102.

Ressin, M. (2022), *Product Innovation Paradigm of Modern Entrepreneurship*, "Quality Innovation Prosperity/Kvalita Inovácia Prosperita", 26 (3), https://doi.org/10.12776/qip.v26i3.1752

Skrabek, W.W. (2013), *Wybrane zagadnienia metodologii nauk społecznych*, Naukowe Wydawnictwo Piotrkowskie, Piotrków Trybunalski.

Teece, D.J. (2000), *Strategies for Managing Knowledge Assets: The Role of Firm Structure and Industrial Context*, "Long Range Planning", 33 (1), pp. 35–54, https://doi.org/10.1016/S0024-6301(99)00117-X

Turro, A., Urbano, D., Peris-Ortiz, M. (2014), *Culture and innovation: The moderating effect of cultural values on corporate entrepreneurship*, "Technological Forecasting and Social Change", 88, pp. 360–369, https://doi.org/10.1016/j.techfore.2013.10.004

Wach, K., Maciejewski, M., Głodowska, A., (2022), *U-Shaped Relationship in International Entrepreneurship: Entrepreneurial Orientation and Innovation as Drivers of Internationalisation of Firms*, "Technological and Economic Development of Economy", 28 (4), pp. 1044–1067, https://doi.org/10.3846/tede.2022.16690

Wpływ innowacji na rozwój biznesu. Przykład umiarkowanych innowatorów i krajów Grupy Wyszehradzkiej

W artykule przeanalizowano związek pomiędzy wymiarami innowacyjności według European Innovation Scoreboard, a wskaźnikiem przedsiębiorczości w grupie krajów umiarkowanych innowatorów. Wykorzystując korelację liniową Pearsona, autor przeprowadził analizę danych opartą na badaniu empirycznym z wykorzystaniem otwartych danych z Sumarycznego Indeksu Innowacji – European Innovation Scoreboard (SII-EIS) oraz Eurostatu za lata 2013–2019. Okres ten obejmuje moment, w którym wszystkie kraje Grupy Wyszehradzkiej (tj. Czechy, Węgry, Polska i Słowacja – V4) zostały zaliczone do tej samej grupy innowacji według EIS. Ze względu jednak na ograniczenia objętościowe artykułu zdecydowano, że do analizy porównawczej zostaną uwzględnieni Umiarkowani Innowatorzy z 2019 r., czyli z okresu, w którym V4 ostatni raz były łącznie klasyfikowane jako Umiarkowani Innowatorzy. Wyniki badań pozytywnie weryfikują wyjściową hipotezę badawczą, że wskaźniki EIS wykazują różną siłę powiązań ze wskaźnikiem przedsiębiorczości w krajach V4 oraz wśród innych gospodarek zaliczanych do kategorii Umiarkowanych Innowatorów (wg SII-2020). Zmienne opisujące ilość i jakość innowacji przedsiębiorców silnie i pozytywnie wpływają na poziom przedsiębiorczości krajów V4. W pozostałych krajach zmienne pochodzące z atrakcyjności inwestycyjnej gospodarek wykazują istotną i dodatnią korelację ze wskaźnikiem przedsiębiorczości. Na podstawie analizy wyników można stwierdzić, że istnieje silna dodatnia korelacja pomiędzy wskaźnikiem przedsiębiorczości, a wskaźnikiem innowacyjności ogółem, który co roku zestawiany jest na podstawie zestawu zmiennych dla krajów Unii Europejskiej. Badanie wykazało, że na wskaźnik przedsiębiorczości w tych krajach duży wpływ mają wskaźniki reprezentujące następujące grupy czynników: innowatorzy (małe i średnie przedsiębiorstwa (MŚP) posiadające innowacje produktowe lub procesowe; MŚP posiadające innowacje marketingowe lub organizacyjne oraz MŚP wprowadzające innowacje we własnym zakresie; atrakcyjne systemy badawcze (międzynarodowe współpublikacje naukowe (Andersson, Ejermo, 2004)); finansowanie i wsparcie (nakłady na kapitał wysokiego ryzyka), inwestycje firmowe (przedsiębiorstwa zapewniające szkolenia w celu rozwijania lub podnoszenia umiejętności swoich pracowników w zakresie ICT) oraz powiązania (innowacyjne MŚP współpracujące z innymi). Wpływ powyższych czynników na rozwój przedsiębiorczości w krajach V4 powoduje, że działania proinnowacyjne podejmowane w działających przedsiębiorstwach silnie korelują z podjęciem decyzji o rozpoczęciu własnej działalności gospodarczej. Można zatem stwierdzić, że przedsiębiorczość w tych krajach ma zupełnie inne podstawy rozwoju niż w pozostałych krajach będących Umiarkowanymi Innowatorami, gdzie powyższe czynniki nie miały znaczenia.

Słowa kluczowe: innowacje, przedsiębiorczość, umiarkowani innowatorzy, Grupa Wyszehradzka, rozwój gospodarczy, finanse

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.02

A Comparative Analysis of Key Integration Blocks

Leszek Jerzy Jasiński https://orcid.org/0000-0001-5724-5568
Ph.D., Full Professor at the Warsaw University of Technology, Warsaw, Poland, e-mail leszek.jasinski@pw.edu.pl

Abstract

Why is integration progressing successfully in some parts of the world but not in others? Why are only some integration blocks hugely important for member countries? And why this is not the case globally? This article provides a comparative analysis of international economic structures, aiming to identify the factors that contribute to the validity and effectiveness of integration.

The article examines eight economic blocks: the European Union, the Agreement between the United States of America, the United Mexican States and Canada, the Southern Common Market, the Association of Southeast Asian Nations, the Euroasian Economic Union, the South Asian Association for Regional Cooperation, the African Union, and the Regional Comprehensive Economic Partnership. We take into account five stages of integration: free trade area, customs union, single market, economic union, and monetary union. To understand the progress of integration, one must consider a number of developments and indicators. The coefficient of economic gravity, which we describe in this paper, is a convenient method to find out how important integration structures are for contracting states.

Keywords: integration block, economic gravity, stage of integration, economic coefficient

JEL: F10, F14

Received: 25.02.2022. Verified: 8.07.2023. Accepted: 21.12.2023

Introduction

Our objective is to find a measure of how strong integration blocks are today. Are they merely political arrangements, or are they well-built economic structures? If they are real economic powers, they are important for all sides concerned. All the evidence points to integration blocks being different from each other. The question is how big these differences are. This will be measured with a tool described in this text.

Integration blocks and stages of integration

The subject of our analysis is the following integration blocks:

- the European Union (EU): built by 27 European states,
- the Agreement between the United States of America, the United Mexican States, and Canada (USMCA): the USA, Mexico, and Canada,
- the Southern Common Market (MERCOSUR): Argentina, Brazil, Paraguay, Uruguay, and Venezuela (suspended),
- the Association of Southeast Asian Nations (ASEAN): Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Phillippines, Singapore, Thailand, and Vietnam,
- the Euroasian Economic Union (EEU): Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia,
- the South Asian Association for Regional Cooperation (SAARC): Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka,
- the African Union (AU): 55 African states; no state on the continent is outside the AU,
- the Regional Comprehensive Economic Partnership (RCEP): Australia, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Myanmar, New Zealand, the Philippines, Singapore, South Korea, Thailand, and Vietnam.

This is not a comprehensive list of all integration blocks that were in force in the first decades of the 21st century. The number of free trade areas is very large, and many of them are alleged constructions. The group of eight structures chosen for this paper may shape the global economy of tomorrow, or at least they seem to have such a chance now. These blocks are formed by states which already heavily influence the international economic stage, and this is what makes this research interesting (Carlsnaes, Risse, and Simmons 2002).

To complete the area of analysis, we must first define the stages of integration we will discuss (Blank, Clausen, and Wacker 1998). International economics usually defines

more than five stages of integration, although five is sufficient for this paper. The next stage should come provided the previous one has already been implemented with success. The first stage is a foundation for all others, and if it is not well set, the subsequent stages do not have enough ground to function properly. We will mention the following economic arrangements:

- FTA (*free trade area*): where the elimination of tariffs and import quotas takes place,
- CU (*customs union*): where a common external tariff is set up,
- SM (*single market*): where the free movement of capital, labour, and services is started,
- EcU (*economic union*): where a common economic policy and transnational economic standards are implemented in many areas, but not all of them,
- CU (*monetary union*): where a common currency and a joint monetary policy are living realities (Winters 1991).

Economic theory makes it clear that integration is not just a trade unification, although in many cases, it does nothing more than facilitate trade (Machlup 1977). All advanced stages of integration need a proper trade basis (Jovanovich 1998).

What makes an integration block effective? Is it when its base, i.e., trade, is well-shaped? There are many answers to these questions (Daimov 2008). To have a successful monetary union, four conditions, which lead to the real convergence of economies, are especially important:

- the trade cycles of the countries concerned converge,
- partners are competitive enough to get rid of exchange rates,
- the public finance systems demonstrate the capacity to run a reliable stabilisation policy,
- the unified market is an economic fact (Jasiński 2021).

Trade blocks, namely free trade areas, customs unions, and single markets, serve as a starting point for further stages of integration. Without them, an economic or monetary union can become a soft solution for the participating countries. The following three conditions are vital for trade integration and, in the long run, they lead to advanced practices:

- a high level of gravity, which is the economic force that works for the mutual attraction of trade partners; for this purpose, a coefficient of economic gravity is used,
- a high revealed trade dependence, i.e., the share of inter-block trade in every partner country's foreign trade as a whole,
- member states' openness to foreign trade, measured by comparing their exports to GDP.

If these three conditions are met, integration can accelerate significantly. It is not driven by the desires or cravings of politicians but rather a necessity for the contracting states. Three conditions indicate the significance of a trade bloc for all parties involved in a multinational deal and when member states are collectively committed to maintaining its viability. If this does not happen, a trade block loses its relevance and does not garner significant attention from governments. The later stages of integration lose their justification and should not be implemented. A block that falls far from meeting these three conditions can become a political, not an economic, initiative with little valuable contribution to the global economy.

The second and third conditions mentioned above are easy to understand and explain why they are included in our analysis. What economic gravity is and how it can be measured with a special coefficient will be described in the next sections of the paper (Jasiński 2018).

The Advancement of present-day integration blocks

The following table gives a comprehensive view of what stages were already reached by the integration blocks in this article. The declared objectives of, for example, the EU and RCEP are quite different, as is their *acquis communautaire*. The EU's intentions go beyond being merely an economic bloc; in contrast, the RCEP is expected to evolve into more of a free trade area, with this transformation projected to occur in approximately 20 years. There is also a big difference between the EU, Mercosur, and the AU (Pinder and Usherwood 2013).

Table 1. Stages of integration in the most important blocks

Blocks	FTA	CU	SM	EcU	MU
EU	Yes	Yes	Yes	Yes	Yes
USMCA	Yes	No	No	No	No
MERCOSUR	Yes	Yes	Proposed	No	No
ASEAN	Yes	No	Proposed	Proposed	Proposed
EEU	Yes	Yes	Yes	Proposed	Proposed
SAARC	Yes	Proposed	Proposed	No	No
AU	Yes	Proposed	Proposed	Proposed	Proposed
RCEP	Proposed	No	No	No	No

Source: author's elaboration.

There are big differences between the eight blocks, and in many cases, the political declarations are not in line with current political and economic action. This is why a delay in implementing what was agreed in an international treaty can be quite big. There is always a danger that time will change the political will to keep to commitments made some years ago. Another problem is that the economies of integration blocks' member states are, in some cases, not fully market systems. In some cases, government powers are much bigger than in a typical mixed economy, reducing the utility and importance of integration agreements.

RCEP is a cooperation platform for a vital component of the global economy, with its signatories accounting for approximately 30 per cent of global GDP. This new arrangement aims to become a free trade area within 20 years, starting from 2022, eliminating up to 90 per cent of import tariffs. However, whether RCEP will fully function as a free trade area in the years to come remains to be seen. RCEP is not yet an operative zone of this kind. It comprises China, Japan and the ASEAN area, and from the point of view of its economic structure, it is not a typical integration block. This three-component structure is reinforced by significant partners: Australia, South Korea, and New Zealand. For years, China did not sign any free trade agreements. However, this changed, and as of January 2023, there are now 17 deals of this kind in force, and RCEP seems to be China's most important trade arrangement. However, time will tell how important it really is.

There is no doubt that the EU is the most advanced integration structure worldwide (McCormick 2014). No other structure follows, or sometimes even tries to follow, the European integration pattern. Their plans are not as far-reaching. Consequently, in some cases, member states may not be required to fulfil advanced requirements and stages of integration.

Economic gravity coefficient: definition

The coefficient we introduce measures the economic proximity between the economies of a given group of states that form an integration block. How big is the force that drives these states to enhance mutual relations?

This indicator will represent the outcome of m criteria, which make the gravity force bigger, and m criteria, which are expected to work in the opposite direction. The number of economic areas under investigation is n. The Economic Gravity Coefficient (EGC) for areas $A_1,\ldots, \mathrm{A}_n$ is as follows

$$R\left(A_1,\ldots, \mathrm{A}_n\right)=\frac{\sum_{\mathrm{j}=1}^{n} p_j V_j}{\sum_{\mathrm{j}=1}^{n} q_j W_j},$$

where V_1,..., V_m and W_1,..., W_m are partial indicators, making the coefficient grow or decline respectively, and p_1,..., p_m, W_1,..., W_m are weights

$$0 \leq p_j, q_j \leq 1, \sum_{j=1}^{m} p_j = \sum_{j=1}^{m} q_j = 1.$$

The job of weights is to strengthen or weaken certain criteria. They do not have to be of the same importance in the analysis. If weights p_j and q_j are all equal, they can be omitted.

How should we define partial indicators V_j and W_j? Let u_{j1},..., u_{jn} inform us about the position of a given area from the point of view of criterion *j* (*j* = 1, ..., *m*). We obtain an *mxn* dimensional matrix $\left[u_{ji}\right]$ for all criteria and areas. The partial indicator V_j, which makes the gravity grow, will be the following:

$$V_j = \frac{1}{n} \sum_{i=1}^{n} \frac{u_{ji}}{P_j},$$

where:

$$P_j = M_j - N_j$$

$$M_j = \max\left\{u_{j1},...,u_{jn}\right\}$$

$$N_j = \min\left\{u_{j1},..., vu_{jn}\right\}$$

M_j is the maximal value for criterion *j*, and N_j the minimal value. This peak value cannot be crossed by elements of the matrix $\left[u_{ji}\right]$. Indicators W_j, which make the gravity weaker, are defined analogously.

Many economic variables can serve as particular criteria for the EGC. This analysis uses six. Three of them are designed to support EGC growth, while the remaining three are intended to have a suppressing effect. They are:

- V_1 – the country's propensity to trade, i.e., the export growth rate divided by the GDP growth rate; the higher the indicator, the better it is for the EGC,
- V_2 – the share of trade inside the group; if this indicator grows, so does the EGC,
- V_3 – the total imports as a per cent of the GDP of a given country; the higher the indicator, the better it is for the EGC,
- W_1 – the average distance between the chosen states; if this indicator grows, the EGC declines,

- W_2 – the competitiveness of a given economy; the World Competitiveness Ranking can be useful (*World Competitiveness Ranking*, n.d.); the higher the indicator, the worse it is for the EGC,
- W_3 – the rating of sectorial structures; the Index of Economic Complexity was applied (Hausmann et al. 2012); the higher the indicator, the worse it is for the EGC.

We did not include GDP as a partial indicator. There is some similarity between GDP and mass, which is important in physics when discussing gravity. This was done because big and small economies often engage in trade and seek improved institutional access to foreign markets. In many cases, it does not matter whether the economy and GDP are big or small; in both situations, they find it advantageous to join an integration block.

The indicator we have just defined is a sum of the contributions of the countries concerned. Every country influences the total in its own way. This contribution depends on partial indicators. They are usually different from each other, but some of them, i.e., the share of trade inside the group and the average distance between the chosen states, are the same for all countries concerned. If we compare the EGC for different blocks, all partial indicators are not at the same level.

It is no surprise that two indicators, the geographical distance between countries and customs protection, work against economic gravity. We are also of the opinion that the sectorial structures of countries must be complementary to expand trade. The Index of Economic Complexity is a good tool to make objective evaluations.

The EGC was presented as an unweighted arithmetic average. All partial indicators affect the synthetic indicators with the same force. However, this can be changed if we conclude that some partial indicators are more important than others. In practice, there are two versions of the EGC: unweighted and weighted.

Our coefficient was defined for a specific time, namely a year. It means that it can change every year, although one should not expect big differences from year to year to arrive. Despite this, it is a good choice to use an average for a few years in the EGC rather than data for a single year.

We have suggested a tool to measure the economic gravity that is easy to interpret and comment on (Hamanaka 2009; Ekanayake, Mukherjee, and Veeramacheneni 2010; van Bergeijk and Brakman 2010; Shepherd 2013; Kabir, Salim, and Al-Mawali 2017). The calculations required to get statistical results are time-consuming to run because of the extensive data collection process. However, the general idea of the coefficient is simple. We think that there should be minimal complexity associated with discussing economic interdependence, especially when looking for measurements of the phenomenon.

The Economic gravity coefficient: Integration blocks

We are now ready to implement the new analytical tool that makes it possible to compare the integration blocks we chose earlier. Averages from 2015–2019 were the basis of our research. Despite many turbulences, this was a time of great stabilisation in the world economy. This is why we wanted to omit the influence of the COVID–19 pandemic and the 2022 Russian invasion of Ukraine and get a view of a stable global economy, at least for a number of years. The data we used are now historical, which is standard in economics and statistics. To have a new picture of economic ties, one needs a new period of stable structures in the global economic system – once again, a time free of trade and investment shocks. Naturally, it is possible to find the EGC for any single year, but this result will quickly lose its usefulness for predictions and conclusions about the future.

Table 2 presents the EGC for the trade blocks under consideration. The results are weighted and unweighted measures. Any set of weights is debatable; nevertheless, it is difficult to claim that all partial indicators are equally important. These remarks do not apply to the unweighted EGC.

Table 2. The weighted and unweighted Economic Gravity Coefficient for the main integration blocks, 2015–2020

Blocks	Weighted EGC	Unweighted EGC
EU	1.33	1.11
USMCA	1.66	1.64
MERCOSUR	0.77	0.83
ASEAN	1.09	1.06
EEU	1.04	1.31
SAARC	0.98	1.08
AU	0.89	0.91
RCEP	1.10	1.08

Source: author's elaboration.

It is not surprising that the EGC is highest in the case of USMCA. Canada and Mexico together account for a third of US exports, much more than China. As regards US imports, China is number one, but the share of its two neighbours is also high. More than 70 per cent of Canadian and Mexican exports are US-oriented. The same is not true of imports, however. So, there is no doubt that the legal arrangement for trade within the North American triangle was necessary for all sides concerned.

The EU member states trade mainly with each other or European non-members. The share of exports and imports from the block is relatively small. Before the EU was established and expanded, trade inside the area was already huge. The new integration arrangements made it much bigger.

At its inception, RCEP was not an advanced trade block, and it is not clear when it will become a full free trade area. Currently, China is the main trade partner of the ASEAN countries, as well as Indonesia, Malaysia, Singapore, and Thailand. However, this is not true of Vietnamese exports. China is also a main import partner for Japan. The bulk of Australia's exports and imports are with China, and the same is true of South Korea. The trade inside the ASEAN is relatively big.

The problem of the South Asian Association for Regional Cooperation is that trade relations between India and Pakistan, the countries that dominate this structure, are limited. Big neighbours are often not close economic partners. For example, Sri Lanka trades with India heavily, but not India with Sri Lanka.

The African Union was started to integrate countries which, from a geographical trade structure perspective, have little in common with their continental partners. Egypt, Nigeria and South Africa, the largest economies in Africa, have few trade ties inside the continent. Big trade exchanges between African countries are rare.

MERCOSUR faces the same problem. Brazil is the main trade partner for Argentina but not vice versa. Meanwhile, for Uruguay, Brazil – the largest state in the region – is important, as is China. The Latin American countries trade mainly with China, the USA and Europe. Mexico is the exception – it is US-oriented.

The countries of the EEU are not the main trade partners of Russia. The only exceptions are, to some extent, Armenia and Belarus. Russia is important for Kazakhstan in exports, but not in imports. From an economic exchange perspective, the EEU and facilitating trade do not seem to be a necessity for member states. All these comments describe the situation before the 2022 war against Ukraine.

The gravity model does not take into consideration that foreign trade in some EEU countries is highly influenced by the government's political decisions. This means there is both economic and political gravity.

To better understand what the EGC is and how it works, we have made similar calculations for a number of economic groups which are not integration blocks. One can expect that, in these cases, the values of the EGC will be high. The results are given in Table 3.

Table 3. The weighted and unweighted Economic Gravity Coefficient for the integration blocks, 2015–2020

Group of countries	Weighted EGC	Unweighted EGC
Eurozone	1.42	1.13
EU6*	1.82	1.43
Vysegrád group	1.79	1.40
Scandinavian countries	2.11	1.63
BENELUX	1.44	1.16
UK and Ireland	1.63	1.25
Spain and Portugal	1.61	1.23

* 6 first member states (Belgium, France, Germany, Italy, Luxembourg, Netherlands).
Source: author's elaboration.

All cases included in Table 3 are indeed examples of very strong gravity, which is what one could expect and what did happen. We have chosen groups of many countries and two pairs of countries. The data in Table 3 can serve as a reference to convince us that economic gravity in trade blocks is sometimes very strong but sometimes weak. That was the case for some blocks, and was also seen in Table This is what we intended to get when looking for a gravity indicator.

The Economic dependency ratio

The Economic Dependency Ratio (EDR) measures the strength of the interconnection between two areas. This measure should not be overly complex, as it could make it challenging to provide a clear and convincing interpretation of its subject for analysis. Naturally, the EDR will not be the same as the EGC. The new indicator should also be easy to calculate, which was not the case of the EGC.

In practice, the trade dependency of a small country on a much larger country can lead to two situations: A stronger partner wants to buy products from a weaker partner, or the weaker partner is more active in finding ways to buy abroad. This leads to the supply effect and the influence effect, respectively (Hirschman 1945). Both effects are difficult to measure; the EDR is an attempt to get the necessary information on this point.

We will consider two indicators: the share of area A_1 in the foreign trade of area A_k, and the share of foreign trade in the GDP of area A_k. An economist can intuitively conclude that the EDR of area A_k on area A_1 will usually be not equal the EDR of area

A_1 on area A_k. This asymmetry is a fundamental characteristic of the EDR concept. The EDR is not reversible. Now, let us look for the definition.

The EDR of area A_k on area A_1 is as follows

$$ED(A_k, A_1) = \sqrt{u_{k1} \cdot w_k},$$

where u_{k1} is the average of shares of area A_1 in the exports and imports of area A_k, and w_k is the average of the rates of exports and imports to the GDP of area A_k. To get the averages, we need observations from a number of years, as we did using the EGR. The first multiplier above signifies the importance of one partner for another; the second multiplier signifies the importance of external trade as a whole for the reference economy. The geometrical mean we use lets us avoid very small values of an indicator.

The bigger $ED(A_k \cdot A_1)$, the stronger the dependence of area A_k on area A_1. It is now clear that the measure we defined is not convertible. Economic knowledge does not suggest that the economic dependence of area A_k on an area A_1 should be as high as the dependence of area A_1 on area A_k. It means we have received the following:

$$ED(A_k, A_1) \neq ED(A_1, A_k).$$

Table 4 includes the EDRs for pairs of countries or for a country and a certain block. In all cases, it is reasonable to assume that there are close economic ties, at least in one direction. This research shows how big the EDR can be in extreme situations, which is also helpful to understand the values of the EGC in Table 3.

Table 4. The Economic Dependency Ratio, 2015–2019

Area A_k	Area A_1	Dependency	
		A_k on A_1	A_1 on A_k
Canada	United States	0.43	0.11
China	United States	0.17	0.13
China	Japan	0.10	0.16
Argentina	Brazil	0.16	0.09
Belarus	Russia	0.53	0.09
Russia	Ukraine	0.08	0.10
France	Germany	0.20	0.18
Austria	Germany	0.35	0.13
Ireland	United Kingdom	0.26	0.08

Area A_k	Area A_1	Dependency	
		A_k on A_1	A_1 on A_k
Spain	Portugal	0.13	0.30
Czechia	Slovakia	0.24	0.36
Germany	Poland	0.13	0.34
Poland	Russia	0.15	0.08
United States	European Union	0.14	0.15
Russia	European Union	0.28	0.10

Source: author's elaboration.

In many cases, a significant asymmetry is observed in the results, as expected. Let us repeat that the economic dependence of a given area on another area is not as high as the dependence in the opposite direction. The inequality of EDRs is especially big for pairs of countries of divergent economic sizes, especially divergent GDPs.

Our suppositions on bilateral relations between particular countries were verified by the empirical research, and the results are generally in line with expectations. For example, Canada's trade dependence on the USA is three times bigger than the dependence of the USA on Canada. The EDR shows Canada needs the USA as a market for its exports. The dependence of Argentina on its main trade partner, Brazil, is bigger than the inverse relation. For Brazil, the main trade partners are China and the USA, not Argentina. The interdependence of the United States and the European Union is shown to be small, which is caused mainly by the small share of trade in the GDP of both subjects. The same situation can be observed for three other pairs: Czechia–Slovakia, Ireland–the United Kingdom, and Austria–Germany.

The introduced indicator helps to analyse trade relations but not the capital links. To some extent, merchandise trade can be substituted by the foreign direct investment. Because of this, the EDR is not a full presentation of economic relations between countries.

Conclusions

The indicator that shows the strength of an integration block provided evidence that the eight economic blocks (the European Union, the Agreement between the United States of America, the United Mexican States and Canada, the Southern Common Market, the Association of Southeast Asian Nations, the Euroasian Economic Union, the South Asian Association for Regional Cooperation, the African Union and the Regional

Comprehensive Economic Partnership), are different from each other. Thus, the consequences of integration in all these cases will not be the same.

There is no doubt that the EU is a strong economic and integration structure, and new initiatives in this area are not very important for the participating parties. The economic dependence between the countries of the world is also differentiated and, in every case, is not the same.

We did not start this paper with any hypothesis on economic relations between countries. Because of this, our job was not to prove anything. Despite this, we can say that the economic intuition and *a priori* expectations were, in many cases, in line with the results of the statistical analysis.

References

Bergeijk, P.A.G. van, Brakman, S. (ed.) (2010), *The Gravity Model in International Trade*, Cambridge University Press, Cambridge.

Blank, J.E., Clausen, H., Wacker, H. (1998), *Internationale ökonomische Integration: von der Freihandelszone zur Wirtschafts- und Währungsunion*, Vahlen, München.

Carlsnaes, W., Risse, T., Simmons, B.A. (2002), *Handbook of International Relations*, SAGE Publications, London, https://doi.org/10.4135/9781848608290

Daimov, R.T. (2008), *Modelling international economic integration: an oscillation theory approach*, Trafford, Victoria.

Ekanayake, E.M., Mukherjee, A., Veeramacheneni, B. (2010), *Trade Blocks and the Gravity Model: A Study of Economic Integration among Asian Developing Countries*, "Journal of Economic Integration", 25 (4), pp. 627–643, https://doi.org/10.11130/jei.2010.25.4.627

Hamanaka, S. (2009), *The Building Block versus Stumbling Block. Debate of Regionalism: From the Perspective of Service Trade Liberalization in Asia*, "Journal of World Trade", 43 (4), pp. 873–891, https://doi.org/10.54648/TRAD2009034

Hausmann, R., Hidalgo, C., Bustos, S., Coscia, M., Simoes, A., Yildirim, M.A. (2012), *The Atlas of Economic Complexity*, The Observatory of Economic Complexity, Harvard.

Hirschman, A.O. (1945), *National Power and the Structure of Foreign Trade*, University of California Press, Berkeley.

Jasiński, L.J. (2018), *Potencjał i rozwój. Organizacja społeczeństwa i technika a stan gospodarki*, Centrum Europejskie Natolin, Warszawa.

Jasiński, L.J. (2021), *Finanse współczesne. Wybrane zagadnienia*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa,

Jovanovich, M. (1998), *International Economic Integration. Limits and Prospects*, Routledge, London.

Kabir, M., Salim, R., Al-Mawali, V. (2017), *The gravity model and trade flows: Recent developments in econometric modeling and empirical evidence*, "Economic Analysis and Policy", 56, pp. 60–71, https://doi.org/10.1016/j.eap.2017.08.005

Machlup, F. (1977), *A History of Thought on Economic Integration*, Columbia University Press, New York, https://doi.org/10.1007/978-1-349-03171-9

McCormick, J. (2014), *Understanding the European Union: A Concise Introduction*, Macmillan, New York.

Pinder, J., Usherwood, S. (2013), *The European Union: A Very Short Introduction*, Oxford University Press, Oxford, https://doi.org/10.1093/actrade/9780199681693.001.0001

Shepherd, B. (2013), *The Gravity Model in International Trade. A User Guide*, United Nations, New York.

Winters, L.A. (1991), *International Economics*, Routledge, London.

Analiza komparatywna głównych bloków integracyjnych

Dlaczego procesy integracyjne w niektórych częściach świata posuwają się w korzystny sposób do przodu, co gdzie indziej nie ma miejsca? Dlaczego niektóre bloki integracyjne są ważne dla krajów, które do nich należą, a nie dzieje się to na całym świecie? Artykuł zawiera komparatywną analizę międzynarodowych struktur gospodarczych, której celem jest wskazanie, co czyni integrację istotną i efektywną.
Przedmiotem badania jest osiem bloków: Unia Europejska, umowa Stany Zjednoczone–Meksyk–Kanada, Wspólny Rynek Południa, Stowarzyszenie Narodów Azji Południowo-Wschodniej, Euroazjatycka Unia Gospodarcza, Południowoazjatyckie Stowarzyszenie Współpracy Regionalnej, Unia Afrykańska i Regionalne Kompleksowe Partnerstwo Gospodarcze. Autor rozpatruje pięć szczebli integracji: strefę wolnego handlu, unię celną, jednolity rynek, unię ekonomiczną i unię monetarną. Aby dobrze zrozumieć postęp integracji, trzeba brać pod uwagę wiele zjawisk i opisujących je wskaźników. Współczynnik grawitacji ekonomicznej jest dogodnym sposobem określenia znaczenia struktur integracyjnych dla umawiających się krajów.

Słowa kluczowe: blok integracyjny, grawitacja ekonomiczna, szczebel integracji, współczynnik ekonomiczny

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.03

Comparing the Efficiency of European Banking Sectors from the Financialisation Perspective Using the DEA Method

Tomasz Grzegorz Florczak https://orcid.org/0000-0002-9111-3400
Ph.D., University of Lodz, Faculty of Economics and Sociology, Institute of Finance, Lodz, Poland
e-mail: tomasz.florczak@uni.lodz.pl

Iwona Dorota Czechowska https://orcid.org/0000-0002-8051-5324
Ph.D., Associate Professor at the University of Lodz, Faculty of Economics and Sociology
Institute of Finance, Lodz, Poland, e-mail: dorota.czechowska@uni.lodz.pl

Adam Kucharski https://orcid.org/0000-0001-8699-7566
Ph.D., University of Lodz, Faculty of Economics and Sociology, Institute of Logistics and Informatics, Lodz
Poland, e-mail: adam.kucharski@uni.lodz.pl

Joanna Stawska https://orcid.org/0000-0001-6863-1210
Ph.D., University of Lodz, Faculty of Economics and Sociology, Institute of Finance, Lodz, Poland
e-mail: joanna.stawska@uni.lodz.pl

Sophia Lobozynska https://orcid.org/0000-0001-5483-6864
Professor, Ivan Franko National University of Lviv, Ukraine, e-mail: lobozynska.sophia@yahoo.com

Abstract

Research background: The importance of the financial sector for the real economy has increased as there has been a transition from industrial capitalism to financial capitalism in recent years. The increasing importance of the financial sector is referred to as financialisation, and it is undoubtedly associated with finance, financial operations, or an increase in the importance of profits generated by financial activities. Financialisation is a long-term process characterised by the growth of the banking sector.

Received: 10.02.2023. Verified: 1.08.2023. Accepted: 23.01.2024

Purpose of the article: This article compares the effectiveness of banking sectors in the European Union (EU) countries from the financialisation perspective.
Methods: The study determined the efficiency of the banking sectors for the 28 EU countries using an input-oriented, non-radial BCC model in 2017 and assessed changes in the efficiency of the entities studied using the Malmquist index between 2008 and 2017.
Findings & value added: With certain outlays and effects, the banking sectors of seven countries were effective in 2017 from the financialisation perspective: Cyprus, Denmark, France, Luxembourg, Malta, Sweden, and the United Kingdom. The effectiveness of individual inputs for the banking sectors from each country was then determined, and benchmark leaders were identified. The analysis of the dynamics of changes in the efficiency of the banking sectors showed that Sweden had the highest values of the Malmquist index between 2008 and 2017 (where efficiency increased by 37.7%).

Keywords: banking sector, efficiency, financialisation, DEA

JEL: G21, N20

Introduction

The search for the sources of the 2007–2008 financial crisis[1] has increased interest in the relationship between the financial sphere and the real economy. A concept that explains such links is financialisation, which is connected with the characteristics of the financial sector (in which financialisation is visible).

Financialisation is most often defined as the growth of the financial sector in relation to the real manufacturing sector (Stockhammer 2012). In the literature, this is described as the transition of the economy from industrial capitalism to financial capitalism (van der Zwan 2014). The dominance of the financial sector is evident through the growing role of financial motives, financial markets, and financial institutions in the functioning of national economies and the international economy (Epstein 2005). There is an emerging trend of profiteering in the economy, especially through financial channels and not primarily from the use of productive activities (Krippner 2011).

The term financialisation first appeared in the early 1990s (Vercelli 2013). The intellectual pioneer in identifying this process is Magdoff (Magdoff and Foster 2014), who noted that capital shifted to the financial sphere due to reduced investment opportunities in the productive sphere (Franc-Dąbrowska 2019). Financialisation, alongside globalisation, became part of the neoliberal doctrine in which the market played a unique role. The financial market is characterized as a realm of perfect competition, efficiency, stability, self-regulation, wealth generation, and the capacity to oversee and guide other markets, all while offering avenues for savings allocation (Palley 2013).

1 The term financial crisis itself points to financial phenomena as its cause. The specific role of the financial sphere in causing crises has been described by Turner (2016) and Laeven and Valencia (2016).

The large number of definitions that describe financialisation indicates that it is a concept that is difficult to define precisely, and according to Dünhaupt (2011), no single definition can be identified. Financialisation is undoubtedly associated with finance, financial operations that focus on new financial instruments, or an increase in the importance of profits generated by financial activities rather than operations realized in the real economy.

Some believe that the growth of the financial sector translates into economic growth and that finance follows economic growth. We believe that financialisation is a long-term process characterised by the growth of the banking sector.

Taking the above into account, **this study aims** to compare the effectiveness of banking sectors in the 28 European Union (EU) countries in 2017 from the financialisation perspective. We chose 2017 as the end of the research period to examine how the effectiveness of financialisation changed in the decade after the beginning of the 2008 financial crisis. Limiting the study period to 2017 was also due to the introduction of IFRS 9 (International Financial Reporting Standard 9 – Financial Instruments) in 2018 (*IFRS 9 Implementation by EU Institutions*, 2021). The implementation of IFRS 9 practices by European countries, particularly regarding credit risk, resulted in changes to the way this risk is managed, through tighter credit policies, which has affected the efficiency of the banking sectors. As the dynamics of changes in efficiency are analysed, we had to ensure data comparability.

Using the non-parametric method called DEA (Data Envelopment Analysis), we aim to **verify the hypothesis** that the countries of Central and Eastern Europe (CEE) have ineffective banking sectors compared to the other banking sectors from the EU. The use of the non-parametric DEA method to assess banking sector efficiency requires that specific outlays and effects be determined. The inputs selected for calculating the efficiency index were household consumption expenditure, employment of people aged 24–64, and the link between bank deposits and GDP. The effects of the banking sector that were selected were loans to the private sector, loans granted by financial institutions, mortgage loans, and loans to enterprises. Using the Malmquist index, the study also determined the non-radial efficiency of banking sectors in the BCC (Banker, Charnes, Cooper) model, focusing on expenditures for 2017, and the dynamics of changes in banking sector efficiency between 2008 and 2017.

The article is organised as follows. It begins with an introduction, while the next section provides an overview of the literature on financialisation. The methodology is presented in the next section before presenting the findings of the study. The last part includes a discussion and conclusions.

What is financialisation?

In the economic literature, there are numerous definitions of financialisation and its causes. Kim (2011) and Palley (2008) see financialisation as a process in which the financial markets, institutions and elites gain increasing influence on economic policy and performance. In contrast, Seccareccia (2012) believes that the financial markets have taken on a leading role in economic systems based on bank financing. According to Álvarez (2012) and Greenwood and Scharfstein (2013), financialisation has been the growing power of financial capital since the 1980s. Krippner (2011) believes that it is a tendency to achieve higher profits in the economy through the financial sector rather than through production. Turbeville (2014) defines it as a process during which the scale and significance of financial instruments and transactions increase compared to the overall economy. According to Montgomerie and Williams (2009), financialisation is the next stage of the development of capitalism, under which financial investments play an important role.

Different definitions of financialisation accompany its various measures, such as the size of the financial sector as a percentage of GDP (Kedrosky and Stangler 2011), the income of rentiers, interest and dividends of non-financial corporations (Stockhammer 2004), or the share of financial sector salaries to private sector salaries (Freeman 2010). It also includes employment in finance as a percentage of total employment, and the share of value-added generated in the financial sector as a proportion of total value-added generated by the country's economy, among many others.

Interest in financialisation first appeared in the late 1970s and increased during the financial crisis in 2008 (Engelen 2008; Turbeville 2014). The literature focuses on defining it (conceptualisation) (van der Zwan 2014), how it is manifested (Ramos 2017) and measured (Assa 2012), as well as its consequences (Turbeville 2014), scale (Deeg and O'Sullivan 2009) and impact on developing economies, usually highly developed countries (Epstein and Jayadev 2005; Assa 2012; Kus 2012; Akkemik and Özen 2014; Tomaskovic-Devey, Lin, and Meyers 2015).

There are also studies on the impact of the banking sector on the real economy. The literature analyses the extent to which institutional reforms (including the liberalisation of the banking sector and the protection of creditors and shareholders) caused financial market development and how the expansion of bank credit and securities markets affected economic development. Pagano (2014) stated that growth factors in the real economy include increased availability of external financing, which affects the origination and development of businesses, and more efficiently allocating capital. Many economists have studied the correlation between the development of the financial market and economic growth, investigating the causes and effects, and therefore, analysed data on the level

of countries, industries and companies (King and Levine 1993a; 1993b; Guiso, Sapienza, and Zingales 2004; Beck, Degryse, and Kneer 2014).

However, there remain research gaps, which prompted us to investigate the effectiveness of financialisation, limited to the banking sector, using the DEA method. This required us to consider the practical conditions and the conclusions of theoretical research. The DEA method and its potential use to study the effectiveness of the financial sector, especially the banking sector, are described later in the paper.

Banking sector efficiency

Efficiency is an area of interest in many academic disciplines, including economics and finance. However, due to its interdisciplinary nature, it is difficult to unambiguously define (Żabski 2017). The general approach found in the literature indicates that efficiency is the ratio of effects (the results of an entity's activities) to inputs (what is used to produce these effects). An effective entity is the one that best converts inputs into effects (Kosmaczewska 2011).

The results from efficiency studies depend on the inputs and outputs adopted. The various configurations make it possible to obtain several efficiency measures, e.g., labour productivity or capital intensity (Kozłowska 2014). It can be measured using indicative, parametric, and non-parametric methods. When studying the efficiency of banking sector entities, it is necessary to indicate what type of efficiency is considered, e.g., technical efficiency, revenue efficiency, cost efficiency, organisational efficiency, or financial efficiency (Perek 2014).

When studying banking sector efficiency, it is also necessary to identify inputs and effects. There are different approaches in the literature to attributing variables that describe the banking sector to inputs or effects. When selecting variables, two approaches are most commonly used: the bank as an intermediary (i.e., it makes a transfer between entities with excess cash and those that request credit products) and the bank as a producer (i.e., it offers services to customers) (Mielnik, Ławrynowicz, and Szambelańczyk 2004).

Based on studies on the efficiency of banking sectors or banks, it is possible to identify the variables used for research using the DEA method in different approaches to the role of the bank. In the case of inputs, the most frequently considered variables are staff expenditure, the number of employees, the value of deposits, operating costs, and the value of fixed assets. These inputs indicate the important role of employment as an input to achieve effects in the banking sector. There are also two balance sheet categories that symbolise a bank's assets and liabilities. The whole is complemented by the operating costs incurred. The outlays have an impact on the size of the effects. The most frequent

are the value of loans, the value of deposits, interest income, and non-interest income. Among the effects, loans are significant, as they generate a proportion of interest income. Effects complement non-interest income. Deposits often appear as both inputs and effects, as they can be understood differently. On the one hand, they represent the value of funds raised by the bank for lending. In this sense, deposits can be understood as a kind of input. On the other hand, adopting the concept of the bank as an intermediary, deposits are an effect of the bank's activities (the amount of funds the bank has managed to raise) (Stępień 2015).

Research methodology

In the 1970s, Charnes, Cooper, and Rhodes (1978, pp. 429–444) developed a method of determining effectiveness based on the quotient of the weighted sum of multiple effects and the weighted sum of multiple inputs. The method they proposed was called DEA. In this method, the weighted sums of P inputs (x_{pj}) and R effects (y_{rj}) are compared separately for each analysed object ($j = 1, ..., J$), also called a DMU (Decision-Making Unit).

The efficiency of each object is determined based on the distance from the empirical limit of technological possibilities, the so-called effectiveness curve. The efficiency of the object is measured by the efficiency factor, denoted as θ. It expresses the link between empirical and optimal technology. Fully effective units lie on the effectiveness curve ($\theta = 1$). This means that they effectively convert inputs into results. Units below the curve are considered ineffective ($\theta < 1$). The input-oriented CCR model[2] can be used (there is also an effect-oriented variant). Its dual form for an object of number o is as follows:

$$\theta_o \rightarrow \min, \tag{1}$$

$$\sum_{j=1}^{J} x_{pj}\lambda_j \leq \theta x_{pj}, \tag{2}$$

$$\sum_{j=1}^{J} y_{rj}\lambda_j \geq y_{rj}, \tag{3}$$

$$\lambda_j \geq 0, \tag{4}$$

where:

λ_j – linear combination coefficients.

2 CCR is taken from the names of the authors: Charnes, Cooper, Rhodes.

When solving the model given by formulas (1)–(4), we look for the minimum value of θ_o – the input multiplier of the *o*-th object, which determines the proportional reduction of each input while maintaining the current level of effects.

The CCR model assumes constant economies of scale, and the measure calculated here is called total technical efficiency. However, the study used an input-oriented model with variable scale effects. If variable effects of scale are required, then the BCC model (Banker, Charnes, and Cooper 1984, pp. 1078–1092) is used, in which models (1)–(4) are supplemented with an additional constraint of the form:

$$\lambda_1 + \lambda_2 + \ldots + \lambda_J = 1. \tag{5}$$

The classic approach to the DEA method assumes equal, proportional changes to all inputs or outputs. However, this assumption can be challenged. The starting point is Russell's efficiency, thanks to which the non-radial efficiency can be determined. In this case, the efficiency indicator in the input-oriented model is most often the average of partial efficiencies in relation to individual inputs. Non-radial efficiency assumes that the partial efficiency due to a given input (or effect) may be different for each input (effect), while the partial efficiency of a single input (effect) is still radial (Färe et al. 2016, pp. 123–130).

The information obtained after solving the models that make up the DEA method is static. Investigating changes in effectiveness over time requires special dynamics indices, such as Malmquist productivity indexes (Bogetoft and Otto 2011). They are based on the Shephard distance, which is the inverse of the optimal value of the objective function, oriented on the effects of the CCR model. These indices for periods t and t+1 are determined as follows:

$$M_t\left(x_t, y_t, x_{t+1}, y_{t+1}\right) = \frac{D_t\left(x_{t+1}, y_{t+1}\right)}{D_t\left(x_t, y_t\right)}, \tag{6}$$

$$M_{t+1}\left(x_t, y_t, x_{t+1}, y_{t+1}\right) = \frac{D_t\left(x_{t+1}, y_{t+1}\right)}{D_{t+1}\left(x_t, y_t\right)}, \tag{7}$$

where:

x_t, x_{t+1} – inputs in periods *t* and *t* + 1;

y_t, y_{t+1} – effects in periods *t* and *t* + 1;

D – the Shephard distance.

The index illustrated by formula (6) compares the efficiency in two periods using technologies from period t as a benchmark. In turn, the index represented by formula (7) takes technologies from period $t + 1$ as a reference point. In practice, the geometric mean of these indices is used for interpretation.

The Malmquist productivity index can be broken down into two components: the technical efficiency index (TE) and the technical change index (TC). The former measures a relative change in effectiveness without changing the position of the efficiency curve. The latter defines a relative change in efficiency related to the technological progress that took place between the research period and the base period (Pinto de Abreu et al. 2012, pp. 1937–1943).

Färe et al. (1994, pp. 66–83) and Ray and Desli (1997, pp. 1033–1039) proposed adjustments to calculate the Malmquist index for the BCC model. This article uses the Färe and Grosskopf approach.

The DEA method is also applied to estimate the effectiveness of the banking sector and its components. Optimizing efficiency can be understood in two ways: reducing inputs to achieve the current effects or increasing the effects using the inputs at the current level (Cooper, Seiford, and Tone 1999). Research conducted using DEA focuses on assessing the effectiveness of banking sectors and banks. This application is important in view of the topic of this study. In banking sector research, the DEA method is often one of two or three methods that allow research goals to be achieved more precisely. Some of these methods verify the relevance of the inputs and/or outputs included in DEA. Others are an extension of effectiveness research and combine non-parametric methods with parametric ones. To apply the DEA method, it is important to identify the variables that best describe the banking sector or banks.

To determine the effectiveness of the surveyed entities, it was necessary to define the inputs and effects of the banking sector. The following variables were defined in the inputs used by the economy in the banking sector:

- Household consumption expenditures, which reflect changes in household behaviours. Increased consumer spending is often the result of easy access to credit money (Řepková 2014). It also means that the greater the consumption, the greater the demand for credit.
- Employment of people aged between 20–Population ageing has an impact on the development of various market sectors, including financial services (Enste, Naegele, and Leve 2008, pp. 330–331).
- Bank deposit to GDP ratio. Referring to the research on the effectiveness of banks, we adopt the "intermediation" approach proposed by Sealey and Lindley (1977), where deposits should be treated as an intermediate input used in the production of the final banking product, i.e., credit.

The effects of the banking sector primarily include credit products, as described by Jordà, Schularick, ad Taylor (2014), Pagano (2014), and Guo et al. (2020). Based on those papers, the following banking sector effects related to financialisation were selected:

- domestic credit to the private sector,
- private credit by deposit money banks and other financial institutions,
- mortgages,
- corporate loans.

Oliveira and Tabak (2005) presented an interesting approach to variable choice. The variables adopted for their study had an impact on their results, so they should sufficiently describe the processes taking place in decision-making units. For this reason, the study should be extended to use other inputs and outputs to properly compare the results.

A low positive correlation between inputs and outputs is preferred in the DEA method. To determine the correlation between the indicators presented above, Pearson's linear correlation coefficient was used. The correlation indicates that inputs and outputs are not fully correlated with each other.

The research was conducted in two parts:

1. Determining the non-radial efficiency in the input-oriented BCC model for 2017.
2. Determining the dynamics of changes in the efficiency of the surveyed entities using the Malmquist index for 2008 and 2017.

Results

The study attempted to determine the effectiveness of financialisation in the banking sectors of EU countries using the DEA method. The results of the input-oriented BCC model[3] are presented in Table 1.

The first stage of interpretation is to identify effective and ineffective objects. Effective banking sectors, from a financialisation perspective, are those that are on the efficiency curve. Those sectors have an efficiency index equal to The effectiveness of the examined units in terms of financialisation means that in the examined group, they best use the inputs of the banking sector, and thus achieve better results. By contrast, ineffective banking sectors are those whose effectiveness ratio is lower than This means that ineffective banking sectors are below the efficiency curve.

3 The calculations were made in the R computing environment using the deaR package.

Table 1. Efficiency indicators of the banking sector in European Union countries in 2017 – results of the non-radial DEA method (the expenditure-oriented BCC model)

Country	Household consumption expenditures	Employment of people aged 20–64	Bank deposit to GDP ratio	Mean effectiveness
Austria	0.627	0.633	0.275	0.511
Belgium	0.486	0.504	0.317	0.436
Bulgaria	0.440	0.120	0.301	0.287
Croatia	0.412	0.232	0.222	0.289
Cyprus	1	1	1	1
Czech Republic	0.395	0.164	0.328	0.296
Denmark	1	1	1	1
Estonia	1	0.519	0.605	0.708
Finland	0.141	0.142	0.511	0.264
France	1	1	1	1
Germany	0.497	0.431	0.887	0.605
Greece	0.331	0.266	0.184	0.260
Hungary	0.232	0.084	0.354	0.223
Ireland	0.577	0.574	0.421	0.524
Italy	0.410	0.399	0.434	0.414
Latvia	0.917	0.430	0.390	0.579
Lithuania	0.558	0.284	0.411	0.417
Luxembourg	1	1	1	1
Malta	1	1	1	1
Netherlands	0.942	0.823	0.333	0.699
Poland	0.556	0.196	0.414	0.389
Portugal	0.120	0.075	0.385	0.193
Romania	0.200	0.066	0.518	0.261
Slovakia	0.497	0.221	0.278	0.332
Slovenia	0.614	0.395	0.311	0.440
Spain	0.610	0.483	0.394	0.495
Sweden	1	1	1	1
United Kingdom	1	1	1	1

Source: own study based on data from Eurostat, Bloomberg, and Thomson Reuters (2019) databases.

The results in Table 1 indicate that the banking sectors in the following seven countries were effective in 2017: Cyprus, Denmark, France, Luxembourg, Malta, Sweden,

and the United Kingdom. These banking sectors proved to be efficient in terms of all expenditures. Possible reasons for the effectiveness of each individual sector vary, and an explanation is given below[4]:

Cyprus – the banking sector consists mainly of banks that act as financial intermediaries while actively competing for clients. The evolution of the banking sector towards a regional financial centre made it possible to increase the differentiation of state budget revenues, which mainly came from tourism before. The greatest development of the financial sector came between 2004 and 2012, which was mainly related to regulatory arbitrage, favourable tax system, and the interest rate on bank deposits. Cyprus also has a high proportion of citizens per bank employee (1 bank employee per 78 inhabitants). The use of the banking sector as a benchmark must be limited due to its peculiarities. Additionally, it is hard to put technology from Cyprus into non-effective banking sectors.

Denmark – banking services are very popular in Denmark. Most adults have a bank account in at least one bank. The banking sector also plays an extremely important role in the economy, mainly because relatively high revenues contributed to the state budget as corporate tax. Between 2005 and 2014, employment in the banking sector decreased from 47,576 to 37,201 employees. In the case of financial assets, which also include deposits, an increase is noticeable.

France – the largest items in the assets of the French banking sector are debt securities and receivables. This results in relatively high effects determined by the value of the credit instruments.

Luxembourg – the banking sector is characterised by the highest ratio of sector assets to GDP in Europe. The results of this indicator are due to the large number of large credit institutions based in the country.

Malta – the most important group of banks in Malta are domestic banks, which are vital to the country's economy. They mainly provide credit and deposit services, and their results have a major impact on the results of the financial sector. The assets of the five largest banks are approximately 2.5 times greater than the country's GDP. The banking sector is characterised by a high level of loans and debt instruments in the asset structure.

Sweden – the Swedish banking sector is characterised by relatively high employment in relation to total employment in the economy. The structure of liabilities in this sector is characterised by a high share of liabilities to the non-financial sector, represented by

4 Banking Structures Report, Reports in selected years, European Central Bank.

household deposits. Outlays in the form of employment and deposits translate into a high level of assets in the Swedish banking sector, exceeding the country's GDP.

United Kingdom – about 20% of banking activities in the world are conducted in this country's financial sector. This is because most banks that operate there conduct international activities. This sector is present in the Anglo-Saxon banking model in which investment banks play an important role. The results of British financial institutions were affected by the financial crisis, which reduced the value of deposits taken from the interbank market. On the other hand, the liabilities of British banks increased due to the increase in the value of deposits taken from households and non-financial corporations. There was a decline in the financial sector, although the efficiency of the sector indicates that the inputs are still being used effectively.

Estonia is an interesting case. Household consumption expenditure is effective, but the overall efficiency of the banking sector is understated by the other two inputs (employment and bank deposits).

The most ineffective banking sectors are in Portugal, Hungary, Greece, Romania, Finland, Bulgaria, Croatia, and the Czech Republic. In each of these countries, efficiency is below 0.3 (in comparison, the efficiency in countries with effective banking sectors is 1). Most of the ineffective facilities are banking sectors of the countries that joined the EU after 2000 – five were countries that had had a centrally planned economy. The low efficiency of the banking sectors in these countries was due to the ineffectiveness of expenditures related to the employment of working-age people.

The second stage of the research was to determine the efficiency of individual inputs used in the research. The entities which, in the overall assessment, are on the efficiency curve will be effective in terms of inputs. When considering individual inputs, we can say that entities use a given input ineffectively. Subsequently, the performance indicators for each of the inputs were interpreted. The first expenditure used in the study was households' consumption expenditure, which is used effectively in countries where the average efficiency is Again, Estonia's banking sector provides an interesting. It belongs to the group of ineffective entities, yet its efficiency index for these expenditures was Latvia and the Netherlands were also close to achieving 100% efficiency in using this input. The banking sectors in Portugal, Finland, Romania, and Hungary were the most ineffective based on households' consumption expenditure.

The second banking sector input was the employment of working-age people. The Dutch banking sector is close to the effectiveness limit for this input. By contrast, the most ineffective banking sectors were in Romania, Portugal, Bulgaria, Finland, the Czech Republic, Poland and Hungary.

The last input was bank deposits, where Germany was close to the efficiency curve. By contrast, the most ineffective banking sectors in terms of expenditure in the form of employment were those in Greece, Croatia, Austria, and Slovakia.

Another area of analysis of the results of the DEA effectiveness study was benchmark leaders. To become effective, ineffective objects must change their technologies, e.g., by following the example of effective units. Thus, for each one, a formula is determined called the benchmarking formula, in which the inputs or effects are multiplied by the coefficients λj derived from optimisation. The benchmarking formula does not have to use all available effective units.

The benchmarking formula takes the form of a weighted sum of inputs, in which the lambdas are the coefficients. A benchmarking formula can be created for each ineffective object. However, due to their large number, the number of entities that need the technology of individual leaders should be given to create such a formula. Accordingly, we consider five leaders (Cyprus, France, Luxembourg, Malta, and the United Kingdom), whose technologies will allow ineffective countries to achieve the same effects with lower inputs. Among all 21 ineffective banking sectors, the Cyprus banking sector plays an extremely important role in assessing the degree of expenditure reduction – it appears in each benchmarking formula. The second banking sector is in France, which can be a role model for ten countries, followed by Great Britain (for six countries), Luxembourg (for three countries), and Malta (for one country).

The second part of the study analysed the dynamics of changes in banking sector efficiency between 2008 and dynamics analysis was performed using the Malmquist index

Table 2. Malmquist Index in the European Union Member States, 2008–2017

Country	Malmquist index	Change from innovation and technological progress	Change from a change of scale
Austria	0.924	0.820	1.128
Belgium	0.998	0.854	1.168
Bulgaria	0.868	0.768	1.131
Croatia	1.102	0.765	1.442
Cyprus	0.872	0.872	1.000

Country	Malmquist index	Change from innovation and technological progress	Change from a change of scale
Czech Republic	0.994	0.758	1.311
Denmark	0.937	0.937	1.000
Estonia	0.719	0.704	1.021
Finland	1.143	0.784	1.457
France	1.314	1.314	1.000
Germany	0.957	1.177	0.814
Greece	1.112	0.810	1.373
Hungary	0.678	0.761	0.892
Ireland	0.362	0.870	0.416
Italy	1.123	0.835	1.345
Latvia	0.516	0.735	0.702
Lithuania	0.684	0.768	0.891
Luxembourg	0.888	0.714	1.244
Malta	0.565	0.565	1.000
Netherlands	1.154	1.155	0.999
Poland	1.280	0.813	1.574
Portugal	0.765	0.817	0.936
Romania	0.944	0.763	1.237
Slovakia	1.278	0.764	1.674
Slovenia	0.726	0.773	0.939
Spain	0.734	0.865	0.848
Sweden	1.378	0.983	1.402
United Kingdom	0.931	0.931	1.000

Source: own study based on data from Eurostat, Bloomberg, and Thomson Reuters (2019) databases.

Table 2 presents the calculated Malmquist indices and the components of their decomposition between 2008 and 2017. The highest values were recorded for the banking sector in Sweden (an increase in efficiency by 37.7%), France (by 31.4%), Poland (by 28%), Slovakia (by 27.8%) and the Netherlands (by 15.4%). However, the lowest values were reported in Ireland (a decrease in efficiency by 63.8%), Latvia (by 48.4%), Malta (by 43.5%), Hungary (by 32.2%) and Lithuania (by 31.6%).

Changes in efficiency resulting from the change in the scale of operations, which had a positive impact on the Malmquist index, occurred in Slovakia (an increase of 67.4%), Poland (57.4%), Finland (45.7%), Croatia (44.2%) and Sweden (40.2%). The Malmquist index

performance decreased due to the change in the scale of operations in the banking sectors in Ireland (a decrease of 58.4%), Latvia (29.8%), Germany (18.6%) and Spain (15.2%). Efficiency gains caused by changes in technological progress were noted in the banking sectors in France (an increase of 31.4%), Germany (17.7%) and the Netherlands (15.5%). By contrast, they had a negative impact in Malta (a decrease of 43.5%), Estonia (29.6%), Luxembourg (28.7%) and Latvia (26.5%).

This study compares the effectiveness of financialisation between banking sectors in CEE and other EU countries. The non-parametric DEA method is often used to examine the effectiveness of banks, banking sectors, or financial systems. The output-oriented BCC model used is one of many methods in this type of research. Limiting the analysis to one model limits the possibilities of interpretation, although a similar approach was adopted by Oliveira and Tabak (2005) and Batir, Volkman, and Gungor (2017).

Other authors compare the results from different DEA models (see Řepková 2014; Svitalkova 2014). Some research supplements the effectiveness study with additional research methods, e.g., panel data analysis (Řepková 2015), the analysis of financial indicators (Tuškan and Stojanović 2016), or the Malmquist index (Da Silva Fernandes, Stasinakis, and Bardarova 2018). Following the example of other authors, the study with the non-parametric DEA method was supplemented with the Malmquist index, which makes it possible to indicate changes in efficiency between 2008 and As the results cover a relatively short period, the study could be expanded to include annual efficiency changes or a determination of effectiveness for several consecutive years.

The results of our study show the effectiveness of the financialisation of the banking sector in EU countries. The banking sectors of the following countries were found to be effective: Cyprus, Denmark, France, Luxembourg, Malta, Sweden, and the UK. The average efficiency for the EU banking sector and the average efficiency coefficients in the analysed period for individual countries were also presented. This study adopted an approach that included the efficiency of banking sectors in 2017 and the change in efficiency compared to 2008, which showed a change in efficiency after ten years.

Conclusions

The growth of the banking sector and financialisation are important issues from the perspective of financial development and, therefore, for the economies of countries where that phenomenon is observed. The study empirically verified the effectiveness of banking sectors from the financialisation perspective in the EU states, based on the proposed set of inputs and outputs. This objective was achieved using the BCC DEA model and the Malmquist index, which required that the outlays and effects for banking sectors be determined. The outlays are household expenditures, employment in the economy, and the ratio of bank

deposits to GDP. The effects of financialisation in the developed model include credit to the private sector, the credit extended by financial institutions, mortgage credit and corporate credit extended by the banking sector.

The results of the study conducted for 2017 show the effectiveness of banking sectors from the financialisation perspective in Cyprus, Denmark, France, Luxembourg, Malta, Sweden, and the United Kingdom. This means that in these countries, the selected expenditures (based on the literature review) on the banking sector were best translated into the effects achieved by this sector. The largest changes in the efficiency of banking sectors from the financialisation perspective between 2008 and 2017 were observed in Sweden, France, Poland, Slovakia, and the Netherlands.

The hypothesis that CEE countries have ineffective banking sectors compared to other EU countries cannot be verified clearly. On the one hand, while the banking sector of each CEE country is ineffective, not all of them are more ineffective than other countries.

Countries where the banking sectors are effective from the financialisation perspective generally have well-developed banking sectors, converting effects into investments very well. However, countries where efficiency gains were observed show good conditions for the development of the banking sector in the longer term.

Limitations of the study include the variables applied and the use of only one DEA model. In the future, research should be extended with other models of nonparametric methods, like a super-efficiency model, or by examining the impact of Brexit or other significant factors that emerged after It will, therefore, be necessary to introduce new variables to describe financialisation. Due to the framework of this study, no attempt was made to determine detailed reasons for the results. This could also be an avenue for a subsequent study.

Acknowledgements

This work was supported by the National Science Centre Poland,
grant No. UMO-2017/26/D/HS4/00954.

References

Akkemik, K.A., Özen, Ş. (2014), *Macroeconomic and institutional determinants of financialisation of non-financial firms: Case study of Turkey*, "Socio-Economic Review", 12 (1), pp. 71–98, https://doi.org/10.1093/ser/mwt006

Álvarez, N. (2012), *The financialization of the Spanish economy: debt, crisis and social cuts*, paper presented at the Workshop on Debt, organized by Rosa Luxemburg Stiftung, Berlin, November 2012.

Assa, J. (2012), *Financialization and its Consequences: the OECD Experience*, "Finance Research", 1 (1), pp. 35–39.

Banker, R., Charnes, A., Cooper, W.W. (1984), *Some Models for Estimating Technical and Scale Efficiencies in Data Envelopment Analysis*, "Management Science", 30 (9), pp. 1031–1142, https://doi.org/10.1287/mnsc.30.9.1078

Batir, T.E., Volkman, D.A., Gungor, B. (2017), *Determinants of bank efficiency in Turkey: Participation banks versus conventional banks*, "Borsa Istanbul Review", 17 (2), pp. 86–96, https://doi.org/10.1016/j.bir.2017.02.003

Beck, T., Degryse, H., Kneer, C. (2014), *Is more finance better? Disentangling intermediation and size effects of financial systems*, "Journal of Financial Stability", 10, pp. 50–64, https://doi.org/10.1016/j.jfs.2013.03.005

Bogetoft, P., Otto, L. (2011), *Benchmarking with DEA, SFA, and R*, Springer, New York, https://doi.org/10.1007/978-1-4419-7961-2

Charnes, A., Cooper, W.W., Rhodes, E. (1978), *Measuring the efficiency of decision making units*, "European Journal of Operational Research", 2 (6), pp. 429–444, https://doi.org/10.1016/0377-2217 (78)90138-8

Cooper, W.W., Seiford, L.M., Tone, K. (1999), *Data Envelopment Analysis. A Comprehensive Text with Models, Applications, References and DEA-Solver Software*, Kluwer Academic Publishers, New York, https://doi.org/10.1007/b109347

Da Silva Fernandes, F., Stasinakis, Ch., Bardarova, V. (2018), *Two-stage DEA-Truncated Regression: Application in banking efficiency and financial development*, "Expert Systems with Applications", 96, pp. 284–301, https://doi.org/10.1016/j.eswa.2017.12.010

Deeg, R., O'Sullivan, M.A. (2009), *The Political Economy of Global Finance Capital*, "World Politics", 61 (4), pp. 731–763, https://doi.org/10.1017/S0043887109990116

Dünhaupt, P. (2011), *The Impact of Financialization on Income Distribution in the USA and Germany: A Proposal for a New Adjusted Wage Share*, "Microeconomic Policy Institute Working Paper", 7.

Engelen, E. (2008), *The Case for Financialization*, "Competition & Change", 12 (2), https://doi.org/10.1179/102452908X289776

Enste, P., Naegele, G., Leve, V. (2008), *The Discovery and Development of the Silver Market in Germany*, [in:] F. Kohlbacher, C. Herstatt (eds.), *The Silver Market Phenomenon. Business Opportunities in an Era of Demographic Change*, Springer, Heidelberg, pp. 325–339, https://doi.org/10.1007/978-3-540-75331-5_22

Epstein, G.A. (2005), *Introduction: Financialization and the World Economy*, [in:] G.A. Epstein (ed.), *Financialization and the World Economy*, Edward Elgar Publishing Limited, Northampton, pp. 3–17.

Epstein, G.A., Jayadev, A. (2005), *The rise of rentier incomes in OECD countries: financialization, central bank policy and labor solidarity*, "Financialization and the World Economy", 39.

Färe, R., Fukuyama, H., Grosskopf, S., Zelenyuk, V. (2016), *Cost decompositions and the efficient subset*, "Omega", 62, pp. 123–130, https://doi.org/10.1016/j.omega.2015.09.004

Färe, R., Grosskopf, S.M., Norris, S., Zhang, Z. (1994), *Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries*, "The American Economic Review", 84 (1), pp. 66–83.

Franc-Dąbrowska, J. (2019), *Financialization and speculation in agriculture – positive and negative aspects of the financialization of the economy*, "Annals of the Polish Association of Agricultural and Agribusiness Economists", XXI (3), pp. 73–81, https://doi.org/10.5604/01.3001.0013.3064

Freeman, R.B. (2010), *It's financialization!*, "International Labour Review", 149 (2), pp. 163–183, https://doi.org/10.1111/j.1564-913X.2010.00082.x

Greenwood, R., Scharfstein, D. (2013), *The Growth of Finance*, "Journal of Economic Perspectives", 27 (2), pp. 3–28, https://doi.org/10.1257/jep.27.2.3

Guiso, L., Sapienza, P., Zingales, L. (2004), *Does Local Financial Development Matter?*, "The Quarterly Journal of Economics", 119 (3), pp. 929–969, https://doi.org/10.1162/0033553041502162

Guo, L., Na, S., Tan, X., Gui, P., Liu, C. (2020), *Evolution of the Efficiency of Nationwide Commercial Banks in China Based on an SBM-Undesirable Model and DEA Window Analysis*, "Mathematical Problems in Engineering", 2020, https://doi.org/10.1155/2020/4682790

IFRS 9 Implementation by EU Institutions. Monitoring Report (2021), EBA/Rep/2021/35, https://www.eba.europa.eu/sites/default/files/document_library/Publications/Reports/2021/1024609/IFRS9%20monitoring%20report.pdf (accessed: 23.11.2023).

Jordà, Ò., Schularick, M., Taylor, A.M. (2014), *The Great Mortgaging: Housing Finance, Crises, and Business Cycles*, "NBER Working Paper Series", 23, https://doi.org/10.3386/w20501

Kedrosky, P., Stangler, D. (2011), *Financialization and Its Entrepreneurial Consequences*, "Ewing Marion Kauffman Foundation Research Paper", https://doi.org/10.2139/ssrn.1798605

Kim, Y. (2011), *A Short Empirical Note on Household Debt, Financialization, and Macroeconomic Performance*, "Working Papers from Trinity College, Department of Economics", 1107.

King, R.G., Levine, R. (1993a), *Finance and Growth: Schumpeter Might Be Right*, "The Quarterly Journal of Economics", 108 (3), pp. 717–737, https://doi.org/10.2307/2118406

King, R.G., Levine, R. (1993b), *Finance, entrepreneurship and growth. Theory and evidence*, "Journal of Monetary Economics", 32 (3), pp. 513–542, https://doi.org/10.1016/0304-3932 (93)90028-E

Kosmaczewska, J. (2011), *Analiza efektywności gospodarowania gmin wiejskich w kontekście rozwoju funkcji turystycznej z wykorzystaniem metody DEA*, „Zeszyty Naukowe SGGW w Warszawie. Ekonomika i Organizacja Gospodarki Żywnościowej", 90, pp. 131–141.

Kozłowska, J. (2014), *Zastosowanie metody DEA w analizie efektywności działania przedsiębiorstw usługowych*, „Zeszyty Naukowe Politechniki Śląskiej. Seria: Organizacja i Zarządzanie", 73, pp. 305–317.

Krippner, G.R. (2011), *Capitalizing on Crisis: The Political Origins of the Rise of Finance*, Harvard University Press, Cambridge, https://doi.org/10.2307/j.ctvjk2x23

Kus, B. (2012), *Financialisation and Income Inequality in OECD Nations: 1995–2007*, "The Economic and Social Review", 43 (4, Winter), pp. 477–495.

Laeven, L., Valencia, F. (2016), *Systemic Banking Crisis Database: An Update*, "IMF Working Paper", 12 (163), https://doi.org/10.5089/9781475505054.001

Magdoff, F., Foster, J.B. (2014), *Stagnation and Financialization: The Nature of the Contradiction*, "Monthly Review", 66 (1), https://doi.org/10.14452/MR-066-01-2014-05_1

Mielnik, M., Ławrynowicz, M., Szambelańczyk, J. (2004), *Efektywność jako determinanta kapitalizacji banków spółdzielczych w Polsce w świetle założeń nowej umowy kapitałowej Komitetu Bazylejskiego*, „Ruch Prawniczy, Ekonomiczny i Socjologiczny", LXVI (1), pp. 103–118.

Montgomerie, J., Williams, K. (2009), *Financialised Capitalism: After the Crisis and beyond Neoliberalism*, "Competition & Change", 13 (2), https://doi.org/10.1179/102452909X416999

Oliveira, C.V., Tabak, B.M. (2005), *An International Comparison of Banking Sectors: A DEA Approach*, "Global Economic Review", 34 (3), pp. 291–307, https://doi.org/10.1080/12265080500292633

Pagano, M. (2014), *Is Europe Overbanked? Czy w Europie jest za dużo banków?*, "mBank – CASE Seminar Proceedings" 132, "Zeszyty mBank – CASE", 132, https://www.case-research.eu/files/?id_plik=5080 (accessed: 15.11.2023).

Palley, T.I. (2008), *Financialization: What it is and Why it Matters?*, "Macroeconomic Policy Institute (IMK) in the Hans-Boeckler-Foundation Working Paper", 04.

Palley, T.I. (2013), *Financialization The economics of finance capital domination*, Palgrave Macmillan, London.

Perek, A. (2014), *Wykorzystanie metody DEA do oceny efektywności banków spółdzielczych w Polsce*, "Economics and Management", 3, pp. 222–235.

Pinto de Abreu, U.G., Gonçalves Gomes, E., Correia Baptista Soares de Mello, J.C., Santos, S.A., Catto, D.F. (2012), *Heifer Retention Program in the Pantanal: a study with data envelopment analysis (DEA) and Malmquist index*, "Revista Brasileira de Zootecnica", 41 (8), https://doi.org/10.1590/S1516-35982012000800019

Ramos, R.A. (2017), *Financialization at the international level: evidence from emerging market economies*, "Economia e Sociedade", 26, https://doi.org/10.1590/1982-3533.2017v26n4art6

Ray, S.C., Desli, E. (1997), *Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries: Comment*, "The American Economic Review", 87 (5), pp. 1033–1039.

Řepková, I. (2014), *Efficiency of the Czech Banking Sector Employing the DEA Window Analysis Approach*, "Procedia Economics and Finance", 12, pp. 587–596, https://doi.org/10.1016/S2212-5671 (14)00383-9

Řepková, I. (2015), *Banking Efficiency Determinants in the Czech Banking Sector*, "Procedia Economics and Finance", 23, pp. 191–196, https://doi.org/10.1016/S2212-5671 (15)00367-6

Sealey, C.W., Lindley, J.T. (1977), *Inputs, Outputs, and a Theory of Production and Cost Depository Financial Institutions*, "The Journal of Finance", 32 (4), pp. 1251–1266, https://doi.org/10.1111/j.1540-6261.1977.tb03324.x

Seccareccia, M. (2012), *Financialization and the transformation of commercial banking: understanding the recent Canadian experience before and during the international financial crisis*, "Journal of Post Keynesian Economics", 35 (2), https://doi.org/10.2753/PKE0160-3477350206

Stępień, K. (2015), *Dylematy pomiaru efektywności banków*, "Zarządzanie Finansami i Rachunkowość", 3 (2), pp. 97–110.

Stockhammer, E. (2004), *Financialisation and the slowdown of accumulation*, "Cambridge Journal of Economics", 28 (5), pp. 719–741, https://doi.org/10.1093/cje/beh032

Stockhammer, E. (2012), *Financialization, income distribution and the crisis*, "Investigación Económica", 71 (279), https://doi.org/10.22201/fe.01851667p.2012.279.37326

Svitalkova, Z. (2014), *Comparison and Evaluation of Bank Efficiency in Selected Countries in EU*, "Procedia Economics and Finance", 12, pp. 644–653, https://doi.org/10.1016/S2212-5671(14)00389-X

Tomaskovic-Devey, D., Lin, K.H., Meyers, N. (2015), *Did financialization reduce economic growth?*, "Socio-Economic Review", 13 (3), pp. 525–548, https://doi.org/10.1093/ser/mwv009

Turbeville, W. (2014), *Financialization and a new paradigm for financial markets*, Demos/New Economic Paradigms/Rockefeller Foundation, New York.

Turner, A. (2016), *Between Debt and the Devil. Money, Credit and Fixing Global Finance*, Princeton University Press, Princeton, https://doi.org/10.1515/9781400873326

Tuškan, B., Stojanović, A. (2016), *Measurement of cost efficiency in the European banking industry*, "Croatian Operational Research Review", 7 (1), pp. 47–66, https://doi.org/10.17535/crorr.2016.0004

Vercelli, A. (2013), *Financialization in a Long-Run Perspective. An Evolutionary Approach*, "International Journal of Political Economy", 42 (4), https://doi.org/10.2753/IJP0891-1916420402

Zwan, N. van der (2014), *Making sense of financialization*, "Socio-Economic Review", 12 (1), pp. 99–129, https://doi.org/10.1093/ser/mwt020

Żabski, Ł. (2017), *Zastosowanie nieparametrycznej metody DEA (Data Envelopment Analysis) do pomiaru efektywności spółek komunalnych*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 481, pp. 152–169.

Porównanie efektywności europejskich sektorów bankowych w perspektywie finansjalizacji. Zastosowanie metody DEA

Wprowadzenie w tematykę badania: Wzrosło znaczenie sektora finansowego w stosunku do sfery realnej, w ostatnich latach nastąpiło przejście od kapitalizmu przemysłowego do kapitalizmu finansowego. Proces wzrostu znaczenia sektora finansowego określany jest mianem finansjalizacji. Zjawisko to niewątpliwie kojarzy się z finansami, operacjami finansowymi czy wzrostem znaczenia zysków generowanych przez działalność finansową. Przyjęliśmy, że finansjalizacja jest procesem długotrwałym, charakteryzującym się wzrostem sektora bankowego.
Cel artykułu: Porównanie efektywności sektorów bankowych w krajach Unii Europejskiej w perspektywie finansjalizacji.
Metody: Badanie polegało na określeniu efektywności sektorów bankowych dla 28 krajów europejskich, z wykorzystaniem nieradialnego modelu BCC zorientowanego na nakłady w 2017 roku oraz ocenie zmian efektywności badanych sektorów z wykorzystaniem indeksu Malmquista w latach 2008–2017.
Wyniki i wartość dodana: W rezultacie ustalono, że przy określonych nakładach i efektach sektory bankowe siedmiu krajów były w 2017 roku efektywne. Efektywne, w perspektywie finansjalizacji, sektory bankowe występowały na Cyprze, w Danii, Francji, Luksemburgu, na Malcie, w Szwecji i Wielkiej Brytanii. Następnie określono efektywność poszczególnych nakładów dla sektorów bankowych z każdego badanego kraju oraz wskazano liderów benchmarków. Analiza dynamiki zmian efektywności sektorów bankowych wykazała, że najwyższe wartości wskaźnika Malmquista między latami 2008 a 2017 obliczono dla Szwecji (wzrost efektywności o 37,7%).

Słowa kluczowe: sektor bankowy, efektywność, finansjalizacja, metoda DEA

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.04

The Impact of Economic Security on Sustainable Entrepreneurship in Central and Eastern Europe – from the Financial Crisis to the COVID–19 Pandemic

Magdalena Kowalska https://orcid.org/0000-0002-5821-0305
Ph.D., University of Lodz, Faculty of Economics and Sociology, Lodz, Poland
e-mail: magdalena.kowalska@uni.lodz.pl

Anna Misztal https://orcid.org/0000-0002-7455-5290
Ph.D., University of Lodz, Faculty of Economics and Sociology, Lodz, Poland , e-mail: anna.misztal@uni.lodz.pl

Rafał Matera https://orcid.org/0000-0003-3683-0439
Prof., University of Lodz, Faculty of Economics and Sociology, Lodz, Poland , e-mail: rafal.matera@uni.lodz.pl

Abstract

The article's main aim is to assess the impact of economic security on sustainable entrepreneurship in Central and Eastern European Countries (CEECs), including Bulgaria, Croatia, Czechia, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovakia and Slovenia from 2008 to 2020. The paper's novelty is the development of indicators of sustainable entrepreneurship and its three pillars: economic, social and environmental. Moreover, we assessed the impact of economic security on sustainable entrepreneurship and conducted a comparative analysis of its consequences on the economic, social and environmental components of entrepreneurship. We use the Pearson correlation coefficient, the Ordinary Least Square Method, and the SUR estimations for structural equations. The results of the analysis indicate that sustainable entrepreneurship and economic security in the analysed countries are growing. However, their dynamics are varied, and what is more, economic security has a statistically significant impact on sustainable entrepreneurship. The impact of economic security on sustainable entrepreneurship from 2008 to 2020 is highest in Slovakia, Bulgaria and Poland. The lowest is in Latvia, Romania and Czechia. We notice that pursuing a stable and responsible macroeconomic policy

Received: 28.06.2023. Verified: 12.09.2023. Accepted: 9.01.2024

affects the implementation of sustainable development goals. It is important to create the best conditions for growth in the long term, which is a challenge because of the problem of finding optimal relationships between factors that determine economic security.

Keywords: sustainable entrepreneurship, economic security, Central and Eastern Europe

JEL: F43, O47, Q01, Q56

Introduction

Entrepreneurship is a multidimensional term defined as a group of personality features and behaviours of people undertaking new economic endeavours. In other words, it is starting a business with the expectancy of making a financial and non-financial profit, solving complex business problems and searching for new business solutions and development paths. Entrepreneurship is improving one's ideas and aspiring to find the best way out of a situation. Entrepreneurship plays an essential function as a driving force in the development of modern economies. It leads to improved living standards, generates capital, and increases employment, prosperity and national income.

Sustainable entrepreneurship (Sus_{Ent}), a part of the strategy for implementing sustainable development goals, is gaining importance. Aside from multiplying profits, Sus_{Ent} is based on supporting and developing employees and local communities and protecting the natural environment. It means the entrepreneur's ability, with his skills, to carry out economic tasks that are both socially and ecologically responsible.

Sus_{Ent} is a relatively new research problem. Therefore, it is poorly recognised, complex and challenging, which results from the fact that it is defined in various ways, and there is no single universally accepted measure to assess it (Urbaniec 2018; Bajdor 2021; Bertello et al. 2022; Di Vaio et al. 2022). In the literature on the subject, most analyses are devoted to discussing theoretical issues related to conceptualising the term (Pacheco, Dean, and Payne 2010; Rosário, Raimundo, and Cruz 2022), development strategies and models (Schaltegger, Lüdeke-Freund, and Hansen 2016; Gregori and Holzmann 2020), and factors that influence the shaping of social and ecological attitudes among entrepreneurs (Raudeliūnienė, Tvaronavičienė, and Dzemyda 2014; Bajdor, Pawełoszek, and Fidlerova 2021).

A novelty in our study is the determination of proprietary indicators for Sus_{Ent} and the separation of its three pillars, economic (E), social (S), and environmental (Env), in Central and Eastern European Countries (CEECs). In addition, we determined

the economic security indicator (E_{Sec}) and assessed its impact on Sus_{Ent} in the studied countries. Our aim is also to indicate the theoretical and empirical implications of the research.

In the analysis, we use Pearson's correlation coefficient and estimation of the OLS and SUR for interdependent equations. We operated on the Eurostat database and used Gretl and Statistica.

The paper includes an introduction, theoretical background, research methodology, results, discussion and conclusions.

Theoretical background

Sustainable entrepreneurship is one of the "catalysts" of social development and environmental protection (Hummels and Argyrou 2021; Wach and Głodowska 2022; Mondal and Gupta 2023). It is part of implementing sustainable development goals, which can be understood as a process based on maintaining favourable operating conditions for the current and future generations (Hockerts and Wüstenhagen 2010; Bajdor 2021). In other words, socio-economic development takes place following the protection of the natural environment (Urbaniec 2018; Bertello et al. 2022).

Sus_{Ent} means business activities that respect the natural environment and uphold corporate social responsibility (Weidinger, Fischler, and Schmidpeter 2014; Lotfi, Yousefi, and Jafari 2018). Entrepreneurs should implement sustainable tasks concerning large projects, everyday activities, and individual meetings with clients. The assumption of sustainable entrepreneurship is the belief that sustainable development and corporate social responsibility are the basis for building the economy of the future – based on values and respect for mutual relations and the environment (Firlej 2005; Davies and Chambers 2018).

Sus_{Ent} is variously defined in the literature on the subject; researchers indicate that it is of pivotal importance to take responsibility for the activities of companies (Dean and McMullen 2007; Johnson and Hörisch 2021), keep up with innovations (Fussler and James 1996; Fichter and Tiemann 2020), use resources effectively, reduce the emission of harmful substances, improve the working conditions, and care for the external environment (Ziarko 2020; Bajdor 2021; Bertello et al. 2022). It brings a competitive advantage to business ventures (Konys 2021; Sadiq et al. 2022). An overview of selected definitions of Sus_{En} is presented in Table 1.

Table 1. Selected definitions of *sustainable entrepreneurship*

Author(s)	Definitions of *sustainable entrepreneurship (SE)*
C. Fussler, P. James (1996)	SE has been proposed as a „breakthrough discipline for innovation".
J.A. Timmons (1999)	SE encompasses activities that consider identifying, assessing and exploiting opportunities to introduce new products and services to the market, often based on natural resources, which are an essential element of the entrepreneurial process.
K. Firlej (2005)	Entrepreneurship, which determines the sustainable economic development of regions, dynamises their development and, consequently, creates opportunities to generate additional income.
T.J. Dean, J.S. McMullen (2007)	SE is the process of discovering, evaluating, and exploiting economic opportunities that are present in market failures which detract from sustainability, including those that are environmentally relevant.
B. Cohen, M.I. Winn (2007)	SE research examines „how opportunities to bring into existence future goods and services are discovered, created, and exploited, by whom, and with what economic, psychological, social, and environmental consequences
D.F. Pacheco, T.J. Dean, D.S. Payne (2010)	We transcend the game theory literature to introduce a more complete understanding of SE, which lies in expanding the concept of the sustainable entrepreneur from discoverer of opportunity in extant economic structures to structural agent who develops institutions to change the „rules of the game" and thereby drives sustainable behaviours.
K. Hockerts, R. Wüstenhagen (2010)	SE is about a combination of economic, social and environmental value creation.
D.A. Shepherd, H. Patzelt (2011)	The objective of SE is to preserve nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society.
S. Schaltegger, M. Wagner (2011)	SE is an innovative, market-oriented and personality-driven form of creating economic and societal value by means of breaking through environmentally or socially beneficial markets or institutional innovations.
M. Urbaniec (2018)	Sustainable entrepreneurship means activities supporting the company's development following pro-ecological principles, considering economic and social benefits.
I.A. Davies, L. Chambers (2018)	SE can make a significant contribution to improving environmental sustainability while running a profitable business.
C. Vallaster et al. (2019)	Sustainable entrepreneurs eliminate traditional business practices, systems and processes and replace them with superior social and environmental products and services.
K. Fichter, I. Tiemann (2020)	SE is the discovery, creation, evaluation and exploitation of opportunities to create innovative goods and services that are consistent with regional, national and SD goals.

Author(s)	Definitions of *sustainable entrepreneurship (SE)*
J. Ziarko (2020)	Sustainable entrepreneurship is about initiating activities and processes that lead to the identification, assessment and exploitation of profitable business opportunities – that is, to be entrepreneurial – while simultaneously contributing to sustainable development.
M.P. Johnson, J. Hörisch (2021)	SE carries great potential to contribute to SD, especially in its potential to replace unsustainable products and services with sustainable ones, to create additional environmental and social value, and to transform markets and societies toward sustainability.
P. Bajdor (2021)	Sustainable entrepreneurship is a comprehensive concept that assumes the existence of mutual relations between the enterprise and the market, society and the environment.
A. Di Vaio et al. (2022)	Sustainable entrepreneurship creates social value through a wide range of economic actors, including individuals, microbusinesses, and large corporations.
A. Bertello et al. (2022)	Sustainable entrepreneurship in the light of new ventures' increasing need to consider the social and environmental impact of their knowledge-intensive activities.

Source: based on the subject literature.

Sus_{Ent} is starting and running a business to achieve economic and social goals and protect the natural environment (Urbaniec 2018; Di Vaio et al. 2022). It means conducting business in various sectors and industries of the economy, where, apart from generating profit, increasing the wealth of owners or increasing the company's value, activities are carried out to support the development of human capital, local communities and the implementation of eco-innovations.

Sus_{Ent} depends on several factors, including the ecological attitude of entrepreneurs, programs that support social development and environmental protection (Middermann, Kratzer, and Perner 2020; Bajdor, Pawełoszek, and Fidlerova 2021; Bakry et al. 2022). One of the factors that socially and ecologically supports responsible initiatives is economic security (Raudeliūnienė, Tvaronavičienė, and Dzemyda 2014; Sulphey and Alkahtani 2017; Khalatur et al. 2021). Maintaining an appropriate level has a positive impact on the development of entrepreneurship while improving the expectations and economic moods of entrepreneurs.

E_{Sec} is the economic basis for the functioning of the state and a key element of the broader concept of national security (Balcerowicz 2004; Leszczyńska and Puchalska 2022; Mahmood 2022). This idea is extremely heterogeneous, multi-threaded, and prefers the meaning of the material, shaping factor standards of quality of life and existence of an individual and entire social group, individually, locally and internationally (Table 2).

Table 2. Selected definitions of *economic security*

Author(s)	Definitions of *economic security*
E. Frejtag-Mika, Z. Kołodziejak, W. Putkiewicz (1996)	Economic security is the ability of the economic system of a state (group of states) to use internal factors of development and international economic interdependence in such a way that will guarantee its unthreatened development.
B. Balcerowicz (2004)	Economic security refers to threats to prosperity, free access to the markets, finances and natural resources they provide, and maintaining the state's position and development.
M. Kahler (2004)	The economic security of a state defines the stability and progressive development of the economy of this territory.
R. Kuźniar (2005)	The issues of economic security primarily covered issues from the sphere of macroeconomics, starting with the structure of the economy, its technological modernity, the condition of state finances (over-indebtedness), the extent of interdependence and degree of reliance on exchange with specific partners or in specific commodity groups (especially energy resources), and therefore susceptibility to external pressures or sudden interruptions in deliveries.
K. Żukrowska, M. Gącik (2006)	Economic security refers to threats to prosperity, free access to markets, financial resources and natural resources that guarantee the continued development of the state and the maintenance of its position. Economic security is also related to maintaining independent production capacities for military purposes.
G. Standing (2007)	Basic economic security is defined as a threefold set of circumstances. First, it requires limited exposure to idiosyncratic, co-variant and systemic risks, uncertainty, hazards and shocks. Second, it requires an ability to cope with them if they materialise. And third, it requires an ability to recover from those outcomes.
R. Zięba (2008)	Economic security refers to threats to prosperity, free access to markets, financial resources and natural resources that ensure the maintenance of the state's position and its development.
O. Kuzmenko et al. (2020)	Economic security is searching for a balanced state of the financial system, which increases the state's resilience to external and internal shocks.
B. Kosowski, A. Kułakowska (2022)	Economic security means a state of existence devoid of risk and uncertainty, and the state's economic security status is assessed through the prism of the state of the economy, stability of the economic system and factors determining development.
M. Leszczyńska, K. Puchalska (2022)	Economic security is not only related to the socio-economic progress and development opportunities of individual countries but also to the impact of the international environment, including the functioning of transnational corporations with significant economic power.
D.R. Mahmood (2022)	Economic security is one of the most critical elements of human security. It refers to the economic capacity of an individual or community.

Source: based on the subject literature.

The concept of economic security (E_{Sec}) covers the decision-making process in the economic area, and it aims to ensure the freedom to shape economic processes following the nation's interests (Standing 2007; Kuzmenko et al. 2020). Micro-scale E_{Sec} refers

to market conditions that enable harmonious development, undisturbed functioning of economies, building sustainable welfare of citizens, and solvency of households or enterprises (Żukrowska 2016; Leszczyńska and Puchalska 2022). E_{Sec} is the state's ability to use internal factors of development and international economic interdependence that will guarantee risk-free development (Kuzmenko et al. 2020; Kosowski and Kułakowska 2022).

E_{Sec} and Sus_{Ent} are closely related, and the existence of one is a condition for the presence of the other. E_{Sec} is a key factor that motivates entrepreneurs to undertake socially and ecologically responsible initiatives. It can be increased by various policy measures to stimulate people's initiative to run existing or start new business ventures more securely and sustainably and to consider the long-term perspective of development and its effects (Cohen and Winn 2007; Wysokińska-Senkus and Raczkowski 2013; Haldar 2019; Rosário, Raimundo, and Cruz 2022). Moreover, economic security activates economic activity and makes entrepreneurs willing to invest and innovate.

Methodology of the research

The main aim of the research is to assess the impact of economic security on sustainable entrepreneurship in Central and Eastern European Countries (CEECs) from 2008 to The research sample covers the following countries: Bulgaria, Croatia, Czechia, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovakia and Slovenia.

We examined countries that experienced a political transformation and became members of the EU at a similar time. The observed economies' size, structure and capabilities are diverse. Moreover, these economies have development prospects and diversified tangible and intangible resources. In addition, their energy sector is largely based on hard coal, they are characterised by a low level of innovation, and the policy is dominated by an approach that focuses primarily on economic growth, with social and environmental protection issues receding into the background. The accession of these countries to the EU meant they had to implement programs to support social and ecological development.

We focused on the time from the financial crisis (the first period after joining the EU) to the beginning of the COVID–19 pandemic. We wanted to assess how sustainable entrepreneurship is developing in those countries, and thus how the approach to development and thinking about the modern world is changing, and to what extent sustainable development depends on economic security. In connection with this goal, we formulated the following main research hypothesis (H): *The country's economic security statistically significantly impacts sustainable entrepreneurship in the CEECs from 2008* to In addition, we formulated the following sub-hypotheses:

- H1: The economic component of the Sus_{Ent} is developing more dynamically than the social and environmental components of sustainable entrepreneurship in the CEECs;
- H2: The dynamics of sustainable entrepreneurship are positive and higher in countries with a more educated population in the CEECs;
- H3: The pillars of sustainable entrepreneurship – economic, social and environmental – are statistically significantly interconnected in the CEECS.

We conducted our research in the following stages:

1. We created an indicator of sustainable entrepreneurship and separated its three economic, social and environmental components. We assumed that sustainable entrepreneurship is the average value of its pillars in a given year. To integrate the explanatory variables, we used the following formulas:

$$E_{ij} = \frac{\sum_{i=1}^{n} \frac{Ed\ ij}{\max Ed\ ij}}{\sum_{i=1}^{n} \frac{P\ ij}{\max P\ ij}}; E_{ij} \in [0;1], \tag{1}$$

$$S_{ij} = \frac{\sum_{i=1}^{n} \frac{Sds\ ij}{\max Sds\ ij}}{\sum_{i=1}^{n} \frac{P\ ij}{\max P\ ij}} + \frac{\sum_{i=1}^{n} \frac{\min Sdd\ ij}{Sdd\ ij}}{\sum_{i=1}^{n} \frac{P\ ij}{\max P\ ij}}; S_{ij} \in [0;1]], \tag{2}$$

$$Env_{ij} = \frac{\sum_{i=1}^{n} \frac{\min Env\ ij}{Env\ ij}}{\sum_{i=1}^{n} \frac{P\ ij}{\max P\ ij}}; S_{ij} \in [0;1], \tag{3}$$

where: Eij; Sij; Envij stands for the normalised value of the j-th variable in the i-th year; xij is the diagnostic variable in the i-th year; SDi indicates the integrated variable in the i-th year.

The Eij indicator is based on the following diagnostic variables (E_{Dij}): enterprises – number; production value – € millions; total purchases of goods and services – € millions, and investment rate (investment/value added at factors cost) – percentage.

The Sij indicator is based on the following diagnostic variables: stimulants (Sds_{ij}): wages and Salaries – € millions; social security costs – € millions; employees – number; apparent labour productivity (Gross value added per person employed) – € thousands; gross

value added per employee – € thousands; and growth rate of employment – percentage; and destimulants (Sdd_{ij}): personnel costs – € millions.

Envij is based on the following destimulants: carbon dioxide; methane; nitrous oxide; sulphur oxides (SO2 equivalent); nitrogen oxides (SO2 equivalent); ammonia (SO2 equivalent).

We use the following formula to create the Sus_{Ent}:

$$Sus_{Ent} = E + S + Env = \sum_{i=1}^{n} \frac{E_{ij}}{n} + \sum_{i=1}^{n} \frac{S_{ij}}{n} + \sum_{i=1}^{n} \frac{Env_{ij}}{n};\ Sus_{Ent} \in [0;1]. \quad (4)$$

2. We create the economic security indicator based on the following formula:

$$E_{Sec} = \sum_{i=1}^{n} \frac{GDP\ ij}{\max GDP\ ij} + \sum_{i=1}^{n} \frac{Exp\ ij}{\max Exp\ ij} + \sum_{i=1}^{n} \frac{Exp\ ij}{\max Exp\ ij} + \sum_{i=1}^{n} \frac{\min Imp\ ij}{Imp\ ij} + \sum_{i=1}^{n} \frac{W\ \&\ S\ ij}{\max W\ \&\ S\ ij} + \sum_{i=1}^{n} \frac{\min U\ ij}{U\ ij} + \sum_{i=1}^{n} \frac{\min HICP\ ij}{HICP\ ij};\ E_{Sec} \in [0;1] \quad (5)$$

where: GDPij; Expij; Impij; W&Sij; Uij; HICPij stands for the normalised value of the j-th variable in the i-th year; GDP – gross domestic product; Exp – export of goods and services, Im – import of goods and services; W&S – wages and salaries; U – unemployment rate; HICP – Harmonised Indices of Consumer Prices.

3. We assessed the relationship between sustainable entrepreneurship and economic security using the Pearson correlation coefficient ($p < 0.05$). We adopt the following ranges of correlation strength: $|rxy| = 0$ – no correlation; $0 < |rxy| \leq 0.19$ – very weak; $0.20 \leq |rxy| \leq 0.39$ – weak; $0.40 \leq |rxy| \leq 0.59$ – moderate; $0.60 \leq |rxy| \leq 0.79$ – strong; $0.80 \leq |rxy| \leq 1.00$ – very strong.

4. We use the OLS method to estimate the model, which is given by the equation:

$$Sus_{Ent} = \hat{\beta}_0 + \hat{\beta}_1 \cdot E_{Sec} + \hat{\beta}_2 \cdot E_{Sec(t-1)} + \varepsilon_i, \quad (6)$$

where β_0 is the intercept, β_1; β_2; β_3; is the slope; εi denotes the i-th residual; i is an observation index.

The regression was written with the following formula:

$$s\left(\hat{\beta}_0,\ldots,\hat{\beta}_4\right)=\sum_{i=1}^{n}e_i^2=\sum_{i=1}^{n}(I_i-\hat{I}_i)^2\rightarrow\min,$$
$$s\left(\hat{\text{a}}_0,\ldots,\ \hat{\text{a}}_4\right)=\sum_{i=1}^{n}\left(Sus_{Ent}-\hat{\beta}_0-\hat{\beta}_1\cdot E_{Sec}-\hat{\beta}_2\cdot \text{E}_{\text{Sec(t-1)}}-\ \text{å}_\text{i}\right)^2\rightarrow\min. \quad (7)$$

5. We create a structural equation model and use the SUR method to estimate it:

$$\begin{cases} E=\hat{\beta}_0+\hat{\beta}_1\text{E}_{\text{Seci}}+\hat{\beta}_2\text{E}_{Sec\,(t-1)i}+\hat{\beta}_3S+\hat{\beta}_4Env+e_i \\ S=\hat{\beta}_0+\hat{\beta}_1\text{E}_{\text{Sec i}}+\hat{\beta}_2\text{E}_{Sec\,(t-1)i}+\hat{\beta}_3E+\hat{\beta}_4Env+e_i \\ Env=\hat{\beta}_0+\hat{\beta}_1\text{E}_{\text{Sec i}}+\hat{\beta}_2\text{E}_{Sec\,(t-1)i}+\hat{\beta}_3E+\hat{\beta}_4S+e_i \end{cases} \quad (8)$$

SUR method estimator:

$$\sqrt{\text{R}}\cdot\left(\hat{\beta}-\ \beta\right)\xrightarrow{\text{d}}\text{N}\ (0,(\tfrac{1}{\text{R}}\cdot\text{X}^{\text{T}}\cdot(\sum-1\otimes\text{I}_\text{R}\ )\cdot\text{X})^{-1}, \quad (9)$$

where: R – observation number, X – equations, IR – dimensional identity matrix, ⊗ denotes matrix Kronecker product, Σ – matrix, y – vector, N – normal distribution, β – model parameter.

Research results

Table 3 shows indicators of sustainable entrepreneurship and its economic, social and environmental pillars. The values of these indicators vary in the analysed countries, which is noteworthy; Sus_{Ent} increased in the analysed period, which is a positive phenomenon, indicating a higher degree of involvement from entrepreneurs in implementing economically and socially responsible tasks.

Table 3. The indicator of sustainable entrepreneurship in CEECs from 2008 to 2020

Country	Indicator	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bulgaria	E	0.77	0.71	0.64	0.69	0.72	0.70	0.73	0.74	0.73	0.77	0.81	0.85	0.84
	S	0.63	0.61	0.61	0.63	0.63	0.64	0.66	0.70	0.72	0.77	0.81	0.87	0.89
	Env	0.66	0.71	0.69	0.64	0.68	0.79	0.74	0.72	0.76	0.76	0.79	0.83	0.87
	Sus_{Ent}	0.68	0.68	0.65	0.65	0.68	0.71	0.71	0.72	0.74	0.77	0.81	0.85	0.87
Croatia	E	0.97	0.89	0.76	0.73	0.71	0.71	0.70	0.75	0.75	0.80	0.83	0.88	0.83
	S	0.87	0.84	0.84	0.82	0.80	0.81	0.83	0.84	0.86	0.89	0.92	0.95	0.93
	Env	0.59	0.67	0.67	0.68	0.73	0.83	0.87	0.82	0.85	0.82	0.86	0.90	0.95
	Sus_{Ent}	0.81	0.80	0.76	0.74	0.75	0.78	0.80	0.80	0.82	0.83	0.87	0.91	0.90
Czechia	E	0.86	0.77	0.83	0.88	0.87	0.85	0.83	0.85	0.85	0.90	0.95	0.96	0.92
	S	0.82	0.77	0.79	0.81	0.80	0.79	0.79	0.81	0.83	0.87	0.91	0.93	0.91
	Env	0.66	0.72	0.74	0.72	0.74	0.77	0.78	0.76	0.79	0.81	0.85	0.91	1.00
	Sus_{Ent}	0.78	0.76	0.78	0.80	0.80	0.81	0.80	0.81	0.82	0.86	0.90	0.94	0.94
Estonia	E	0.70	0.57	0.59	0.70	0.74	0.79	0.76	0.77	0.78	0.84	0.88	0.92	0.87
	S	0.69	0.65	0.66	0.70	0.72	0.74	0.76	0.77	0.79	0.83	0.87	0.90	0.90
	Env	0.65	0.70	0.65	0.66	0.66	0.65	0.65	0.71	0.71	0.69	0.72	0.83	0.96
	Sus_{Ent}	0.68	0.64	0.63	0.68	0.71	0.72	0.72	0.75	0.76	0.79	0.82	0.88	0.91
Hungary	E	0.81	0.72	0.73	0.75	0.74	0.73	0.78	0.81	0.82	0.88	0.93	0.99	0.97
	S	0.80	0.75	0.76	0.77	0.76	0.78	0.79	0.82	0.83	0.86	0.90	0.91	0.88
	Env	0.78	0.85	0.85	0.84	0.90	0.89	0.88	0.88	0.89	0.84	0.84	0.90	0.93
	Sus_{Ent}	0.80	0.77	0.78	0.79	0.80	0.80	0.82	0.84	0.85	0.86	0.89	0.94	0.92
Latvia	E	0.77	0.58	0.60	0.67	0.76	0.77	0.76	0.78	0.79	0.85	0.87	0.91	0.85
	S	0.69	0.62	0.63	0.65	0.68	0.70	0.71	0.73	0.75	0.78	0.85	0.90	0.90
	Env	0.84	0.87	0.87	0.89	0.87	0.87	0.86	0.86	0.87	0.84	0.83	0.82	0.88
	Sus_{Ent}	0.77	0.69	0.70	0.73	0.77	0.78	0.78	0.79	0.80	0.83	0.85	0.88	0.87
Lithuania	E	0.69	0.51	0.52	0.60	0.66	0.70	0.72	0.74	0.75	0.81	0.89	0.94	0.90
	S	0.59	0.54	0.56	0.59	0.60	0.62	0.65	0.67	0.71	0.75	0.81	0.72	0.74
	Env	0.81	0.92	0.89	0.85	0.85	0.89	0.88	0.84	0.85	0.84	0.79	0.84	0.81
	Sus_{Ent}	0.70	0.66	0.66	0.68	0.71	0.74	0.75	0.75	0.77	0.80	0.83	0.83	0.82
Poland	E	0.77	0.70	0.73	0.77	0.76	0.78	0.81	0.82	0.81	0.84	0.94	0.97	0.94
	S	0.70	0.69	0.72	0.73	0.73	0.73	0.74	0.75	0.76	0.80	0.87	0.91	0.91
	Env	0.77	0.83	0.83	0.84	0.86	0.87	0.89	0.90	0.92	0.89	0.90	0.96	0.97
	Sus_{Ent}	0.75	0.74	0.76	0.78	0.78	0.79	0.82	0.83	0.83	0.85	0.90	0.95	0.94

Country	Indicator	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Romania	E	0.81	0.68	0.66	0.77	0.73	0.70	0.71	0.78	0.76	0.78	0.82	0.88	0.86
	S	0.71	0.66	0.67	0.68	0.68	0.71	0.72	0.71	0.75	0.80	0.72	0.77	0.77
	Env	0.68	0.76	0.80	0.77	0.80	0.84	0.86	0.86	0.92	0.94	0.93	0.92	0.99
	Sus_{Ent}	0.73	0.70	0.71	0.74	0.74	0.75	0.76	0.79	0.81	0.84	0.82	0.85	0.87
Slovakia	E	0.60	0.50	0.71	0.73	0.73	0.79	0.79	0.81	0.82	0.86	0.93	0.91	0.86
	S	0.75	0.73	0.78	0.80	0.80	0.79	0.79	0.82	0.83	0.86	0.89	0.91	0.91
	Env	0.60	0.65	0.66	0.70	0.74	0.78	0.79	0.79	0.83	0.83	0.86	0.92	1.00
	Sus_{Ent}	0.65	0.63	0.72	0.74	0.76	0.78	0.79	0.80	0.83	0.85	0.89	0.91	0.92
Slovenia	E	0.88	0.77	0.74	0.75	0.75	0.74	0.75	0.76	0.78	0.84	0.88	0.90	0.83
	S	0.84	0.80	0.82	0.83	0.81	0.81	0.83	0.84	0.87	0.89	0.92	0.94	0.94
	Env	0.69	0.73	0.73	0.74	0.77	0.79	0.84	0.87	0.89	0.90	0.89	0.91	0.98
	Sus_{Ent}	0.80	0.76	0.77	0.77	0.78	0.78	0.81	0.82	0.85	0.88	0.90	0.92	0.92

Source: own study based on Eurostat (n.d.).

The values of selected descriptive statistics for E, S, Env and Sus_{Ent} are presented in Table 4. They indicate different but comparable values in individual pillars of sustainable entrepreneurship. It cannot be unequivocally stated which of the Sus_{Ent} dimensions has a higher level.

Table 4. The descriptive statistics of the sustainable entrepreneurship indicator in CEECs from 2008 to 2020

Country	Indicator	Descriptive statistics				
		Mean	SD	Median	Min	Max
Bulgaria	E	0.75	0.06	0.73	0.64	0.85
	S	0.71	0.10	0.66	0.61	0.89
	Env	0.74	0.07	0.74	0.64	0.87
	Sus_{Ent}	0.73	0.07	0.71	0.65	0.87
Croatia	E	0.79	0.08	0.76	0.70	0.97
	S	0.86	0.05	0.84	0.80	0.95
	Env	0.79	0.10	0.82	0.59	0.95
	Sus_{Ent}	0.81	0.05	0.80	0.74	0.91

Country	Indicator	Descriptive statistics				
		Mean	SD	Median	Min	Max
Czechia	E	0.87	0.05	0.86	0.77	0.96
	S	0.83	0.05	0.81	0.77	0.93
	Env	0.79	0.08	0.77	0.66	1.00
	Sus_{Ent}	0.83	0.06	0.81	0.76	0.94
Estonia	E	0.76	0.10	0.77	0.57	0.92
	S	0.77	0.08	0.76	0.65	0.90
	Env	0.71	0.09	0.69	0.65	0.96
	Sus_{Ent}	0.75	0.08	0.72	0.63	0.91
Hungary	E	0.82	0.09	0.81	0.72	0.99
	S	0.82	0.05	0.80	0.75	0.91
	Env	0.87	0.04	0.88	0.78	0.93
	Sus_{Ent}	0.84	0.05	0.82	0.77	0.94
Latvia	E	0.77	0.10	0.77	0.58	0.91
	S	0.74	0.09	0.71	0.62	0.90
	Env	0.86	0.02	0.87	0.82	0.89
	Sus_{Ent}	0.79	0.06	0.78	0.69	0.88
Lithuania	E	0.73	0.13	0.72	0.51	0.94
	S	0.66	0.08	0.65	0.54	0.81
	Env	0.85	0.03	0.85	0.79	0.92
	Sus_{Ent}	0.74	0.06	0.75	0.66	0.83
Poland	E	0.82	0.08	0.81	0.70	0.97
	S	0.77	0.07	0.74	0.69	0.91
	Env	0.88	0.05	0.89	0.77	0.97
	Sus_{Ent}	0.82	0.07	0.82	0.74	0.95
Romania	E	0.76	0.06	0.77	0.66	0.88
	S	0.72	0.04	0.71	0.66	0.80
	Env	0.85	0.08	0.86	0.68	0.99
	Sus_{Ent}	0.78	0.05	0.76	0.70	0.87
Slovakia	E	0.77	0.12	0.79	0.50	0.93
	S	0.82	0.06	0.80	0.73	0.91
	Env	0.78	0.11	0.79	0.60	1.00
	Sus_{Ent}	0.79	0.09	0.79	0.63	0.92

Country	Indicator	Descriptive statistics				
		Mean	SD	Median	Min	Max
Slovenia	E	0.80	0.06	0.77	0.74	0.90
	S	0.86	0.05	0.84	0.80	0.94
	Env	0.83	0.09	0.84	0.69	0.98
	Sus_{Ent}	0.83	0.06	0.81	0.76	0.92

Source: own study based on Eurostat (n.d.).

Table 5 presents indicators of countries' economic security; the level varied and fluctuated during the research period. There were lower E_{sec} levels at the beginning of the period, when the financial crisis occurred, and in many cases, the level of security fell in 2020, the first year of the COVID–19 pandemic.

Table 5. The indicator of economic security in CEECs from 2008 to 2020

Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bulgaria	0.44	0.39	0.38	0.39	0.35	0.20	0.65	0.76	0.76	0.37	0.53	0.58	0.44
Croatia	0.62	0.64	0.63	0.60	0.58	0.57	0.65	0.63	0.63	0.64	0.69	0.76	0.84
Czechia	0.51	0.58	0.54	0.53	0.52	0.54	0.63	0.70	0.65	0.65	0.72	0.75	0.69
Estonia	0.42	0.51	0.41	0.43	0.45	0.48	0.54	0.69	0.56	0.58	0.62	0.68	0.63
Hungary	0.54	0.53	0.53	0.53	0.53	0.54	0.72	0.75	0.66	0.68	0.71	0.75	0.69
Latvia	0.49	0.47	0.44	0.44	0.47	0.52	0.52	0.56	0.73	0.60	0.65	0.69	0.67
Lithuania	0.45	0.45	0.43	0.42	0.45	0.49	0.64	0.55	0.58	0.58	0.62	0.68	0.66
Poland	0.48	0.47	0.47	0.47	0.48	0.50	0.66	0.54	0.62	0.60	0.65	0.70	0.70
Romania	0.48	0.49	0.47	0.47	0.48	0.50	0.54	0.67	0.60	0.65	0.68	0.72	0.69
Slovakia	0.52	0.55	0.54	0.53	0.54	0.55	0.72	0.63	0.63	0.64	0.69	0.73	0.70
Slovenia	0.60	0.64	0.58	0.57	0.56	0.55	0.63	0.60	0.75	0.64	0.69	0.74	0.80

Source: own study based on Eurostat (n.d.).

Descriptive statistics of E_{Sec} are presented in Table Croatia has the highest average value of the E_{Sec} indicators, while the lowest is in Bulgaria. The highest maximum value is also in Croatia, and again, the lowest minimum is in Bulgaria. The level of economic security in the surveyed countries is similar, which indicates that the development conditions are similar.

Table 6. The descriptive statistics of the economic security indicator in CEECs from 2008 to 2020

Country	Descriptive statistics				
	Mean	SD	Median	Min	Max
Bulgaria	0.48	0.16	0.44	0.20	0.76
Croatia	0.65	0.07	0.63	0.57	0.84
Czechia	0.62	0.08	0.63	0.51	0.75
Estonia	0.54	0.09	0.54	0.41	0.69
Hungary	0.63	0.09	0.66	0.53	0.75
Latvia	0.56	0.10	0.52	0.44	0.73
Lithuania	0.54	0.09	0.55	0.42	0.68
Poland	0.57	0.09	0.54	0.47	0.70
Romania	0.57	0.09	0.54	0.47	0.72
Slovakia	0.61	0.08	0.63	0.52	0.73
Slovenia	0.64	0.08	0.63	0.55	0.80

Source: own study based on Eurostat (n.d.).

Pearson's linear correlation coefficients ($p < 0.05$) are presented in Figure Hungary has the highest statistically significant correlation between Sus_{Ent} and E_{Sec}, at 0.95; the lowest is in the Czech Republic (0.77). The results show a strong relationship between economic security and sustainable entrepreneurship.

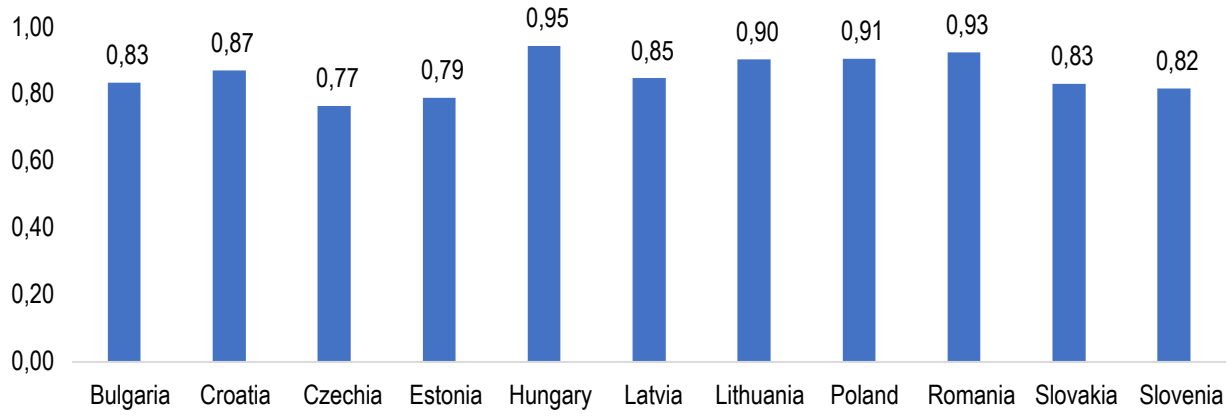

Figure 1. The Pearson's R correlation coefficients of Sus_{Ent} and E_{Sec} in CEECs from 2008 to 2020, $p < 0.05$ (n = 13)

Source: own study based on Eurostat (n.d.).

The OLS estimation results indicate that economic security statistically impacts sustainable entrepreneurship in the CEECs. The highest impact is in Slovakia (0.976), and the lowest is in Latvia (0.503) (Table 7).

Table 7. Results of OLS regressions in the period from 2008 to 2020: $Sus_{\mathrm{Ent}} = \alpha_0 + \alpha_1 E_{Sec} + \varepsilon_{\mathrm{i}}$

Country	Independent variable	Coefficient	Std. error	p-value	R^2
Bulgaria	Const	0.244	0.098	0.0293	0.697
	E_{Sec}	0.756	0.151	0.0004	
Croatia	Const	0.395	0.071	0.0002	0.760
	E_{Sec}	0.642	0.109	0.0001	
Czechia	Const	0.492	0.086	0.0001	0.588
	E_{Sec}	0.551	0.139	0.0022	
Estonia	Const	0.368	0.090	0.0018	0.623
	E_{Sec}	0.703	0.165	0.0013	
Hungary	Const	0.452	0.040	<0.0001	0.893
	E_{Sec}	0.626	0.065	<0.0001	
Latvia	Const	0.507	0.054	<0.0001	0.720
	E_{Sec}	0.503	0.095	0.0002	
Lithuania	Const	0.421	0.047	<0.0001	0.818
	E_{Sec}	0.602	0.086	<0.0001	
Poland	Const	0.442	0.054	<0.0001	0.823
	E_{Sec}	0.675	0.094	<0.0001	
Romania	Const	0.474	0.038	<0.0001	0.856
	E_{Sec}	0.530	0.065	<0.0001	
Slovakia	Const	0.192	0.121	0.1411	0.692
	E_{Sec}	0.976	0.196	0.0004	
Slovenia	Const	0.447	0.081	0.0002	0.670
	E_{Sec}	0.592	0.125	0.0006	

Source: own study based on Eurostat (n.d.).

Table 8 shows the results of the SUR estimation. The pillars of sustainable entrepreneurship are statistically significantly interdependent. Very often, there is a connection between economic and social development. Economic security has a statistically significant impact only on the social pillar of Sus_{Ent} in the Czech Republic, the social and environmental components in Hungary, the economic, social and environmental pillars in Lithuania, the environmental pillar in Poland, and the economic and environmental pillars in Romania.

Table 8. Results of SUR regressions in the period from 2008 to 2020

Country	Dependent variable	Independent variable	Coefficient	Std. error	p-value	R^2
Bulgaria	E	const	0.335	0.046	1.62E–05	0.815
		S	0.583	0.065	2.03E–06	
	S	const	–0.538	0.079	4.47E–05	0.903
		E	1.012	0.086	3.38E–07	
		Env	0.659	0.068	2.19E–06	
	Env	const	0.305	0.065	0.0006	0.736
		S	0.618	0.091	2.86E–05	
Croatia	E	const	–0.359	0.130	0.0199	0.828
		S	1.963	0.172	4.73E–07	
		Env	–0.687	0.077	4.51E–06	
	S	const	0.185	0.049	0.0035	0.868
		E	0.506	0.044	4.73E–07	
		Env	0.350	0.034	1.17E–06	
	Env	const	–0.517	0.190	0.0214	0.797
		E	–1.427	0.160	4.51E–06	
		S	2.824	0.273	1.17E–06	
Czechia	E	const	0.091	0.093	0.3473	0.826
		S	0.936	0.111	3.91E–06	
	S	const	0.055	0.052	0.3217	0.931
		E_{Sec}	0.043	0.039	0.295	
		E	0.656	0.062	2.21E–06	
		Env	0.229	0.040	0.0003	
	Env	const	–0.407	0.208	0.076	0.694
		S	1.436	0.249	0.0001	
Estonia	E	const	–0.017	0.055	0.7701	0.932
		S	1.465	0.090	1.67E–08	
		Env	–0.484	0.099	0.0006	
	S	const	0.006	0.035	0.8644	0.959
		E	0.668	0.041	1.67E–08	
		Env	0.353	0.052	4.44E–05	
	Env	const	0.004	0.099	0.9699	0.715
		E	–1.517	0.310	0.0006	
		S	2.432	0.355	4.44E–05	

Country	Dependent variable	Independent variable	Coefficient	Std. error	p-value	R^2
Hungary	E	const	−0.578	0.084	2.50E−05	0.953
		S	1.712	0.102	3.46E−09	
	S	const	0.349	0.020	6.41E−09	0.972
		E_{Sec}	0.141	0.052	2.14E−02	
		E	0.465	0.045	1.25E−06	
	Env	const	1.200	0.234	0.0004	0.300
		E_{Sec}	0.868	0.359	0.0363	
		S	−1.058	0.531	7.45E−02	
Latvia	E	const	1.123	0.265	1.70E−03	0.838
		S	0.880	0.085	1.21E−06	
		Env	−1.171	0.285	2.10E−03	
	S	const	0.031	0.071	6.75E−01	0.807
		E	0.922	0.092	6.86E−07	
	Env	const	0.977	0.031	3.93E−12	0.469
		E	−0.154	0.040	2.80E−03	
Lithuania	E	const	1.934	0.263	2.42E−05	0.904
		E_{Sec}	0.926	0.127	2.58E−05	
		Env	−2.007	0.272	2.36E−05	
	S	const	1.286	0.279	1.00E−03	0.823
		E_{sec}	0.545	0.112	7.00E−04	
		Env	−1.084	0.292	4.00E−03	
	Env	const	0.962	0.032	3.57E−11	0.692
		E_{sec}	0.429	0.099	1.40E−03	
		E	−0.473	0.064	2.36E−05	
Poland	E	const	−0.041	0.063	5.26E−01	0.926
		S	1.113	0.081	2.98E−08	
	S	const	−0.361	0.173	6.14E−02	0.714
		Env	1.290	0.197	4.13E−05	
	Env	const	0.574	0.044	5.10E−08	0.756
		E_{sec}	0.539	0.077	2.26E−05	

Country	Dependent variable	Independent variable	Coefficient	Std. error	p-value	R^2
Rumunia	E	const	0.467	0.071	3.77E–05	0.584
		E_{sec}	0.519	0.122	1.30E–03	
	S	const	0.299	0.077	2.90E–03	0.711
		E	0.264	0.104	2.97E–02	
		Env	0.256	0.080	9.40E–03	
	Env	const	0.424	0.078	2.00E–04	0.702
		E_{sec}	0.744	0.134	2.00E–04	
Slovakia	E	const	–0.774	0.181	1.30E–03	0.797
		S	1.885	0.220	3.37E–06	
	S	const	0.393	0.029	7.76E–08	0.891
		E	0.215	0.031	3.97E–05	
		Env	0.330	0.036	3.77E–06	
	Env	const	–0.687	0.138	4.00E–04	0.844
		S	1.790	0.167	3.77E–07	
Slovenia	E	const	–0.269	0.090	1.36E–02	0.843
		S	1.900	0.163	3.94E–07	
		Env	–0.683	0.098	3.87E–05	
	S	const	0.144	0.035	2.20E–03	0.945
		E	0.515	0.044	3.94E–07	
		Env	0.368	0.030	2.04E–07	
	Env	const	–0.394	0.118	0.0075	0.861
		E	–1.341	0.193	3.87E–05	
		S	2.667	0.214	2.04E–07	

Source: own study based on Eurostat (n.d.).

Discussion

Our research shows that a country's economic security is pivotal for sustainable entrepreneurship in the CEECs. The selected research period, which begins with the financial crisis and ends with the beginning of the COVID–19 pandemic, is unique due to economic fluctuations and a diverse level of economic security in the countries. Thus, we confirm the results of previous research, which indicate the deterioration of economic results in periods of crisis and gradual fluctuations around the trend (Leszczyńska and Puchalska

2022; Mahmood 2022). At the same time, we find that economic security in the surveyed countries is at an average level, although the trend is slightly increasing.

A socio-economic phenomenon that should be unequivocally assessed positively is sustainable entrepreneurship, whose growth dynamics in the analysed period increased (Lotfi, Yousefi, and Jafari 2018; Ziarko 2020; Bajdor 2021). Like other researchers (Haldar 2019; Rosário, Raimundo, and Cruz 2022), we noted that businesses are gradually implementing the concept of sustainable development, but there is a need to take further actions to increase the level.

The results of Pearson's correlation coefficient and the OLS estimation indicate the validity of the main research hypothesis. Therefore, a country's economic security statistically significantly impacted sustainable entrepreneurship in the CEECs from 2008 to Maintaining appropriate macroeconomic relations is important for sustainable economic initiatives (Sulphey and Alkahtani 2017; Khalatur et al. 2021). In our research, we examined the impact of only one variable; therefore, in further analyses, it will be necessary to examine a wider group of exogenous and endogenous determinants that affect Sus_{Ent}.

We cannot confirm the first sub-hypothesis because, in the analysed countries, it is only periodically true that the economic component of the Sus_{Ent} develops more dynamically than the social and environmental components. It means that entrepreneurs actively undertake social and ecological activities and do not focus only on maximising economic results.

We confirm the second sub-hypothesis because the dynamics of sustainable entrepreneurship are positive, and higher in countries with a more educated population. Thus, we confirm the importance of environmental awareness and knowledge about management processes and their impact on the natural environment in the CEECs.

The third sub-hypothesis is true because the economic, social and environmental pillars of sustainable entrepreneurship are statistically significantly interconnected in the CEECs. In most countries, there is a link between economic and social development, and these pillars are mutually reinforcing. Environmental development is influenced by both economic and social development, which is important. This positive relationship indicates that economic growth has been successfully separated from environmental protection.

Our study has limitations related to the selection of variables for models, the estimation methods, and the approach to normalising indicators. Despite this, it is important for both economic theory and practice. From the point of view of theory, it is important to discuss theoretical issues related to sustainable entrepreneurship and to formulate an original definition. The separation of three components of sustainable entrepreneurship and the development of our own research methodology to assess the impact of factors on sustainable entrepreneurship constitute a valuable contribution to the literature

on the subject. The study results are important for economic practice. We suggest a connection between the pillars of sustainable entrepreneurship, its positive growth dynamics and the connection with economic security; this is important for implementing macroeconomic and environmental policies in the surveyed countries.

Conclusions

Sustainable entrepreneurship includes the activities of entrepreneurs whose goal is to develop enterprises in economic, social and environmental areas. However, it depends on several factors, including a country's economic security, as shown by the results of our research. The level of economic security fluctuates in the surveyed countries, which results from their gradual recovery from the financial crisis after 2008.

Sustainable entrepreneurship in Central and Eastern Europe has a positive upward trend, which is optimistic because sustainable development is being implemented in business practice.

Table 9 shows which CEECs were leaders in sustainable entrepreneurship and economic security in 2020. It also shows where economic security has the strongest impact on sustainable entrepreneurship from 2008 to 2020.

The highest levels of sustainable entrepreneurship in 2020 are in countries with a relatively large population, high economic activity, easy business set-up procedures and growing customer demand for ecological products and services. The lowest levels are in smaller countries, with a lower level of socio-economic development.

The highest levels of economic security in 2020 are in countries with relatively high macroeconomic indicators. By contrast, the lowest levels are in smaller countries with trade balance problems.

The impact of economic security on sustainable entrepreneurship from 2008 to 2020 is highest in countries where the enterprise sector is dependent on macroeconomic conditions. The lowest impact is observed in countries where internal issues related to industry-specific factors and business operations are decisive.

Table 9. Countries ranked from highest to lowest value of the indicator

Sustainable entrepreneurship in CEECs (2020)		Economic security in CEECs (2020)		Strength of the impact of economic security on sustainable entrepreneurship in CEECs (2008–2020)	
Czechia	0.94	Croatia	0.84	Slovakia	0.976
Poland	0.94	Slovenia	0.80	Bulgaria	0.756
Hungary	0.92	Poland	0.70	Estonia	0.703
Slovakia	0.92	Slovakia	0.70	Poland	0.675
Slovenia	0.92	Czechia	0.69	Croatia	0.642
Estonia	0.91	Hungary	0.69	Hungary	0.626
Croatia	0.90	Romania	0.69	Lithuania	0.602
Bulgaria	0.87	Latvia	0.67	Slovenia	0.592
Latvia	0.87	Lithuania	0.66	Czechia	0.551
Romania	0.87	Estonia	0.63	Romania	0.530
Lithuania	0.82	Bulgaria	0.44	Latvia	0.503

Source: own study based on Eurostat (n.d.).

The research results clearly show that economic security is a key factor that influences entrepreneurs' behaviour in sustainable development. An appropriate level positively affects the social and ecological responsibility of business.

Future research will focus on isolating exogenous and endogenous factors that affect sustainable entrepreneurship. In addition, we will conduct comparative analyses of its level across all EU countries.

References

Bajdor, P. (2021), *Zrównoważona przedsiębiorczość. Analiza i model*, Politechnika Częstochowska, Częstochowa.

Bajdor, P., Pawełoszek, I., Fidlerova, H. (2021), *Analysis and Assessment of Sustainable Entrepreneurship Practices in Polish Small and Medium Enterprises*, "Sustainability", 13 (7), 3595, https://doi.org/10.3390/su13073595

Bakry, D.S., Daim, T., Dabic, M., Yesilada, B (2022), *An evaluation of the effectiveness of innovation ecosystems in facilitating the adoption of sustainable entrepreneurship*, "Journal of Small Business Management", https://doi.org/10.1080/00472778.2022.2088775

Balcerowicz, B. (2004), *Bezpieczeństwo polityczne Rzeczypospolitej Polskiej*, Wydawnictwo Akademii Obrony Narodowej, Warszawa.

Bertello, A., Battisti, E., De Bernardi, P., Bresciani, S. (2022), *An integrative framework of knowledge-intensive and sustainable entrepreneurship in entrepreneurial ecosystems*, "Journal of Business Research", 142, pp. 683–693, https://doi.org/10.1016/j.jbusres.2021.12.054

Cohen, B., Winn, M. (2007), *Market imperfections, opportunity and sustainable entrepreneurship*, "Journal of Business Venturing", 22 (1), pp. 29–49, https://doi.org/10.1016/j.jbusvent.2004.12.001

Davies, I.A., Chambers, L. (2018), *Integrating hybridity and business model theory in sustainable entrepreneurship*, "Journal of Cleaner Production", 177, pp. 378–386, https://doi.org/10.1016/j.jclepro.2017.12.196

Dean, T.J., McMullen, J.S. (2007), *Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action*, "Journal of Business Venturing", 22 (1), pp. 50–76, https://doi.org/10.1016/j.jbusvent.2005.09.003

Di Vaio, A., Hassan, R., Chhabra, M., Arrigo, E., Palladino, R. (2022), *Sustainable entrepreneurship impact and entrepreneurial venture life cycle: A systematic literature review*, "Journal of Cleaner Production", 378, 134469, https://doi.org/10.1016/j.jclepro.2022.134469

Eurostat (n.d.), *Database*, https://ec.europa.eu/eurostat/data/database (accessed: 10.03.2023).

Fichter, K., Tiemann, I. (2020), *Impacts of promoting sustainable entrepreneurship in generic business plan competitions*, "Journal of Cleaner Production", 267, 122076, https://doi.org/10.1016/j.jclepro.2020.122076

Firlej, K. (2005), *Ograniczenia prawne rozwoju działań przedsiębiorczych w kontekście integracji z Unią Europejską*, "Zeszyty Naukowe Akademii Ekonomicznej w Krakowie", 671, pp. 63–72.

Frejtag-Mika, E., Kołodziejak, Z., Putkiewicz, W. (1996), *Bezpieczeństwo ekonomiczne we współczesnym świecie*, Politechnika Radomska, Radom.

Fussler, C., James, P. (1996), *Driving eco-innovation: a breakthrough discipline for innovation and sustainability*, Financial Times/Prentice Hall, London.

Gregori, P., Holzmann, P. (2020), *Digital sustainable entrepreneurship: A business model perspective on embedding digital technologies for social and environmental value creation*, "Journal of Cleaner Production", 272, 122817, https://doi.org/10.1016/j.jclepro.2020.122817

Haldar, A. (2019), *Towards a conceptual understanding of sustainability-driven entrepreneurship*, "Corporate Social Responsibility and Environmental Management", 26 (6), pp. 1157–1170, https://doi.org/10.1002/csr.1763

Hockerts, K., Wüstenhagen, R. (2010), *Greening Goliaths versus emerging Davids – Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship*, "Journal of Business Venturing", 25 (5), pp. 481–492, https://doi.org/10.1016/j.jbusvent.2009.07.005

Hummels, H., Argyrou, A. (2021), *Planetary demands: Redefining sustainable development and sustainable entrepreneurship*, "Journal of Cleaner Production", 278, 123804, https://doi.org/10.1016/j.jclepro.2020.123804

Johnson, M.P., Hörisch, J. (2021), *Reinforcing or counterproductive behaviors for sustainable entrepreneurship? The influence of causation and effectuation on sustainability orientation*,

"Business Strategy and the Environment", 31 (3), pp. 908–920, https://doi.org/10.1002/bse.2925

Kahler, M. (2004), *Economic security in an era of globalisation: Definition and provision*, "The Pacific Review", 17, https://doi.org/10.1080/0951274042000326032

Khalatur, S., Masiuk, Y., Kachula, S., Brovko, L., Karamushka, O., Shramko, I. (2021), *Entrepreneurship development management in the context of economic security*, "Entrepreneurship and Sustainability Issues", 9 (1), pp. 558–573, https://doi.org/10.9770/jesi.2021.9.1(35)

Konys, A. (2019), *Towards Sustainable Entrepreneurship Holistic Construct*, "Sustainability", 11, 6749, https://doi.org/10.3390/su11236749

Kosowski, B., Kułakowska, A. (2022), *Percepcja bezpieczeństwa ekonomicznego gospodarstw domowych*, "Politeja", 4 (79), pp. 327–342, https://doi.org/10.12797/Politeja.19.2022.79.16

Kuzmenko, O., Šuleř, P., Lyeonov, S., Judrupa, I., Boiko, A. (2020), *Data mining and bifurcation analysis of the risk of money laundering with the involvement of financial institutions*, "Journal of International Studies", 13 (3), https://doi.org/10.14254/2071-8330.2020/13-3/22

Kuźniar, R. (2005), *Polityka i siła*, Wydawnictwo Scholar, Warszawa.

Leszczyńska, M., Puchalska, K. (2022), *Implikacje dla bezpieczeństwa ekonomicznego krajowych gospodarek, wynikające z ekspansji przedsiębiorstw międzynarodowych*, "Polityka i Społeczeństwo", 4 (20), pp. 172–192.

Lotfi, M., Yousefi, A., Jafari, S. (2018), *The Effect of Emerging Green Market on Green Entrepreneurship and Sustainable Development in Knowledge-Based Companies*, "Sustainability", 10 (7), 2308, https://doi.org/10.3390/su10072308

Mahmood, D.R. (2022), *Afghan Refugees: A Threat to the Economic Security of Pakistan*, "Journal of Psychology and Political Science", 3 (01), pp. 16–23, https://doi.org/10.55529/jpps.31.16.23

Middermann, L.H., Kratzer, J., Perner, S. (2020), *The Impact of Environmental Risk Exposure on the Determinants of Sustainable Entrepreneurship*, "Sustainability", 12 (4), 1534, https://doi.org/10.3390/su12041534

Mondal, S.S., Gupta, H. (2023), *Assessing enablers of green entrepreneurship in circular economy: An integrated approach*, "Journal of Cleaner Production", 388, 135999, http://doi.org/10.1016/j.jclepro.2023.135999

Pacheco, D.F., Dean, T.J., Payne, D.S. (2010), *Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development*, "Journal of Business Venturing", 25 (5), pp. 464–480, https://doi.org/10.1016/j.jbusvent.2009.07.006

Raudeliūnienė, J., Tvaronavičienė, M., Dzemyda, I. (2014), *Towards Economic Security and Sustainability: Key Success Factors of Sustainable Entrepreneurship in Conditions of Global Economy*, "Journal of Security and Sustainability Issues", 3 (4), https://journals.lka.lt/journal/jssi/article/1615/info

Rosário, A.T., Raimundo, R.J., Cruz, S.P. (2022), *Sustainable Entrepreneurship: A Literature Review*, "Sustainability", 14 (9), 5556, https://doi.org/10.3390/su14095556

Sadiq, M., Nonthapot, S., Mohamad, S., Chee Keong, O., Ehsanullah, S., Iqbal, N. (2022), *Does green finance matter for sustainable entrepreneurship and environmental corporate social*

responsibility during COVID–19?, "China Finance Review International", 12 (2), pp. 317–333, https://doi.org/10.1108/CFRI-02-2021-0038

Schaltegger, S., Wagner, M. (2011), *Sustainable entrepreneurship and sustainability innovation: categories and interactions*, "Business Strategy and the Environment", 20 (4), pp. 222–237, https://doi.org/10.1002/bse.682

Schaltegger, S., Lüdeke-Freund, F., Hansen, E.G. (2016), *Business Models for Sustainability: A Co-Evolutionary Analysis of Sustainable Entrepreneurship, Innovation, and Transformation*, "Organization & Environment", 29 (3), https://doi.org/10.1177/1086026616633272

Shepherd, D.A., Patzelt, H. (2011), *The New Field of Sustainable Entrepreneurship: Studying Entrepreneurial Action Linking "What is to be Sustained" with "What is to be Developed"*, "Entrepreneurship Theory and Practice", 35 (1), https://doi.org/10.1111/j.1540-6520.2010.00426.x

Standing, G. (2007), *How Cash Transfers Boost Work and Economic Security*, "DESA Working Paper", 58, ST/ESA/2007/DWP/58.

Sulphey, M.M., Alkahtani, N. (2017), *Economic Security and Sustainability Through Social Entrepreneurship: The Current Saudi Scenario*, "Journal of Security and Sustainability Issues", 6 (3), https://ssrn.com/abstract=3061091

Timmons, J.A. (1999), *New Venture Creation: Enterpreneurship for the 21 Centure*, Irwin/McGraw-Hill, Boston.

Urbaniec, M. (2018), *Rola przedsiębiorczości w kontekście zrównoważonego rozwoju*, "Przedsiębiorczość – Edukacja", 14, pp. 26–39, https://doi.org/10.24917/20833296.14.2

Vallaster, C., Kraus, S., Kailer, N., Baldwin, B. (2019), *Responsible entrepreneurship: outlining the contingencies*, "International Journal of Entrepreneurial Behavior & Research", 25 (3), pp. 538–553, https://doi.org/10.1108/IJEBR-04-2018-0206

Wach, K., Głodowska, A. (2022), *Entrepreneurship research in economics and management: Understanding the term and the research trends*, "International Entrepreneurship Review", 8 (4), pp. 7–24, https://doi.org/10.15678/IER.2022.0804.01

Weidinger, Ch., Fischler, F., Schmidpeter, R. (2014), *Editors Sustainable Entrepreneurship Business Success through Sustainability*, Springer, Heidelberg–New York–Dordrecht–London.

Wysokińska-Senkus, A., Raczkowski, K. (2013), *Economic Security in the Context of Sustainability*, "Rural Development", 6 (1), pp. 454–462.

Ziarko, J. (2020), *Kształcenie menedżerskich kompetencji zrównoważonej przedsiębiorczości wyzwaniem dla szkoły wyższej*, [w:] D. Fatuła (ed.), *Zarządzanie zrównoważonym rozwojem organizacji. Wybrane aspekty*, Oficyna Wydawnicza AFM, Kraków.

Zięba, R. (2008), *Bezpieczeństwo międzynarodowe po zimnej wojnie*, Wydawnictwa Akademickie i Profesjonalne, Warszawa.

Żukrowska, K., Gącik, M. (2006). *Bezpieczeństwo międzynarodowe – teoria i praktyka*, Oficyna Wydawnicza SGH, Warszawa.

Żukrowska K. (red.) (2016), *Otwarcie. Konkurencyjność. Wzrost*, Wydawnictwo SGH, Warszawa.

Wpływ bezpieczeństwa ekonomicznego na zrównoważoną przedsiębiorczość w Europie Środkowo-Wschodniej – od kryzysu finansowego do pandemii COVID–19

Głównym celem artykułu jest ocena wpływu bezpieczeństwa ekonomicznego na zrównoważoną przedsiębiorczość w krajach Europy Środkowej i Wschodniej (CEECs), w tym w Bułgarii, Chorwacji, Czechach, Estonii, na Węgrzech, Litwie, Łotwie, w Polsce, Rumunii, Słowacji i Słowenii w okresie od 2008 do 2020 r. Nowością artykułu jest opracowanie wskaźników zrównoważonej przedsiębiorczości i jej trzech filarów: ekonomicznego, społecznego i środowiskowego. W części empirycznej autorzy ocenili wpływ bezpieczeństwa ekonomicznego na zrównoważoną przedsiębiorczość i przeprowadzili analizę porównawczą jego wpływu na komponenty przedsiębiorczości: ekonomiczny, społeczny i środowiskowy. Do badań wykorzystano współczynniki korelacji Pearsona, klasyczną metodę najmniejszych kwadratów i metodę równań pozornie niepowiązanych (SUR). Wyniki analizy wskazują, że zrównoważona przedsiębiorczość i bezpieczeństwo ekonomiczne w analizowanych krajach rosną, choć ich dynamika jest zróżnicowana, ponadto bezpieczeństwo ekonomiczne ma statystycznie istotny wpływ na zrównoważoną przedsiębiorczość. Autorzy dostrzegają, że prowadzenie stabilnej i odpowiedzialnej polityki makroekonomicznej wpływa na realizację celów zrównoważonego rozwoju. Istotne jest stworzenie jak najlepszych warunków do wzrostu w długim okresie, co jest wyzwaniem ze względu na problem znalezienia optymalnych relacji pomiędzy czynnikami decydującymi o bezpieczeństwie ekonomicznym i zrównoważonym rozwoju.

Słowa kluczowe: zrównoważona przedsiębiorczość, bezpieczeństwo ekonomiczne, Europa Środkowo-Wschodnia

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.05

Financial Constraints on Firm Growth: The Role of Firm Age in the ASEAN–6

Yee Ling Ng https://orcid.org/0000-0001-6463-0827
Universiti Putra Malaysia, School of Business and Economics, Selangor, Malaysia
e-mail: gs56863@student.upm.edu.my

Wei Theng Lau https://orcid.org/0000-0002-1196-5372
Ph.D., Senior Lecturer at Universiti Putra Malaysia, School of Business and Economics, Selangor, Malaysia
e-mail: lwtheng@upm.edu.my

Wei Ni Soh https://orcid.org/0000-0003-3593-1684
Ph.D., Senior Lecturer at Universiti Putra Malaysia, School of Business and Economics, Selangor, Malaysia
e-mail: sohweini@upm.edu.my

Nazrul Hisyam Ab Razak https://orcid.org/0000-0001-7631-2391
Ph.D., Associate Professor at Universiti Putra Malaysia, School of Business and Economics, Selangor, Malaysia
e-mail: nazrul@upm.edu.my

Abstract

The paper assesses the moderating role of firm age in the relationship between financial constraints, as measured by the KZ index, and the WW index on three alternative measures of firm growth (Asset growth, *ROA*, and *ROE*) in the ASEAN–6 region. This study employs a sample of ASEAN–6 listed firms over the period 2009–2019 using Fixed Effects and the System GMM model. Firm age is found to interact positively with financial constraints in their effects on firm growth. The negative impact of financial constraints on firm growth is less severe with older age firms.

Keywords: financial constraint, Fixed Effect Model, System GMM model, ASEAN, KZ index, WW index, firm growth

JEL: C58, D33, L25

Received: 20.03.2023. Verified: 3.08.2023. Accepted: 23.01.2024

Introduction

The Association of Southeast Asian Nations (ASEAN) has emerged as a significant global player through a noteworthy trajectory, underscoring its standing as a promising force within the region. Firm growth is a motivation for firms to stay competitive and progress. The ASEAN countries act as global exporters and a huge potential region; therefore, governments should give them access to an international network to support them and to help them understand the local regulations and corporate governance.

However, growth requires funds to finance growth. Financial problems can bring empire-building expansion before it brings problems of administrative organization. Financing is the greatest growth-constrained obstacle for a firm. The most precise definition of financial constraint is a wedge between the internal and external costs of funds (Kaplan and Zingales 1997). Financial constraints are a hurdle for economic development as constraints limit firms' ability to compete in the market and to have access to external financing for issuing shares and borrowing. The effect of financial constraints on firm growth can be affected by firm age. The older a firm, the more knowledge it has in terms of the crucial aspects of the business (e.g., well-developed supply channels, technologies, customer relationships, access to resources, human capital, and lower financing costs). These abilities and skills inherent in older firms confer a competitive advantage, resulting in superior performance. Consequently, this advantage can contribute to the success of ASEAN's regional economic integration, aligning with their pursuit of long-term objectives.

Firm age is a unique branding element to serve customers that illuminates the histories of each firm. Thus, there must be something special about the businesses that have endured. Firms can experience growth along many dimensions, reflecting varying levels of desirability and attitudes toward growth objectives depending on the characteristics of the firm.

Liability of Newness refers to the tendency of younger firms to have higher failure rates relative to older firms (Stinchcombe 2000). This is because new firms often face the challenges of learning new responsibilities and tasks, incurring significant expenses, establishing networks with clients and supporters, and developing a formalized information structure or normative basis. This suggests that survival is problematic for start-ups when competing with established companies, although young, innovative companies now have more accessible capital than ever before. On the other hand, aging companies might face constraints hat severely limit their ability to adapt to changing conditions (Aldrich and Auster 1986).

The objective of this study is to examine the moderating role of firm age, which can affect the direction and strength of the relationship between financial constraints and firm growth. The moderating role of firm age is operationalized as the length of the initial

public offering (IPO) period during which a firm has been active in business activities. The length of this period can increase or decrease the impact of financial constraints on firm growth. Older firms have the advantages of the strength of accumulated experience and superior performance (Leoncini et al. 2019). However, as firms get older, there is the possibility of bureaucracy, reducing organizational flexibility and the ability to make prompt changes. Thus, this study suggests that the strength of the negative relationship between financial constraints on firm growth depends on the firms' accumulated experience in terms of learning and the source of knowledge.

Our study contributes to the literature in the following ways. First, considering the drawbacks associated with accounting-based financial constraint measures, this study uses the KZ and WW indices with three different firm growth proxies: asset growth, *ROA*, and *ROE*. Secondly, this study employs both fixed effect as the baseline regression and the System GMM Model to act as a robustness check on the results. Thirdly, this study sheds light on firm age as a moderating variable between financial constraint and firm growth in the ASEAN–6 region[1] context, which contributes to the existing literature. The paper is structured as follows: Part 2 contains the literature and theoretical background, Part 3 discusses the data and methodology, Part 4 contains the empirical results, and Part 5 concludes.

Literature review

Nakatani (2021) showed that younger ICT firms contribute more total factor productivity growth than older firms, which is in line with life-cycle theory. The negative relationship between firm age and firm growth was also supported by Arrighetti et al. (2021). Bruderl and Schussler (1990) showed that individual firms face adolescence at the period when mortality is low. After this phase, the death risks jump to a high level, followed by a continuous decline. The length of adolescence varies according to the number of initial resources a firm has. Coad, Segarra, and Teruel (2016) stated that as firms get older, they gain experience and become more routinized. Mature firms, as time goes by, build on previous routines, existing capabilities, accumulated reputations, and the ability to handle uncertainties. According to Leoncini et al. (2019), firm experience appears to play an important role in growth. In their study, firm age has a moderating effect. They found that more mature companies are better equipped with technologies to transform into growth. Secondly, older firms have better access to finance to cope with the cost of eco-innovating. Thirdly, older firms have greater pressure and incentives to renew their aging assets in an eco-sustainable manner.

1 Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

Firm age has significant and negative effects on job creation (firm growth) (Yang 2018). As firms age, the productivity of newly created jobs in the firm could decline. The negative relationship is due to the organizational inertia that constrains the firm's ability to change (Coad, Segarra, and Teruel 2016). This idea was also supported by Coad and Tamvada (2012), who showed that age has a retarding effect on firm growth in India. They found that young firms grow faster than old firms, and growth becomes less dependent on firm age for old firms. The result is similar to Cowling, Liu, and Zhang (2018), who studied young firms. They found that they had the highest share of growth after the global financial crisis in 2008 in the UK. Cowling, Liu, and Zhang (2018) found that a negative relationship between firm age and growth persists. In the aftermath of the 2010 recession, younger firms, particularly those with younger owners, exhibited a stronger inclination towards short-term growth, as indicated by employment and sales growth. Older firms have lower firm growth when the proxy for firm growth is employment growth. This indicates that when the economic environment improves, the sensitivity of firm age to employment growth (firm growth) becomes stronger.

Barba Navaretti, Castellani, and Pieri (2014) showed that age has a negative sign from 25% of the conditional growth rate distribution. However, at the lowest growth rates, age has a positive relationship with firm growth, indicating that aging is associated with lower growth. Based on the evidence from French, Italian and Spanish manufacturing firms from 2001–2008, they found that young firms grow faster than old firms, especially in the highest growth quantiles with a robust inclusion of firm characteristics indicated by labor productivity, capital intensity, and financial structure. They also showed that younger firms' high growth is managed by younger CEOs, who play a significant role in driving job creation. Fast-growing firms have also been shown to be more productive and have easier access to credit.

Data and methodology

Data description

This firm-level study covers the period from 2009 to It excludes all financial institutions and real estate sectors, as they are treated as special due to their different role in the payment system and intermediation functions. This study considers the ASEAN–6 region: Indonesia, Malaysia, Singapore, Philippines, Thailand, and Vietnam. All variables are winsorized at the 5% and 95% levels to mitigate the impact of outliers using STATA software. The choice of proxies for each variable is as follows:

Table 1. Variable Definitions

	Variable	Proxies	Variable Definitions	Unit	Source
Dependent Variable	Firm Growth	Asset Growth	$Asset_{t+1}$ – $Asset_t$ / $Asset_{t+1}$	Percentage	McFaddin & Clouse (1993)
		Return of Equity	Net income after taxes / total equity	Percentage	Dopierała et al. (2022)
		Return of Asset	Net income after taxes / Average total assets this year and the previous year's	Percentage	Dopierała et al. (2022)
Independent Variable	Financial Constraint	WW Index	–0.091*Cash Flow / Total Assets–0.062*Dividend Dummy+0.021*Long Term Liabilities / Total Assets–0.044 Log Total Assets+0.102 Industry Sales Growth–0.035 Sales Growth	Index	Whited and Wu (2006)
		KZ Index	–1.001909*Cash Flows / Total Assets+ 0.2826389* TobinQ+3.139193*Debt / Total Capital–39.368*Dividends / Total Assets–1.315*Cash / Total Assets	Index	Kaplan and Zingales (1997)
Moderating Variable	Firm Age	Date of IPO	Respective Period Year – IPO Year	Percentage	Coad (2018)
Control Variables	Firm Size	Market Capitalization	Total Market Capitalization	Absolute Value	Haran et al. (2021)
	Profitability	Gross Profit Margin	Gross Income / Net Sales	Percentage	Çoban (2014)
	Working Capital	Working Capital	Total Working Capital	Absolute Value	Regasa et al. (2019)

Sources: McFaddin and Clouse 1993; Kaplan and Zingales 1997; Whited and Wu 2006; Çoban 2014; Coad 2018; Regasa et al. 2019; Haran et al. 2021; Dopierała et al. 2022.

This study explores the moderating effect of firm age, which is incorporated into the following formula for analysis:

$$FirmGrowth_{it} = \beta_0 + \beta_{1b}\log FC_{it} + \beta_{2b}\log Age_{it} + \beta_{3b}(\log FC_{it} * \log Age_{it}) + \\ + \beta_{4b}\log Age_{it} + \beta_{5b}\log marketcap_{it} + \beta_{6b} profit_{it} + \beta_{7b}\log workingcap_{it} + \varepsilon_{it}, \quad (1)$$

where:

$FirmGrowth_{it}$ – The relative change in assets from the previous year,

$\log FC_{it}$ – Log of financial constraint index proxied by KZ index and WW index,

$\log Age_{it}$ – Log of firm age,

$\log marketcap_{it}$ – Log of market capitalization,

$profit_{it}$ – Gross profit margin,

$\log workingcap_{it}$ – Log of working capital,

ε_{it} – Error term.

This study uses asset growth, *ROE*, and *ROA* as the proxies for firm performance (Dopierała et al. 2022; Egorova, Grishunin, and Karminsky 2022). The dependent variable, firm growth, is measured using three different proxies in accordance with firm growth literature: Firstly, asset growth is used as the firm growth proxy, as firms grow by first acquiring assets (Lefebvre 2023), and assets bring in profits from increased sales volume (Theodore and Lindberg 1978). *ROE* and *ROA* are the indicators that show the effectiveness of a firm (Tran, Nguyen, and Tran 2019). Thus, this study considers different proxies for different roles of growth motivation and attitude toward growth.

First, as verified from the perspective of financing constraints, measurements are not directly observable. Based on the literature review, the KZ and WW indices are used. In studies that use those indices, the KZ index demonstrates that firms that are classified as a constraint are associated with external finance constraints. Those firms with high debt-to-capital ratios appear to invest at a low rate despite good investment opportunities. The WW index considers both internal and external financing considerations (exogenous). According to Whited and Wu (2006), the WW index considers both quantitative data on exogenous firm characteristics (i.e., external financial constraints) and internal characteristics (endogenous). This is different from the KZ index, which focuses on endogenous characteristics using the Generalized Method of Moments (GMM). The higher the KZ and WW indices, the greater the financial constraint (Hadlock and Pierce 2010; Chang and Song 2013; Guariglia and Yang 2016).

IPO date was chosen as the proxy for firm age as it marks the inception of the company's existence under new ownership. Figure 1 presents the age distribution for firms from 0 (new-born companies) to 117 years old. Firm age in this study sample exhibits a positively skewed distribution. Young firms are the most numerous, and above the mode, the number of firms steadily decreases with age in a way that might resemble exponential decay, which would be an acceptable representation of empirical distributions. Therefore, this study draws the reader's attention to the likely under-representation of very old firms in our data, which can be expected to have implications for how our results should be interpreted. To compress the scale, log transformation is applied.

This study controls several variables, such as firm size, profit, and working capital. In the Managerialism view, firm growth is attributed to firm size. This study tests whether larger firms

become more competent over time or if further improvement declines in terms of growth. Profit margin is controlled as, according to the neoclassical theory of firms, the goal of the firm is to maximize profit in the long term. This study aims to determine whether profitability is a measure of fitness, with profitable firms growing through the discovery of cost-reduction innovations or imitation, with less profitable ones losing their market share, which aligns with Evolutionary Theory. It may also have an adverse relationship with firm growth due to profitability focusing on short-term results and postponing long-term growth (Machek and Machek 2014). The study also controls working capital since it affects firm performance (Laghari and Chengang 2019; Regasa, Fielding, and Roberts 2019).

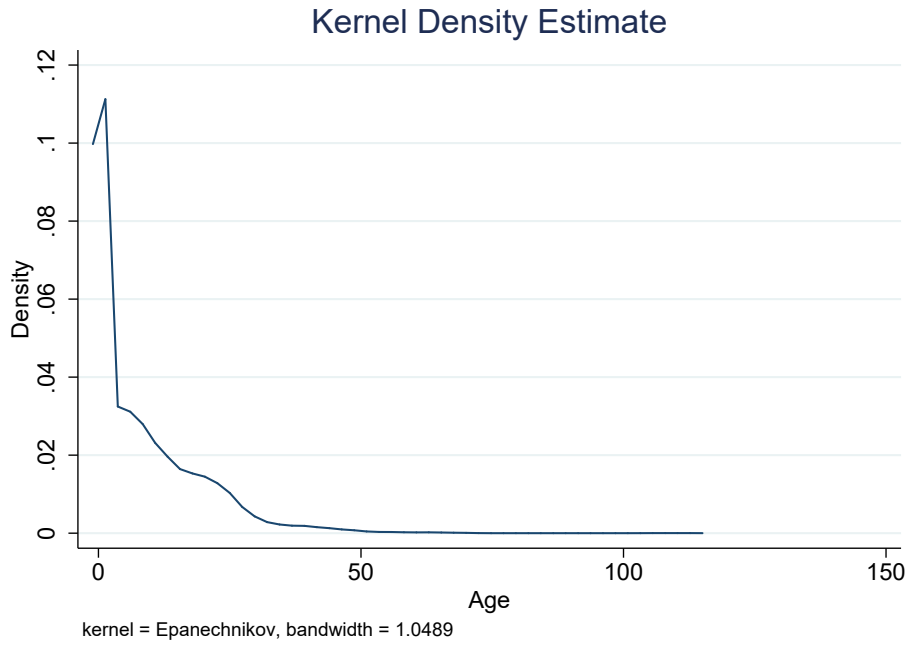

Figure 1. Firm Age of ASEAN–6 from 2009–2019

Source: own elaboration.

Model specification

The fixed effect model is used to test the moderating effect of firm age and financial constraints. However, the panel data structure may be an issue. To measure the effects of unobserved variables on firm performance, fixed or random effect models are employed. To choose between the fixed-effects model and the random-effects model, the Hausman test with the hypothesis: $H_0 = Random\ Effects\ and\ H_a = Fixed\ Effects$ is used to determine the exogeneity of the unobserved errors. The p-value is significant at the 5% level; thus, H_0 is rejected. Therefore, this study favors the fixed effect model to eliminate the influence of unobservable and time-independent factors. The fixed-effect model can reduce unobserved firm-level heterogeneity, but other firm-related, time-varying

unobserved factors might lead to endogeneity. This study takes an instrumental variable approach and uses the lagged value of service transitions. Thus, for related and unrelated service transitions, we use predicted values lagged by one year as instruments. Additionally, system GMM is applied as a robustness check to test the motion of financial variables and to resolve potential endogenous problems and autocorrelation among the errors.

Empirical results

Table 2 shows descriptive statistics for all variables in the ASEAN–6 from 2009 to 2019 before examining the regression results. This average firm growth in ASEAN over the ten years shows an increase of 0.046. *ROA* and *ROE* are measured one year in advance, which shows 0.037% and 0.038%, respectively. The KZ and WW financial constraint indices show mean values of 0.144% and 5.222%, respectively. The firm age is the natural logarithm of the respective period year minus the IPO date, which in ASEAN firms is, on average, 1.836 years old. ASEAN–6 firms experience an increase in profit, with a mean value profit margin of 0.281%. The market capitalization and working capital were, on average, 18.395% and 11.231%.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Asset Growth	44,237	0.046	0.422	−0.671	1.192
ROA	43,012	0.037	0.072	−0.124	0.181
ROE	39,436	0.081	0.144	−0.269	0.363
KZ	42,566	0.144	1.035	−1.965	1.581
WW	37,871	5.222	9.659	−0.466	22.258
KZ*Age	42,566	0.276	2.782	−7.981	6.419
WW*Age	37,871	7.012	19.029	−1.892	80.285
Age	56,001	1.836	1.577	0.000	4.061
Marketcap	37,569	18.395	1.911	15.146	22.201
Profit	39,774	0.281	0.205	0.024	0.772
Workingcap	39,339	11.231	12.563	−16.636	20.080

The table reports the summary statistics for all variables (mean, standard deviation denoted as Std. Dev., minimum value denoted as Min, maximum value denoted as Max). The study observations range from 2009 to 2019. All variables are taken from the Thomas Refinitiv database. Growth rates are based on annual changes. All variables are winsorized at the 5% and 95% levels.
Source: own calculation using data from Thomas Refinitiv (2023).

Figures 2 and 3 illustrate the association between each dimension of the financial constraint indices, which are proxied by the KZ index and WW index, with firm growth proxied by asset growth, *ROA* and *ROE*. While the KZ index is negatively correlated with firm growth in Figure 1, the WW index is positively correlated with firm growth in Figure These differences underscore the importance of carefully clarifying the results by investigating how these structural elements interact with each other using econometric analysis.

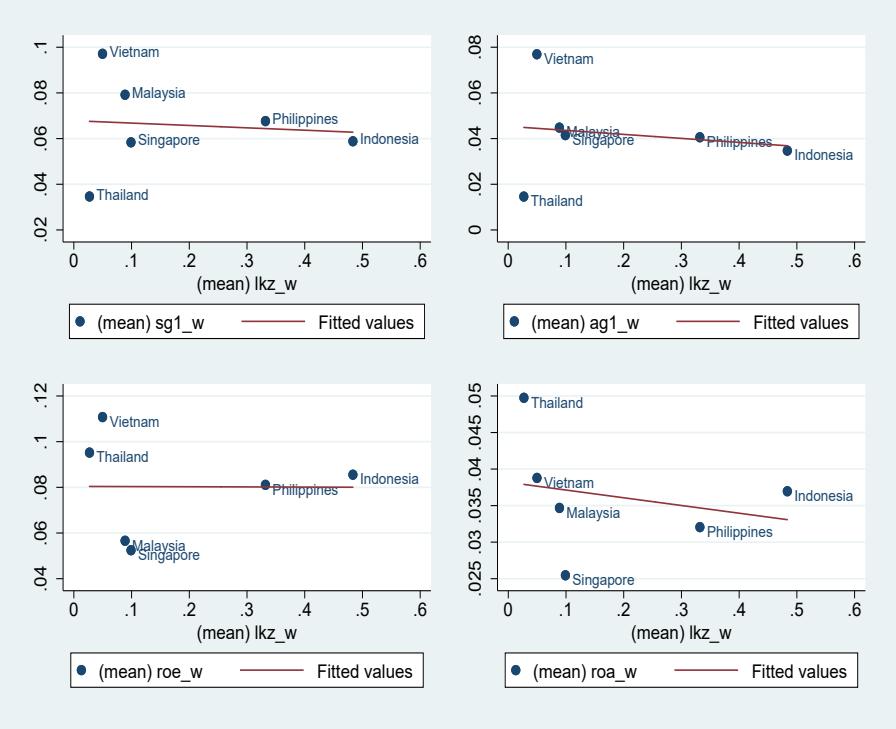

Figure 2. Financial Constraint KZ Index and Firm Growth, 2009–2019

Notes: Horizontal axis = lkz_w = log of the KZ index; Vertical axis = sg1_w: Sales growth; ag1_w: Asset growth; roe_w = Return of equity; roa_w = Return of asset
Source: own elaboration.

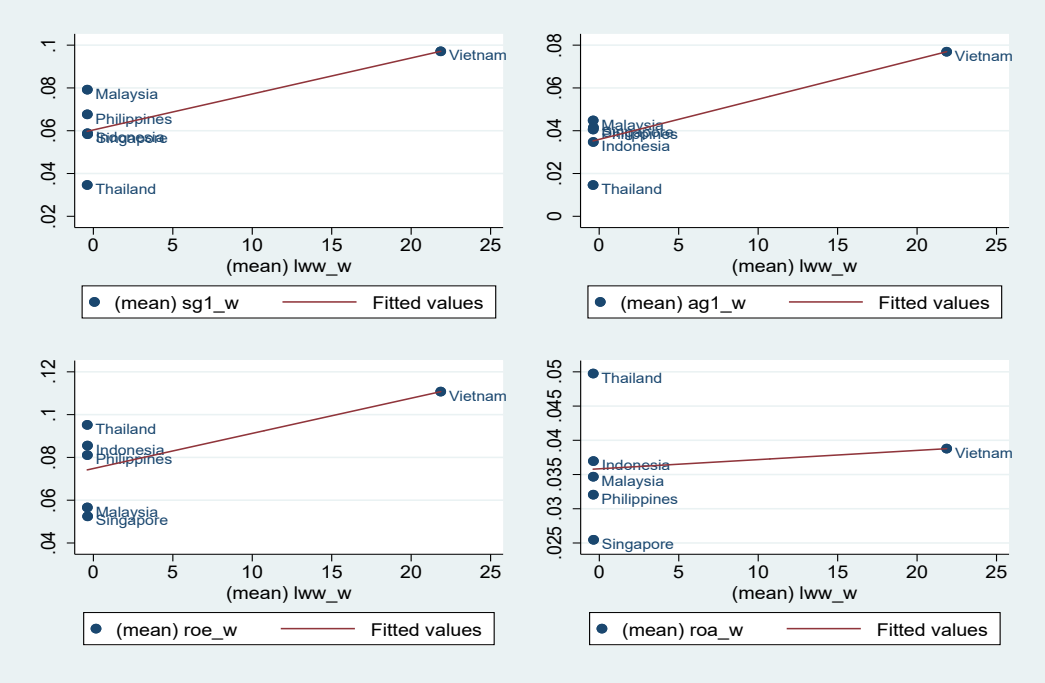

Figure 3. Financial Constraint WW index and firm growth, 2009–2019

Notes: Horizontal axis = lww_w = log of the WW index; Vertical axis = sg1_w: Sales growth; ag1_w: Asset growth; roe_w = Return of equity; roa_w = Return of asset
Source: own elaboration.

Table 3 shows a preliminary estimate of pairwise correlation coefficients, which examines the association between each pair of indicators for all kinds of industry firms (excluding financial institutions and real estate sectors) in the ASEAN–6. All dependent variables have a one-year lead, except for sales growth and asset growth. Firstly, the log KZ index has a negative correlation with all firm growth proxies (asset growth, *ROA*, and *ROE*). By contrast, the log WW index shows the opposite sign on all firm growth compared to the KZ index. The highest correlation coefficient of the KZ index on firm growth proxies is *ROA* (–0.2904), indicating that the log KZ index is associated with 0.0843% of the variance in *ROA* ($R^2 = \left(-0.2904^2\right) = 0.0843$). Secondly, the interaction between financial constraint for both indices on firm growth shows opposite results with firm growth. Thirdly, almost all correlation coefficients are statistically significant at the 1% and 5% levels. Fourthly, firm age has a negative correlation with all firm growth proxies at a 1% level of significance. A useful association between variables is obtained thereby. However, the coefficients have some limitations: they capture only linear relationships, they do not imply causality, and there is a possibility of spurious regression. Thus, the subsequent analysis uses a regression model to analyze the moderating role of firm age between financial constraints and firm growth.

Table 3. Pairwise Correlation

	Asset Growth	ROA	ROE	KZ	WW	KZ*Age	WW*Age	Age	Marketcap	Profit	Working-cap
Asset Growth	1										
ROA	−0.0121**	1									
ROE	−0.0124**	0.6984***	1								
KZ	−0.0039	−0.2904***	−0.2257***	1							
WW	0.0487***	0.0103*	0.1041***	−0.0525***	1						
KZ*Age	−0.0049	−0.3082***	−0.2305***	0.8501***	−0.0782***	1					
WW*Age	0.0350***	0.0224***	0.0822***	−0.0866***	0.7290***	−0.0698***	1				
Age	−0.0173***	−0.0920***	−0.1581***	−0.0443***	−0.3873***	0.0755***	−0.0137***	1			
Marketcap	−0.0319***	0.1876***	0.2219***	−0.0728***	−0.4296***	−0.0630***	−0.3234***	−0.2572***	1		
Profit	−0.0058	−0.0054	0.1482***	0.1172***	−0.1899***	−0.2037***	−0.1575***	−0.1574***	0.0321***	0.2848***	1
Workingcap	0.0088*	0.0073	0.1116***	0.0532***	−0.2871***	−0.0288***	−0.2231***	−0.0037	0.0924***	0.1468***	0.0351***

The Pairwise Correlation presents the relationship between financial constraint indices, the KZ and WW indices, with different measures of growth in all sectors, except for financial institutions and real estate sectors. In the models, the dependent variable of firm growth is measured as asset growth, *ROA*, and *ROE*. Firm age is a moderating variable between financial constraint and firm growth. This study controls log market capitalization, gross profit margin, and working capital. Parentheses *, **, *** denote p-values of 0.10, 0.05, and 0.01, respectively.
Source: own calculation using data from Thomas Refinitiv (2023).

Table 4 presents the results obtained from estimating a static model using Fixed Effect regression. The interpretation starts with the constant, as usual, which represents the predicted value for those observations that have 0 values on all independent variables in the model: In columns (1), (3), and (5) with financial constraint as KZ index in the model, the estimated asset growth, *ROA*, and *ROE* of average firm age are 0.291%, 0.0103%, and 0.0325%. On the other hand, columns (2), (4), and (6) with financial constraint as WW index in the model, the estimated asset growth, *ROA*, and *ROE* of average firm age are 3.984%, 0.122%, and 0.0791%.

The fixed effect model is reported here as it gives estimates that are of the same sign and similar. For the financial constraints, the KZ and WW indices are used to explore the impact on three alternative firm growth proxies: asset growth, *ROA*, and *ROE*. Table 4 shows that the finance–growth relationship depends on firm age. Estimations in models (2), (4), (5), and (6) display constant results on positive firm age as a moderator between financial constraints on all three firm growth proxies (asset growth, *ROA*, and *ROE*) at the 1% level of significance. This shows that going public can relax financial constraints and increase the availability of capital for growth. The longer the IPO period, the more firms are able to gain access to new financial resources, as by reducing information asymmetry, they signal the firm's value to the public. This result emphasizes the importance of entrepreneurial fundraising in the growth process.

As Table 4 shows, the impact of financial constraint on *ROA* and *ROE* shows consistent results. The simple effect of financial constraint on *ROE* is –0.0282%, and the interaction term (KZ*Age) has a positive impact on *ROE* of 0.00693%. For a unit increase in age, the strength of the negative impact of financial constraint on firm growth is weakened by the size of the interaction term (–0.0282 + 0.00693 = –0.0213). In other words, the coefficient on the interaction term between financial constraint and firm growth shows that for each unit increase in age, the negative impact of the financial constraint on *ROE* becomes weaker, decreasing by 0.00693% (column 5).

On the other hand, when the KZ index is replaced with the WW index, for every unit increase in age, the negative impact of financial constraint on *ROE* becomes weaker, decreasing by 0.00118% (column 6). This suggests that the negative impact of financial constraints on firm growth is weakened by the presence of older firms compared to younger ones. This may be due to less information asymmetry and the higher ability to meet creditors' collateral requirements for older firms due to their credit track record, reputation, and established networks, which result in greater bargaining power and better access to finance.

Thus, the result shows that the differences in financing decisions that lead to growth are likely due to the role of firm characteristics, i.e., firm age. This is consistent with the resource-based view approach to the corporate life cycle, whereby younger firms have resource scarcity and are in the process of discovering reliable structures and routines. In other words, firms would need to translate their financial constraint into securing an IPO, which can build their reputation and improve their firm's growth.

Regarding the control variables, market capitalization is significantly negatively correlated with asset growth but significantly positively correlated with *ROA* and *ROE*. ASEAN firms show profit-led growth at a rate of 1% in terms of *ROA* and *ROE*. In the ASEAN–6 region, working capital shows inconsistent results with firm growth proxies.

Table 4. Fixed Effect Estimations – Interaction Term between Firm Age and Financial Constraint (KZ and WW Indices) and Firm Growth

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Asset Growth	Asset Growth	ROA	ROA	ROE	ROE
KZ	0.00308		−0.00869***		−0.0282***	
	(0.010)		(0.001)		(0.003)	
KZ*Age	−0.00262		0.000482		0.00693***	
	(0.003)		(0.000)		(0.001)	
WW		−0.702***		−0.0226***		−0.0150**
		(0.029)		(0.004)		(0.007)
WW*Age		0.00133**		0.00109***		0.00118***
		(0.001)		(0.000)		(0.000)
Age	0.00011	0.00969	−0.00833***	−0.0203***	−0.0134***	−0.0261***
	(0.006)	(0.009)	(0.001)	(0.001)	(0.002)	(0.002)
Marketcap	−0.0140***	−0.0149***	0.00180***	0.00285***	0.00425***	0.00541***
	(0.005)	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)
Gross profit	0.0416	0.0276	0.0545***	0.0601***	0.107***	0.110***
	(0.032)	(0.032)	(0.004)	(0.004)	(0.008)	(0.008)
Workingcap	−0.0000169	0.0000479	0.0000524	0.000143***	−0.000312***	−0.000158*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.291***	3.984***	0.0103	0.122***	0.00325	0.0791*
	(0.091)	(0.176)	(0.011)	(0.020)	(0.022)	(0.042)
Observations	27,127	26,911	28,960	25,652	28,247	25,439
R-squared	0.000	0.026	0.026	0.032	0.019	0.016
Number of ids	3,780	3,684	3,771	3,613	3,577	3,475
Hausman Test	5.53	617.83	517.4	417.34	482.16	367.51
	(0.478)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
VIF	2.290	2.66	2.40	2.53	2.45	2.55
Heterosce-dasticity	2.30*10^36	1.20*10^35	424.17	394.462	306.681	222.616
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Asset Growth	Asset Growth	ROA	ROA	ROE	ROE
Serial Correlation	121.236	83.899	424.17	394.462	306.681	222.616
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: The Fixed Effect Model examines the relationship between two different financial constraint indices, namely the KZ and WW indices, and three different growth-oriented measures: Asset Growth, *ROE*, and *ROA*. This analysis is conducted across all sectors, excluding financial institutions and the real estate sector, with firm age as a moderating variable between financial constraint and firm growth. This study controls market capitalization, gross profit margin, and working capital. Standard errors are in parentheses. *, **, *** denote p-values of 0.10, 0.05, and 0.01, respectively.
Source: own calculations using data from Thomas Refinitiv (2023).

Robustness checking

The System GMM regression is employed to explore an alternative method for obtaining robust results. First, this study implies an alternative estimation method by reworking equation (1), the static Fixed Effect panel model turned into System GMM. The results are reported in Table. The sign of the results consistently indicates a positive moderating effect of firm age on firm growth in the presence of financial constraints, which remains unchanged when considering the WW index. This supports the theory that older firms, according to the resource-based view, weaken the negative relationship between financial constraint on firm growth.

In sum, *ROA* and *ROE* as measures of firm growth do provide a stable picture. As shown in Table 4 and 5, the coefficients for financial constraint KZ and WW indices on firm growth proxies are negative, indicating that limited financial resources restrict firms' operations. Consequently, firms may be compelled to scale down their investment projects, resulting in lower performance and growth that aligns with the available funding. However, the control variables are not consistent with Table 4.

Table 5. Robustness Check System GMM – Interaction Term between Firm Age and Financial Constraint (KZ and WW Indices) on Firm Growth

VARIABLES	Asset Growth	Asset Growth	ROA	ROA	ROE	ROE
L.sg1_w	–0.194***	–0.202***	0.531***	0.624***	0.474***	0.486***
	(0.008)	(0.008)	(0.015)	(0.022)	(0.015)	(0.016)
lkz_w	0.0027		–0.00323*		–0.00026	
	(0.016)		(0.002)		(0.005)	

VARIABLES	Asset Growth	Asset Growth	ROA	ROA	ROE	ROE
lkz_wlage_w	0.000356		0.00440***		0.0102***	
	(0.006)		(0.001)		(0.002)	
lww_w		−0.00988***		−0.00546***		−0.00583***
		(0.002)		(0.001)		(0.001)
lww_wlage_w		−0.00067		6.50E−05		0.000317
		(0.001)		(0.000)		(0.000)
lage_w	0.000957	−0.0261**	−0.00682***	−0.00455***	−0.00855***	−0.0105***
	(0.008)	(0.011)	(0.001)	(0.002)	(0.002)	(0.003)
lmarket-cap_w	−0.0105	−0.0309***	−0.0131***	−0.0150***	−0.0247***	−0.0247***
	(0.008)	(0.009)	(0.001)	(0.001)	(0.003)	(0.003)
profit_w	0.00922	−0.0247	−0.0640***	−0.0738***	−0.126***	−0.149***
	(0.066)	(0.066)	(0.008)	(0.009)	(0.017)	(0.018)
lworking-cap_w	0.000415	0.000213	−0.000197***	−0.000295***	−0.000591***	−0.000855***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.227	0.742***	0.293***	0.350***	0.553***	0.595***
	(0.140)	(0.167)	(0.024)	(0.026)	(0.047)	(0.051)
Observations	26,126	26,096	28,104	24,917	27,282	24,657
Number of id	3,744	3,739	3,753	3,612	3,530	3,467

Note: The System GMM Model examines the relationship between two different financial constraint indices, the KZ and WW indices, and three different growth-oriented measures: Asset Growth, *ROE*, and *ROA* in all sectors, excluding financial institutions and the real estate sector. Firm age serves as a moderating variable between financial constraint and firm growth. Additionally, this study controls market capitalizations, gross profit margin, and working capital. Standard errors are in parentheses. *, **, and *** denote p-values of 0.10, 0.05, and 0.01, respectively.
Source: own calculations using data from Thomas Refinitiv (2023).

Conclusions

The results demonstrate the growth-related trends in the ASEAN–6 from 2009 to 2019, which are associated with firm growth in terms of asset growth, *ROA*, and *ROE*. The positive moderating role of firm age in the relationship between financial constraint and firm

growth is confirmed by robustness check using i) both fixed effect and system GMM models, and ii) different measures for firm growth and financial constraint.

Both methodologies show that the negative relationship between financial constraint and firm growth weakens when the firm age is older. This article addresses the research gap by investigating the combined effects of age and financial constraint, revealing their impact and direction. The results suggest solutions that older firms, despite their complexity and novelty, can exploit productive opportunities for growth. This is made possible due to their accumulated reputation, experience, and networks with supporters and clients, as well as economies of scale, which allows the firm to channel the reallocation of financial resources when generating income. ASEAN firms must avoid screening out too many growth ideas and opt instead to invest in a portfolio of growth experiments. Going public (the IPO) serves as a useful external enabler of entrepreneurship activities, fostering growth.

A growth crisis often happens due to a government's chronic failure to encourage ambitious entrepreneurs. Firm growth should remain at the heart of government strategy as it is the basic engine of ASEAN's transformation. There is no evidence that working capital contributes to growth for ASEAN firms. There is profit-led growth in terms of *ROA* and *ROE*.

The findings make significant contributions to the financial constraint literature. First, financial constraint is a barrier to expanding growth. Secondly, from a theoretical point of view, this study contributes to Stinchcombe's (2000) theory of "Liability of Newness". Firm age has a role that might be more interesting than simply focusing on age itself as a factor. The positive interaction term between firm age and financial constraint in this study shows that older firms experience less severe financial constraints on firm growth. Governments should harness the significant potential of these older firms within the ASEAN–6 to bolster a robust economic system, build trust and confidence among foreign investors, and strengthen the business cycle.

These findings also have implications for management in practice. First, companies often face competing interests from a wide range of stakeholders. Corporate practitioners should have a clear understanding of their growth objectives, and management decisions should align with these objectives. It's important to acknowledge that different firms have varying different desires and attitudes toward growth. Firms should take specific actions that align with their growth vision and expansion goals, ensuring their ability to survive and stay true to the purpose of the business. It is essential to maintain a long-term perspective and adapt to the changing world around us. Secondly, they should take advantage of the age of the company, which can act as a form of inertia, to transform the organizational structure to implement growth. Older firms have better equipment and technology, better access to finance, and greater pressure and incentives to adapt their strategies to changing market

conditions. It is important to take advantage of accumulated business experience, as it should mitigate financial constraints on firm growth. Thirdly, the ASEAN–6 should proactively explore business opportunities with higher profitability and allocate a larger portion of their total profits towards growth initiatives, as the results show a significant positive relationship with firm growth.

This study has some limitations. The first is that the sample used in this study only comprises ASEAN firms. Second, a "one-size-fits-all" taxonomy is not regarded as the best solution for ASEAN since each country has a different economic level with different main economic activities and objectives across many different sectors. Thus, the results of this study cannot be applied to other countries or industries. Third, the study has taken a static view of the moderating role of firm age between financial constraint and firm growth. A dynamic view would yield additional insights by examining the lag effect of time.

References

Aldrich, H.E., Auster, E.R. (1986), *Even Dwarfs Started Small: Liabilities of Age and Size and Their Strategic Implications*, "Research in Organizational Behavior", 8, pp. 165–198.

Arrighetti, A., Cattani, L., Landini, F., Lasagni, A. (2021), *Work flexibility and firm growth: Evidence from LEED data on the Emilia-Romagna region*, "Industrial and Corporate Change", 30 (6), pp. 1516–1538, https://doi.org/10.1093/icc/dtab028

Barba Navaretti, G., Castellani, D., Pieri, F. (2014), *Age and firm growth: evidence from three European countries*, "Small Business Economics", 43 (4), pp. 823–837, https://doi.org/10.1007/s11187-014-9564-6

Bruderl, J., Schussler, R. (1990), *Organizational Mortality: The Liabilities of Newness and Adolescence*, "Administrative Science Quarterly", 35 (3), 530, https://doi.org/10.2307/2393316

Chang, H., Song, F.M. (2013), *Testing the Pecking Order Theory with Financial Constraints*, "SSRN Electronic Journal", https://doi.org/10.2139/ssrn.2200847

Coad, A. (2018), *Firm age: A survey*, "Journal of Evolutionary Economics", 28 (1), pp. 13–43, https://doi.org/10.1007/s00191-016-0486-0

Coad, A., Tamvada, J.P. (2012), *Firm growth and barriers to growth among small firms in India*, "Small Business Economics", 39 (2), pp. 383–400, https://doi.org/10.1007/s11187-011-9318-7

Coad, A., Segarra, A., Teruel, M. (2016), *Innovation and firm growth: Does firm age play a role?*, "Research Policy", 45 (2), pp. 387–400, https://doi.org/10.1016/j.respol.2015.10.015

Çoban, S. (2014), *The Interaction between Firm Growth and Profitablity: Evidence from Turkish (Listed) Manufacturing Firms*, "The Journal of Knowledge Economy & Knowledge Management", 9, pp. 73–82.

Cowling, M., Liu, W., Zhang, N. (2018), *Did firm age, experience, and access to finance count? SME performance after the global financial crisis*, "Journal of Evolutionary Economics", 28 (1), pp. 77–100, https://doi.org/10.1007/s00191-017-0502-z

Dopierała, Ł., Mosionek-Schweda, M., Laskowicz, T., Ilczuk, D. (2022), *Financial performance of renewable energy producers: A panel data analysis from the Baltic Sea Region*, "Energy Reports", 8, pp. 11492–11503, https://doi.org/10.1016/j.egyr.2022.09.009

Egorova, A.A., Grishunin, S.V., Karminsky, A.M. (2022), *The Impact of ESG factors on the performance of Information Technology Companies*, "Procedia Computer Science", 199, pp. 339–345, https://doi.org/10.1016/j.procs.2022.01.041

Guariglia, A., Yang, J. (2016), *A balancing act: Managing financial constraints and agency costs to minimize investment inefficiency in the Chinese market*, "Journal of Corporate Finance", 36, pp. 111–130, https://doi.org/10.1016/j.jcorpfin.2015.10.006

Hadlock, C.J., Pierce, J.R. (2010), *New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index*, "Review of Financial Studies", 23 (5), pp. 1909–1940, https://doi.org/10.1093/rfs/hhq009

Haran, M.E., Lo, D., McCord, M., Davis, P., Lim, L.C. (2021), *Impact of firm-level attributes on listed real estate company performance*, "Journal of Property Investment & Finance", 39 (4), pp. 323–348, https://doi.org/10.1108/JPIF-03-2020-0030

Kaplan, S.N., Zingales, L. (1997), *Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?*, "The Quarterly Journal of Economics", 112 (1), pp. 169–215, https://doi.org/10.1162/003355397555163

Laghari, F., Chengang, Y. (2019), *Investment in working capital and financial constraints: Empirical evidence on corporate performance*, "International Journal of Managerial Finance", 15 (2), pp. 164–190, https://doi.org/10.1108/IJMF-10-2017-0236

Lefebvre, V. (2023), *The growth process of IPO firms*, "Journal of Business Venturing Insights", 19, e00377, https://doi.org/10.1016/j.jbvi.2023.e00377

Leoncini, R., Marzucchi, A., Montresor, S., Rentocchini, F., Rizzo, U. (2019), *Better late than never": The interplay between green technology and age for firm growth*, "Small Business Economics", 52 (4), pp. 891–904, https://doi.org/10.1007/s11187-017-9939-6

Machek, O., Machek, M. (2014), *Factors of Business Growth: A Decomposition of Sales Growth into Multiple Factors*, "WSEAS Transactions on Business and Economics", 11 (35), pp. 380–38511.

McFaddin, S., Clouse, M. (1993), *A new model for sustainable growth in the energy industry*, "Energy Economics", 15 (1), pp. 3–7, https://doi.org/10.1016/0140-9883(93)90036-Q

Nakatani, R. (2021), *Total factor productivity enablers in the ICT industry: A cross-country firm-level analysis*, "Telecommunications Policy", 45 (9), 102188, https://doi.org/10.1016/j.telpol.2021.102188

Regasa, D., Fielding, D., Roberts, H. (2019), *Sources of Financing and Firm Growth: Evidence from Ethiopia*, "Journal of African Economies", 29 (1), pp. 26–45, https://doi.org/10.1093/jae/ejz012

Stinchcombe, A.L. (2000), *Social structure and organizations*, "Advances in Strategic Management", 17, pp. 222–259, https://doi.org/10.1016/S0742-3322(00)17019-6

Theodore, C., Lindberg, R.A. (1978), *Survival & Growth: Management Strategies of the Small Firm*, American Management Association, New York.

Thomas Refinitiv (2023), *Screener App Database*, https://eikon.thomsonreuters.com/index.html (accessed: 1.01.2023).

Tran, V.T., Nguyen, T.T., Tran, N.T.M. (2019), *Gender difference in access to local finance and firm performance: Evidence from a panel survey in Vietnam*, "Economic Analysis and Policy", 63, pp. 150–164, https://doi.org/10.1016/j.eap.2019.05.004

Whited, T.M., Wu, G.W. (2006), *Financial Constraints Risk*, "The Review of Financial Studies", 19 (2), pp. 531–559, https://doi.org/10.1093/rfs/hhj012

Yang, L. (2018), *Firm Age, Size, and Employment Dynamics: Evidence from Japanese firms*, RIETI Discussion Paper Series 18-E–006.

Zhang, D., Lucey, B.M. (2022), *Sustainable Behaviors and Firm Performance: The Role of Financial Constraints" Alleviation*, "Economic Analysis and Policy", 74, pp. 220–223, https://doi.org/10.1016/j.eap.2022.02.003

Ograniczenia finansowe rozwoju firmy: rola wieku firmy w krajach ASEAN–6

W artykule oceniono wpływ wieku firmy na relację między ograniczeniami finansowymi, mierzonymi wskaźnikami KZ i WW, a trzema alternatywnymi miarami wzrostu firm (wzrost aktywów, *ROA* i *ROE*) w regionie ASEAN–6. W niniejszym badaniu wykorzystano próbę obejmującą firmy notowane na giełdzie regionu ASEAN–6 w latach 2009–2019 przy użyciu metody efektów stałych (Fixed Effects) i systemowej uogólnionej metody momentów (System GMM). Stwierdzono, że wiek firmy łącznie z ograniczeniami finansowymi wpływa pozytywnie na rozwój firmy. Negatywny wpływ ograniczeń finansowych na wzrost firm jest mniej dotkliwy w przypadku firm starszych.

Słowa kluczowe: ograniczenia finansowe, metoda efektów stałych, systemowa uogólniona metoda momentów, ASEAN, wskaźnik KZ, wskaźnik WW, wzrost firmy

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.06

The Role of Digital Services Trade Restrictiveness in Exports: Before and During COVID–19

Sri Indah Nikensari https://orcid.org/0000-0002-0413-655X
Ph.D., Full Professor at Universitas Negeri Jakarta, Jakarta, Indonesia, e-mail: indah_nikensari@unj.ac.id

Shanty Oktavilla https://orcid.org/0000-0003-4602-6938
Ph.D., Lecturer at Universitas Negeri Semarang, Semarang, Indonesia, e-mail: oktavilia@mail.unnes.ac.id

Navik Istikomah https://orcid.org/0000-0003-1333-5478
Ph.D., Lecturer at Universitas Pendidikan Indonesia, Bandung, Indonesia, e-mail: navik.istikomah@upi.edu

Nindya Farah Dwi Puspitasari https://orcid.org/0000-0001-9327-2045
Lecturer at Universitas Terbuka, Tangerang Selatan, Indonesia, e-mail: nindyafarah@ecampus.ut.ac.id

Abstract

Digital technology has penetrated various fields, including international trade. This study aims to analyze how barriers/openness to trade in digital services affected exports before the COVID–19 pandemic (2015–2016) and during the pandemic (2019–2020). Based on the Gravity model, exports seem to be influenced by digital services trade restrictiveness, including infrastructure and connectivity restrictions (X1), electronic transaction restrictions (X2), and other restrictions (X3). The panel data regression equation was used to analyze data from various countries (European 17 countries, Asian 8 countries, and Latin American 3 countries) sourced from OECD Statistical Data. The selection of sample countries was based on data availability and homogeneity. The results showed that the effect of digital services trade restrictiveness on exports was low before the pandemic and increased during the pandemic era. Prior to the pandemic, restrictions on electronic transactions had a weak and negative impact on exports; meanwhile, during the pandemic, all restrictions impacted exports, except for other restrictions. In the pandemic era, restrictions on infrastructure & connectivity had a negative

Received: 4.03.2023. Verified: 31.07.2023. Accepted: 23.01.2024

impact, but restrictions on electronic transactions had a positive impact on exports due to a decline in global exports and several countries reducing restrictions on electronic transactions.

Keywords: digital services trade restrictiveness, exports, Gravity model, trade openness, COVID–19 pandemic

JEL: F010, F100, F140, F430

Introduction

The contraction of economic growth in 2020 compared to 2019 generally occurred due to the COVID–19 pandemic, where the component of exports of goods and services became the component with the deepest contraction. Low export performance impacts growth, and also reflects low competitiveness (Ruzekova, Kittova, and Steinhauser 2020). The World Trade Organization estimated that global trade contracted by 9.2 percent.

World trade performance in several countries improved slightly in 2021, as projected by the World Trade Organization. This was because several COVID–19 vaccines had been found to stop the pandemic, although other variants of the virus then emerged. However, the impact of the pandemic brought about new arrangements and procedures to support future global trade performance, namely the increasing role of digital technology in economic activities. The use of digital technology allows for the creation of new goods and services, which are ordered and delivered digitally, such as e-books, online education, or online banking services. Digitization is the process of turning the essence of an organization's products, services and processes into internet-compatible data packages that can be created, stored, and transferred in bits and bytes, along with the information associated with them, for marketing, sales, and distribution (Banalieva and Dhanaraj 2019).

International trade today, especially exports, depends on services. Services have long been perceived as playing a secondary role in world trade, and services account for about 50% of world trade in value-added terms (Roy 2019). According to Heuser and Mattoo (2017), three-quarters of the total services in trade are attached to merchandise rather than services traded directly. In the long term, the international trade in merchandise is declining, relatively speaking. However, trade in services, especially electronic services, is in a relatively long-term upward trend, including cross-border data flows, which are growing exponentially (Borchert et al. 2020). Trade in digital services in international trade is no doubt increasing, especially with the restrictions on the movement of people due to the 2019 COVID–19, because many trading activities use digital services.

Drake-Brockman et al. (2020) stated that the shift to the digital economy intensified during the COVID–19 pandemic as producers of goods and services connected with customers through online platforms. Digital technology can add value by increasing productivity and/or lowering costs and barriers associated with the flow of traditional

goods and services. With digitalization, the costs of engaging in international trade can be reduced, connecting businesses and consumers globally, helping to spread ideas and technology, and facilitating the coordination of global value chains (Brouthers, Geisser, and Rothlauf 2016). In international trade, Meltzer and Lovelock (2018) stated that increasing digital connectivity and global data flows around the world increase trade opportunities. González and Ferencz (2018) further stated that digital transformation increases economic openness. Several service trade transactions are also conducted online, such as health services, education services, and entertainment (Mackey and Nayyar 2017; Budd et al. 2020; Mao et al. 2020; Ratten 2020). Digitization creates new trade opportunities for companies to sell more products to more markets, resulting in countries diversifying their export products. In this digital era, connectivity infrastructure, as well as international flows of ICT goods, significantly affects services exports (Wajda-Lichy et al. 2022).

In the current era of digitalization, the export of goods and services includes the export of digital products. Digital products refer to digital goods and digital services. The trade in digital services in international trade has increased, especially since the restrictions on the movement of people due to COVID–19, so many trading activities use digital services. Digitization has transformed international trade and provides an estimate of the impact of increased digital connectivity on trade. Digitization is critical to the trade in more complex manufactured goods and services that can be delivered digitally. Services are not only traded directly but also indirectly manifested in manufacturing exports (Drake-Brockman et al. 2020). In gross terms, trade in services accounts for a quarter of global trade in goods and services (WTO 2019). However, in 2020, the World Bank noted that the contribution of service exports to GDP was 10.58, a decrease of 3% compared to the previous year.

Trade in digital goods and services has been significant in the last decade. However, not all countries have open trade in digital services in global trade. In general, there are striking differences in the trade openness of digital services in developed countries in Europe and developing countries in Asia. Based on data from the OECD, the Digital Services Trade Restrictiveness (DSTR) in Asian countries is higher than in some European countries, meaning that there are more barriers to digital trade in Asian countries than in European countries. As the example explanation, Figure 1 describes the Digital Services Trade Restrictiveness Index (DSTRI) in seventeen European countries, eight Asian countries, and three Latin American countries in The figure shows that all DSTRIs (Digital Services Trade Restrictiveness Indices) in European countries are less than By contrast, the majority of DSTRIs in Asian and Latin American countries are greater than 0.15, meaning that European countries have greater openness in trading digital services.

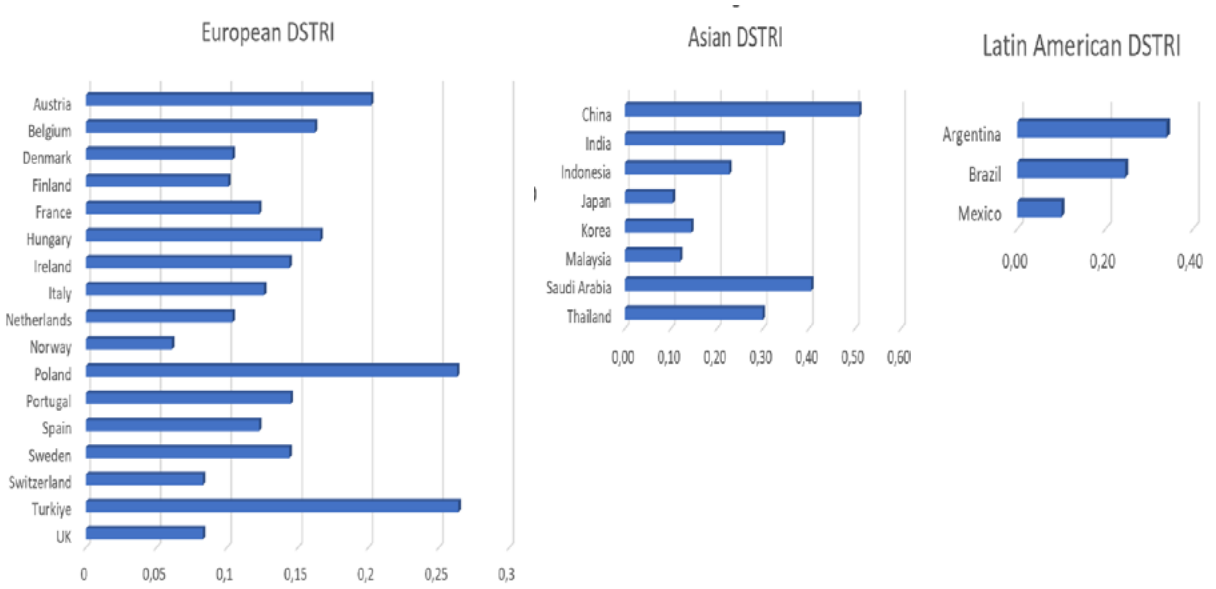

Figure 1. DSTRI in Europe, Asia, and Latin America

Source: OECD (n.d.).

There are several studies on barriers to trade in digital services, but not many compared the periods before and during the COVID–19 pandemic. This study compares the effect of several components of DSTR on exports. The component studied is an index that tends to change in the pre-pandemic period (2015–2016) and during the COVID–19 pandemic (2019–2020). It comprises infrastructure and connectivity barriers, electronic transactions, and other barriers in European, Asian, and Latin American countries. DSTRIs that tend to remain unchanged, are not included in this analysis, for example, barriers in the payment system and barriers to intellectual property rights. Export performance is determined by the role of digital services, as well as other factors, such as the number of goods produced. The Gravity model is used as a control (Abeliansky and Hilbert 2017). Therefore, the number of goods produced is included as a variable, because the number of goods produced determines a country's production capacity and will affect exports. This is evident when production capacity increases, so exports also increase (Gay 2016; Shiferaw 2017; Gnangnon 2018). This variable will be the control variable in this study, because, without it, trade through digital services is meaningless.

The rest of the paper is structured as follows. The next section describes the research methodology. Section 3 contains the results and discussion, while the conclusions and recommendations are in Section 4.

Methodology

The Gravity model is used as the basis for the equation in this study. This model was first introduced by Tinbergen in 1962 (Tayyab, Tarar, and Riaz 2012; Chaney 2018; Guðjonsson et al. 2021), who showed that international trade flows are influenced by the size of the economy and distance. Furthermore, in 1980, Krugman stated that distance can be approached by the presence of barriers in international trade (Chaney 2008; 2018; Serrano and Pinilla 2012). This study focuses on trade barriers in the context of digital services trade restrictiveness, while the size of each country's economy is determined by the number of products they produce.

Quantitative research using an ex post facto approach was chosen to test the hypotheses proposed in this study. Export performance is measured by the total real value of overseas sales, which in this study uses US dollars based on present values, collected from World Bank data. Manufactured products are measured by the value of the total number of goods produced by the processing industry, in US dollars, again collected from the World Bank.

Digital Services Trade in this study is measured by DSTRIs as measured by the OECD. The DSTRIs in this study use three restrictions: the index of restrictions to infrastructure and connectivity, the index of restrictions to electronic transactions, and other indices of restrictions, for data for the year before (2015–2016) and the period of the COVID–19 pandemic (2019–2020). The reason for using these two periods is because the OECD's DSTRI calculations only started in 2014, and in 2015, world trade conditions had started to rise after the 2008 financial crisis (Figueira 2017; Nikensari et al. 2021). Another reason is that the barriers to digitalization in trade in all the countries studied did not change much from 2014 to As for the data during the pandemic, data from 2019 and 2020 were used, arguing that the COVID–19 pandemic began in the final quarter of 2019.

Considering the availability of the OECD's DSTRI data and considering the homogeneity of the data, the scope of the research covers eight countries in Asia (India, Indonesia, Japan, Kazakhstan, Malaysia, Saudi Arabia, South Korea, and Thailand), three Latin American countries (Argentina, Brazil, and Mexico), as well as 17 OECD countries (Austria, Belgium, Denmark, Finland, France, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Türkiye, and the UK). Germany and China are not included, because their exports are very large compared to other countries.

By considering the Gravity model, the constellation of the relationship between the independent variables and export performance is shown in the following equation:

$$EX = f(\text{Economic Size, Distance}). \quad (1)$$

$$EX = f(DST, Manf). \quad (2)$$

Exports are influenced by the implementation of trade in digital services, where *EX* is export performance, *DST* is digital services trade (measured by restrictions on trade in digital services), and *Manf* is the availability of manufactured products. The DST in this study only includes three of the previously mentioned five criteria: infrastructure and connectivity (*Infr*), electronic transactions (*Elect*), and other digital barriers (*Oth*). Other restrictions, such as payment systems and intellectual property rights barriers, are not examined, because most of the countries studied have low (zero) barriers. Then the equation becomes:

$$EX = f(Infr, Elect, Oth, Manf). \quad (3)$$

Using the panel data regression method, separate analyses were carried out for the periods before and during the COVID–19 pandemic. The research equation is formulated as follows:

$$\ln EX_{it} = \alpha_{it} + \beta 1\ Infr_{it} + \beta 2\ Elect_{it} + \beta 3\ Oth_{it} + \beta 4\ Manf_{it} + \varepsilon_{it}, \quad (4)$$

where:

$\ln EX_{it}$ – exports of country i, year t,

$Infr_{it}$ – infrastructure and connectivity barrier of country i, year t,

$Elect_{it}$ – electronic transactions barrier of country i, year t,

Oth_{it} – others barrier of country i, year t,

$Manf_{it}$ – manufacture product of country i, year t,

α_i – constant,

β – regression coefficient.

The stages of analysis using the panel data regression equation were preceded by selecting the best model, normality test and detection of classic multicollinearity symptoms, and hypothesis testing.

Results and discussion

Based on the pre-pandemic data, the mean export of the 28 countries in 2015/2016 was USD 242.74 billion; the highest exports amounted to USD 635.82 billion, while the lowest

amounted to USD 35.49 billion. The average restrictiveness in infrastructure and connectivity was still quite high before the pandemic, with the highest restrictiveness index of However, there were countries without restrictiveness in digital services trade. The average restrictiveness in electronic transactions and other digital barriers is quite low. Factors other than restrictiveness, namely manufactured products, had a mean of USD 170.14 billion, with the highest production value of USD 1268.00 billion and the lowest of USD 19.44 billion.

In the pandemic era, the average export of the 28 countries in 2019–2020 was USD 270.24 billion; the highest was USD 697.48 billion, and the lowest was USD 46.71 billion. The average restrictiveness in infrastructure and connectivity is still quite high in the pandemic era, with the highest restrictiveness index of 0.48 and the lowest of The average restrictiveness in electronic transactions and other digital barriers was quite low and slightly decreased compared to before the pandemic. Factors other than restrictiveness, namely manufactured products, had an average of USD 185.08 billion, with the highest production value of USD 1275.48 billion and the lowest of USD 23.22 billion.

Table 1. Data summary before and during the pandemic

Before	Exports	INFRS	ELECTR	OTHERS	MANUFAC
Mean	242.7385	0.107625	0.033125	0.036500	179.1432
Median	193.2925	0.079000	0.032000	0.022000	95.52700
Maximum	635.8210	0.790000	0.064000	0.109000	1268.000
Minimum	35.48600	0.000000	0.021000	0.000000	19.44100
In era					
Mean	270.2379	0.112768	0.033107	0.036107	185.0850
Median	234.7055	0.079000	0.021000	0.022000	113.8415
Maximum	697.4806	0.476000	0.064000	0.109000	1275.477
Minimum	46.71400	0.040000	0.021000	0.000000	23.21600

Source: authors' compilation using Eviews.

Average exports and average manufactured products during the pandemic increased slightly compared to the pre-pandemic period. However, this increase seems to be influenced more by exports and the amount of production before the end of 2019, when the COVID–19 issue had not yet emerged and infected the population. After the pandemic began to spread at the end of 2019, average exports and manufactured products began to decline, experiencing the deepest contraction in Q2 However, in the following quarters, there was a slight recovery, in exports, in particular. Even though, exports were still much lower than before COVID–19.

The average restrictiveness in infrastructure and connectivity is the highest compared to the other two restrictiveness factors in this study, both before and during the pandemic. However, during the pandemic, this restrictiveness increased, meaning that there were higher barriers than before the pandemic. In 2019–2020, the restrictiveness in infrastructure and connectivity increased in several countries, including Argentina, Austria, Kazakhstan, Poland, Saudi Arabia, Turkey, and even Japan. Meanwhile, the restrictiveness in electronic transactions was quite low. It decreased slightly during the pandemic, because Indonesia and Denmark decreased their transparency in digital services trade by reducing restrictiveness in electronic transactions. The restrictiveness in electronic transactions did not change much before and during the pandemic.

Furthermore, based on the data and using multiple regression analysis techniques, Table 2 shows the results before and during the COVID–Based on the best model selection test, the Random Effect Model is a panel data regression model that was selected as the analysis tool, with data from the 28 countries. The table also shows that in the pre-pandemic period, there were only two variables that affected export performance: manufactured products as the control variable, and barriers to trade in digital services from electronic transactions as the main variables studied. However, the effect was less significant. During the COVID–19 period, all the variables studied, both the main and control variables, had a significant effect on export performance, except for the other restrictiveness variables.

Simultaneously, the proposed variables influenced exports, showing an increase before and during the pandemic. If the magnitude of the simultaneous influence of independent variables on exports was only 36% before the pandemic, during the pandemic, it increased by 58.49%. If the restrictiveness in infrastructure and connectivity had no effect on exports before the pandemic, then during the pandemic, the opposite happened. The restrictiveness in infrastructure and connectivity had a negative effect on exports; in other words, if the restrictiveness goes up, exports go down, and vice versa. The data showed that during the pandemic, global exports declined sharply, especially in 2020, and during the same period, restrictiveness in infrastructure and connectivity increased in several countries. This result is in line with Nordås and Rouzet (2017; Yang, Wang, and Whang 2023) which states that if the restrictiveness in digital services trade increases, it will reduce exports and imports, and vice versa.

Table 2. Test summary of the export model

LExports_before pandemic		LExports_during pandemic	
Chow test:		Chow test:	
– prob. c-s F	0.0000	– prob. c-s F	0.0000
– prob. Chi-square	0.0000	– prob. Chi-square	0.0000
Hausman test: – prob. c-s random	0.4107	Hausman test: – prob. c-s random	0.0448
LM-test: prob. B-P	0.0000	LM-test: prob. B-P	0.0000
Conclusion: The best model is REM		Conclusion: The best model is REM	
Normality test: Jaeque Bera prob.		Normality test:	
	2.2313	– Jaeque Bera	2.5259
	0.3277	– prob.	0.2828
Multicollinearity test: Centered VIF	< 5.0000	Multicollinearity test: Centered VIF	< 5.0000
REM: LExports before the pandemic		**REM: LExports during the pandemic**	
Variables	Fixed Effects Model	Variables	Random Effect Model
Constanta	5.1 677	Constanta	5.0929
t-stat	(26.3 514)***	t-stat	(28.8544)***
Infrastructure & Connectivity t-stat	– 0.3 625 (–0.9 137)	Infrastructure & Connectivity t-stat	– 1.5456 (–2.2096)***
Electronic transaction t-stat	– 4.0 570 (–1.3 066)*	Electronic transaction t-stat	9.3707 (2.8672)***
Other Restrictiveness	– 1.5 021	Other Restrictiveness	– 1.8652
t-stat	(–05 638)	t-stat	(–0.8522)
Manufacture goods	0.0 017	Manufacture goods t-stat	0.0011
t-stat	(3.3 852)***		(4.3558)***
R2	0.3 619	R2	0.5849
Adj. R2	0.1 407	Adj. R2	0.2902
F-stat	3.2 506	F-stat	5.1959

Note: *** sig. 5%, ** sig. 10%, * sig. 20%.
Source: authors' compilation using Eviews.

According to the OECD, the main contributors to the calculation of the restrictiveness index in infrastructure and connectivity are policies that affect connectivity, such as actions on cross-border data flows and data localization (Ferencz and Gonzales 2018). Additionally, it takes into account actions that limit or block the use of communication services, and maps the extent to which best practice regulations

on interconnection between network operators are implemented to ensure smooth communication. The tendency of some countries to increase restrictiveness in infrastructure and connectivity is in line with the policy of limiting the import of digital services in destination countries, because the internet is very limited and regulated, requiring data to be localized. Thus, there is a restrictiveness in accessing online information that can be accessed from outside. The country concerned has limited the use of digital services that can be accessed from outside, but at the same time, its exports have not decreased. Maybe this is what China is doing that creates barriers to trade in digital services in the international market (Meltezer 2020). It has the power to develop a digital economy and is the second-largest digital economy player after the United States, controlling 40% of global e-commerce transactions (Woetzel et al. 2017). Additionally, if the goods being exported are high-tech products, as is the case in China, trade barriers in digital services are less sensitive to exports (Gupta, Ghosh, and Sridhar 2022). This is why China is not included in this research sample, because the data from that country are very different from most other countries, both in exports and in their DSTRI.

Meanwhile, restrictiveness in electronic transactions includes discriminatory conditions for issuing licenses for e-commerce activities, the possibility of online tax registration and declaration for non-resident companies, deviations from internationally accepted rules regarding electronic contracts, actions that hinder the use of authentication in e-commerce, and the lack of effective dispute resolution mechanisms. The positive effect of restrictiveness in electronic transactions on export performance during the pandemic was due more to the fact that in 2020 exports experienced a global contraction, while restrictiveness in electronic transactions was already quite low in many countries. This restrictiveness even fell in Saudi Arabia and India. The low restrictiveness in electronic transactions reflects the openness of digital services trade in these countries, and this is good for increasing exports. However, due to the global situation that was hit by the pandemic shock, the low restrictiveness in electronic transactions was powerless to increase exports.

Other restrictiveness describes other barriers to digital commerce. They include, among others: performance requirements that affect cross-border digital commerce (for example, mandatory use of software and local encryption or mandatory technology transfer); download and streaming restrictions; restrictions on online advertising; commercial or local presence requirements; and the lack of effective redress mechanisms against online anti-competitive practices. This restrictiveness is quite low in almost all the countries studied, but has no effect on exports, as the value of the measured indicator did not change in the two years before or during the pandemic.

As a control variable, manufactured products have a positive influence on exports in the pre-pandemic and pandemic periods. This is because, based on the data studied,

the average number of manufactured and exported products increased in the periods before and during the pandemic. Thus, when manufactured products increased, exports also increased. This finding is in line with several studies that state the relationship between manufactured products and exports (Gay 2016; Shiferaw 2017; Gnangnon 2018). The increase in exports and manufactured products in the pandemic period was higher than the average before the pandemic, which was due to the high exports and manufactured products in 2020, by comparison, although the value experienced a decline compared to 2019, it was still higher than the pre-pandemic period.

Research limitations

This research has limitations due to data availability related to restrictiveness in the digital service trade. Most of the data are from Europe with only a few countries in Asia and Latin America. In European countries, the majority of restrictiveness in digital trade is low, or openness is high, while many countries outside Europe are high in digital trade barriers. It would be interesting to discuss the restrictiveness of digital services trade in countries outside Europe, and how they have adapted to the evolving landscape of digital transactions over time.

Conclusion

The openness of trade in digital services in several Asian and Latin American countries is still low compared to several countries in Europe. The findings of this study indicate that before the COVID–19 pandemic, only restrictiveness in electronic transactions and control variables affected export performance, while restrictiveness in infrastructure and connectivity, as well as other digital restrictiveness, had no effect on export performance. In the era of the pandemic, all the variables studied affected export performance, except for other restrictiveness. Restrictiveness in infrastructure and connectivity negatively impacted exports. This is because in 2020, when exports contracted/fell, several countries increased restrictiveness in infrastructure and connectivity. On the other hand, electronic transaction barriers positively affected exports. This occurred because when the majority of countries had low restrictions on electronic transactions, there were instances when some countries further reduced these restrictions. During this period, global export conditions were undergoing a significant contraction, making it appear as if the restrictiveness of electronic transactions had a minimal effect on increasing exports.

Based on the phenomenon of reduced on digital services trade restrictions during the COVID–19 pandemic, in the future, digitalization will encourage countries outside the European Union and China to further reduce barriers to trade in digital services to increase their exports.

Recommendations

To increase exports, several countries in Asia and Latin America in this study reduced restrictiveness in digital services trade, which was previously still high. For this reason, it is necessary to review for countries that otherwise increased their restrictiveness, or decreased trade openness in digital services, because openness in digital services trade can increase exports if there are no extreme conditions due to the pandemic.

Regarding the limited data on trade in digital services, the United Nations and the World Bank should also measure the openness of trade in digital services in all countries, because this is the era of digital trade.

References

Abeliansky, A.L., Hilbert, M. (2017), *Digital technology and international trade: Is it the quantity of subscriptions or the quality of data speed that matters?*, "Telecommunications Policy", 41 (1), pp. 35–48, https://doi.org/10.1016/j.telpol.2016.11.001

Banalieva, E.R., Dhanaraj, C. (2019), *Internalization theory for the digital economy*, "Journal of International Business Studies", 50 (8), pp. 1372–1387, https://doi.org/10.1057/s41267-019-00243-7

Borchert, I., Cory, N., Drake-Brockman, J., Fan, Z., Findlay, C., Kimura, F., Nordås, H.K., Lodefalk, M., Peng, S.Y., Roelfsema, H., Rizal Damuri, Y. (2020), *Digital Technologies, Services and the Fourth Industrial Revolution*, "Working Paper", 2020–02.

Brouthers, K.D., Geisser, K.D., Rothlauf, F. (2016), *Explaining the internationalization of ibusiness firms*, "Journal of International Business Studies", 47 (5), pp. 513–534, https://doi.org/10.1057/jibs.2015.20

Budd, J., Miller, B.S., Manning, E.M., Lampos, V., Zhuang, M., Edelstein, M., Rees, G., Emery, V.C., Stevens, M.M., Keegan, N., Short, M.J. (2020), *Digital technologies in the public-health response to COVID–19*, "Nature Medicine", 26 (8), pp. 1183–1192, https://doi.org/10.1038/s41591-020-1011-4

Chaney, T. (2008), *Distorted Gravity: The Intensive and Extensive Margins of International Trade*, "American Economic Review", 98 (4), pp. 1707–1721, https://doi.org/10.1257/aer.98.4.1707

Chaney, T. (2018), *The Gravity Equation in International Trade: An Explanation*, "Journal of Political Economy", 126 (1), pp. 150–177, https://doi.org/10.1086/694292

Drake-Brockman, J., Borchert, I., Cory, N., Fan, Z., Findlay, C., Kimura, F., Yagci, M. (2020), *Impact of digital technologies and the fourth industrial revolution on trade in services*, "Digital Society, Global Trade and Investment", G20 Insights.

Ferencz, J., Gonzales, F. (2018), *Barriers to trade in digitally enabled services in the G20*, "OECD Trade Policy. Papers", 232, 17.

Figueira, C.H.C. (2017), *Determinants of the Portuguese GDP stagnation during the 2001–2014 period: an empirical Investigation*, Doctoral Dissertation, Nova School of Business and Economics, Portugal.

Gay, D., (2016), *Productive capacity and trade in the Solomon Islands*, "United Nations Department of Economic and Social Affairs, Committee for Development Policy Background Paper", 31, New York.

Gnangnon, S.K. (2018), *Impact of multilateral trade liberalization and aid for trade for productive capacity building on export revenue instability*, "Economic Analysis and Policy", 58, pp. 141–152, https://doi.org/10.1016/j.eap.2018.02.002

López González, J., Ferencz, J. (2018), *Digital Trade and Market Openness*, "OECD Trade Policy Papers", 217, OECD Publishing, Paris, https://doi.org/10.1787/1bd89c9a-en

Guðjonsson, S., Minelgaite, I., Kristinsdóttir, H., Stankevičienė, J. (2021), *Who benefits of trade with China? Examining the effects of free trade agreements on trade flow with China using an adjusted gravity model*, "Journal of International Studies", 14 (3), https://doi.org/10.14254/2071-8330.2021/14-3/1

Gupta, S., Ghosh, P., Sridhar, V. (2022), *Impact of data trade restrictions on IT services export: A cross-country analysis*, "Telecommunications Policy", 46 (9), 102403, https://doi.org/10.1016/j.telpol.2022.102403

Heuser, C., Mattoo, A. (2017), *Services Trade and Global Value Chains*, "World Bank Policy Research Working Paper", 8126, https://doi.org/10.1596/1813-9450-8126

Mackey, T.K., Nayyar, G. (2017), *A review of existing and emerging digital technologies to combat the global trade in fake medicines*, "Expert Opinion on Drug Safety", 16 (5), pp. 587–602, https://doi.org/10.1080/14740338.2017.1313227

Mao, Z., Li, D., Yang, Y., Fu, X., Yang, W. (2020), *Chinese DMOs" engagement on global social media: examining post-related factors*, "Asia Pacific Journal of Tourism Research", 25 (3), pp. 274–285, https://doi.org/10.1080/10941665.2019.1708759

Meltezer, J. (2020), *China's digital services trade and data governance: How should the United States respond*, https://www.brookings.edu/articles/chinasdigital-services-trade-and-data-governance-how-should-the-united-states-respond (accessed: 15.06.2020).

Meltzer, J.P., Lovelock, P. (2018), *Regulating for a digital economy: Understanding the importance of cross-border data flows in Asia*, "Global Economy and Development Working Paper", 113.

Nikensari, S.I., Puspitasari, N.F.D., Setyadharma, A., Ratnawati, N. (2021), *Determinants of world trade stagnation in three regions*, "Journal of International Studies", 14 (2), https://doi.org/10.14254/2071-8330.2021/14-2/10

Nordås, H.K., Rouzet, D. (2017), *The Impact of Services Trade Restrictiveness on Trade Flows*, "The World Economy", 40 (6), pp. 1155–1183, https://doi.org/10.1111/twec.12424

OECD (n.d.), https://stats.oecd.org/ (→ Industries and Services → Services Trade Restriction → DSTRI) (accessed: 8.08.2022).

Ratten, V. (2020), *Coronavirus (Covid–19) and the entrepreneurship education community*, "Journal of Enterprising Communities: People and Places in the Global Economy", 14 (5), pp. 753–764, https://doi.org/10.1108/JEC-06-2020-0121

Roy, M. (2019), *Elevating services: Services Trade Policy, WTO Commitments, and Their Role in Economic Development and Trade Integration*, "Journal of World Trade", 53 (6), pp. 923–950, https://doi.org/10.54648/TRAD2019037

Ruzekova, V., Kittova, Z., Steinhauser, D. (2020), *Export Performance as a Measurement of Competitiveness*, "Journal of Competitiveness", 12 (1), pp. 145–160, https://doi.org/10.7441/joc.2020.01.09

Serrano, R.l., Pinilla, V. (2012), *The long-run decline in the share of agricultural and food products in international trade: a gravity equation approach to its causes*, "Applied Economics", 44 (32), pp. 4199–4210, https://doi.org/10.1080/00036846.2011.587786

Shiferaw, A. (2017), *Productive capacity and economic growth in Ethiopia*, "United Nations, Department of Economics and Social Affairs, CDP Background Paper", 34, ST/ESA/2017/CDP/34.

Tayyab, M., Tarar, A., Riaz, M. (2012), *Review of gravity model derivations*, "Mathematical Theory and Modeling", 2 (9), pp. 82–95.

Wajda-Lichy, M., Fijorek, K., Denkowska, S., Kawa, P. (2022), *The impact of information and communication technology on services exports: Evidence from developed and developing economies*, "International Entrepreneurship Review", 8 (3), pp. 69–80, https://doi.org/10.15678/IER.2022.0803.05

Woetzel, J., Seong, J., Wang, K.W., Manyika, J., Chui, M., Wong, W. (2017), *China's digital economy: A leading global force*, McKinsey Global Institute, New York.

WTO (2019), *World Trade Report 2019: The future of services trade*, Geneva, https://www.wto.org/english/res_e/booksp_e/00_wtr19_e.pdf (accessed: 20.06.2022).

Yang, F., Wang, Y., Whang, U. (2023), *Trade restrictions on digital services and the impact on manufacturing exports*, "The Journal of International Trade & Economic Development", pp. 1–28, https://doi.org/10.1080/09638199.2023.2195958

Wpływ ograniczeń w handlu usługami cyfrowymi na eksport przed i w trakcie pandemii COVID–19

Technologia cyfrowa przeniknęła do różnych dziedzin, w tym handlu międzynarodowego. Niniejsze opracowanie ma na celu analizę wpływu barier w handlu usługami cyfrowymi/otwartości na handel tymi usługami na eksport przed pandemią COVID–19 (2015–2016) i w czasie pandemii (2019–2020). Na podstawie modelu Gravity wydaje się, że na eksport wpływa restrykcyjność handlu usługami cyfrowymi, w tym ograniczenia dotyczące infrastruktury i łączności (X1), ograniczenia dotyczące transakcji elektronicznych (X2) i pozostałe ograniczenia (X3). Do analizy danych z różnych krajów (17 krajów europejskich, 8 krajów azjatyckich i 3 krajów Ameryki Łacińskiej) pochodzących z baz danych statystycznych OECD wykorzystano równanie regresji danych panelowych. Wyboru krajów dokonano, opierając się na dostępności i jednorodności danych. Wyniki pokazały, że wpływ restrykcyjności handlu usługami cyfrowymi na eksport był niski przed pandemią i wzrósł w dobie pandemii. Przed pandemią obostrzenia w transakcjach elektronicznych miały słaby i negatywny wpływ na eksport, tymczasem w czasie pandemii wszystkie obostrzenia miały wpływ na eksport, z wyjątkiem pozostałych ograniczeń. W czasie pandemii ograniczenia dotyczące infrastruktury i łączności miały negatywny wpływ na ekstort. Natomiast ograniczenia dotyczące transakcji elektronicznych miały pozytywny wpływ na eksport ze względu na spadek globalnego eksportu i zmniejszenie przez kilka krajów ograniczeń dotyczących transakcji elektronicznych.

Słowa kluczowe: ograniczenia w handlu usługami cyfrowymi, eksport, model grawitacyjny, otwartość na handel, pandemia COVID–19

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.07

Business Models of Ukrainian Banks: the Impact of the Revolution of Dignity, the COVID–19 Pandemic, and Russia's Military Aggression

Igor Kravchuk https://orcid.org/0000-0003-2556-8877
Ph.D., Associate Professor at the Bydgoszcz University of Science and Technology, Bydgoszcz, Poland
e-mail: igor.kravchuk@pbs.edu.pl

Abstract

The purpose of the article is to identify key banking activity models in Ukraine and show how they changed under the influence of the Revolution of Dignity, the COVID–19 pandemic, and the imposition of martial law. The proposed method uses cluster analysis of the main indicators for banking activity (concerning assets, liabilities and income) based on Ward's agglomerative hierarchical clustering algorithm and the Tau index in the NbClust package as the criterion for evaluating the optimal number of clusters. The research covers all Ukrainian banks, spanning the period 2013–2022.

In 2014 (after the Revolution of Dignity), the actions of the National Bank of Ukraine (NBU) had a positive impact on the models of Ukrainian banks: there was no opaque model of banks and banking models became more transparent and more resilient to financial shocks. Between 2021 and 2022, five banking models were identified: universal banks, wholesale funding banks, corporate-investment banks, retail banks, and commission banks. The negative impact of COVID–19 on the Ukrainian economy was reflected in all banking models by the following: (1) a significant increase in the role of securities in assets, which was caused by a decrease in lending due to an increase in their riskiness; (2) the use of central bank funds to liabilities management, which was evidence of a deterioration in financing conditions in the deposit market.

The following main changes in Ukraine's banking system at the end of 2022 (during the war) were identified: (1) a decrease in the number of banks that mainly use funds from the NBU to support their activities; (2) the closure of only four banks by the NBU (including two with majority shareholders from Russia) during the year; (3) an increase in the share of the non-government debt securities portfolio in banks' assets; (4) declines in *ROE* and *ROA* for all banking models

Received: 17.03.2023. Verified: 1.08.2023. Accepted: 23.01.2024

during the war, and three banking models became unprofitable; (5) the significantly higher share of non-performing loans in the credit portfolio for all banking models, especially for the retail banking model.
The value-added of this research is the analysis of how banking models in Ukraine have changed at the micro level (reflected in the financial statements) *inter alia* in wartime.

Keywords: bank, assets and liabilities management, martial law, corporate-investment banking, deposit-based funding

JEL: C38, G21, G32, M19

Introduction

Ukraine's banking system began to take shape in 1991 after the collapse of the Soviet Union. Its evolution was characterized by the emergence of European continental banking models, so funding was carried out mostly from deposit sources, and loans dominated among assets. Many banking institutions were opened, including many small banks, whose purpose was to finance the real business of the ultimate beneficiaries of banks (the insider banking business model). There were also many abusive practices in the activities of banks, and their financial stability was low. In 2014, the National Bank of Ukraine (NBU) significantly changed its approach to supervision, which was reflected in the withdrawal of a significant number of banking institutions. As a result of the NBU's actions, the models of existing commercial banks have become more transparent and more resilient to financial shocks.

In recent years, banks in Ukraine have faced new "black swans". First, there was the development of the COVID–19 pandemic, and from February 2022, they had to modify their activities under martial law introduced in response to Russia's military aggression against Ukraine.

Considering the existing challenges, the purpose of the article is to identify key models of banking activity in Ukraine and how they have changed under the influence of the Revolution of Dignity, the COVID–19 pandemic, and the imposition of martial law.

Literature review

Recent research on the subject can be analyzed from three perspectives: (1) approaches to identifying business models of banks based on cluster analysis, (2) defining banking models in Ukraine, and (3) characteristics of the changes in Ukraine's financial system during the war. Hanafizadeh and Marjaie (2021) noticed an obvious growth in citations of banking business model articles. Between 2002 and 2020, the number of articles discussing banking business models has increased from two articles to 25 articles per year.

Modern researchers use various approaches based on cluster analysis to identify banks' business models and analyze their changes. Farnè and Vouldis (2017, pp. 14, 20) used an enhanced version of the methodology proposed by Vichi and Kiers (2001), which developed the factorial k-means algorithm that involves both factor analysis (reducing dimensionality) and the k-means procedure (clustering objects and finding their centroids in this low-dimensional subspace). In this article, Hartigan's heuristic rule was used to select the number of clusters.

Ayadi and De Groen (2014, pp. 6, 10–13) used six instruments to form the clusters: (1) loans to banks (as a % of assets); (2) trading assets (as a % of assets); (3) bank liabilities (as a % of assets); (4) customer deposits (as a % of assets); (5) debt liabilities (as a % of assets); (6) derivative exposures (as a % of assets). They used Ward's clustering method and Calinski and Harabasz's pseudo-F index to diagnose the appropriate number of clusters.

Roengpitya et al. (2017, pp. 1, 4–5) also identified bank business models based on balance-sheet characteristics by applying Ward's agglomerative clustering algorithm and Calinski and Harabasz's F-index as a goodness-of-fit measure for a clustering outcome. Hryckiewicz and Kozłowski (2017, p. 3) used a portfolio approach, i.e., they examined bank activities and funding sources in the context of specific combinations of assets with a liability structure. They investigated systemically important banks[1] using the k-medoid clustering approach.

Mergaerts and Vander Vennet (2016, p. 74) used three profitability indicators and the Z-score as a proxy for banks' distress to investigate the long-term performance impact of bank business models in Europe from 1998 to 2013. They developed an approach based on factor analysis that uses the common variance of the business model variables to capture latent strategies. They focused on two factors. The first captures the retail orientation of the banks, while the second captures the degree of functional diversification, i.e., a lower loan ratio in exchange for a higher share of non-interest income. They documented the continuous nature of business models using multidimensional scaling that approximates the true distances between the banks using a two-dimensional representation as accurately as possible so that similar banks are grouped together.

Regarding banking models in Ukraine, Onyshchenko (2015) used seven main variables to identify business models: (1) bank loans (as a % of assets); (2) bank liabilities (as a % of assets); (3) corporate loans (as a % of assets); (4) corporate liabilities (as a % of assets); (5) household loans (as a % of assets); (6) household liabilities (as a % of assets); (7) trading assets (as a % of assets). She used cluster analysis to identify three main business models of banks: (1) retail-oriented, (2) diversified, and (3) corporate (as of 1.01.2015).

1 A systemically important bank is one whose failure might cause a financial crisis.

In another paper, Onyshchenko and Zaiats (2019) identified five main business models of banks: (1) traditional, (2) corporate, (3) retail, (4) universal, and (5) investment. They did this using six variables: (1) interbank loans (as a % of assets), (2) corporate loans (as a % of assets), (3) household loans (as a % of assets), (4) investment portfolio (as a % of assets), (5) corporate deposits (as a % of assets), and (6) household deposits (as a % of assets) (as of 1.01.2018). However, their choice of variables for analysis is open to criticism as some have a high level of negative pairwise correlation (e.g., the share of household deposits and corporate deposits in assets or the share of household loans and corporate loans in assets).

Rashkovan and Pokidin (2016, pp. 1, 17–18) analyzed seven business model variables (balance sheet): (1) Assets/Branches (UAH); (2) Average loan maturity (years); (3) Average loan size (thousands UAH); (4) Equity and subordinated banks ratio; (5) Retail loans ratio – the proportion of retail loans to revenue-generating assets; (6) Retail deposit ratio – the proportion of retail funding to the sum of overall liabilities minus subordinated debt; (7) Loans ratio – the share of loans (excluding interbank) to assets. They identified six distinct bank business models using Kohonen's self-organizing maps: (1) Households-to-Corporates, (2) Retail, (3) Universal, (4) Corporate, (5) Investment/Wholesale, and (6) Frozen/Undecided. The data they used was semi-annual, spanning January 2013 to July 2016.

Kornyliuk and Kornyliuk (2018) analyzed the specific origin of business models in the Ukrainian banking system from 2014 to 2017 using K-mean clustering. Five basic business models were identified (universal, retail, corporate, "retail finance to corporate lending," and frozen). They used balance sheet variables: (1) Retail loans to total loans; (2) Retail deposits to liabilities; (3) Non-deposit resources to liabilities; (4) Equity to assets ratio; (5) Net assets (logarithm).

Zarutska et al. (2020) proposed the structural-functional groups of banks methodology (the SFGB method) to determine and analyze banking business models, and to form the risk profil of each bank. To perform cluster analysis (using self-organizing Kohonen maps), it is suggested to use the 33 financial indicators based on National Bank of Ukraine statistics for the period from 1.01.2019 to 1.10.2019. They identified ten business models of Ukrainian banks. Meanwhile, again using the SFGB method, Zarutska et al. (2022) compared the key features of the banking system as of January 1 and September 1, 2022, and analyzed how Ukrainian banks' business models had changed in wartime.

The 2022 Russian invasion of Ukraine changed the situation in Ukraine's financial system. Pshik and Oleynyuk (2022) and Korneev (2022) described how the financial system functions in extreme conditions of martial law. Druhov and Druhova (2022) and Lobozynska, Skomorovych, and Vladychyn (2022) analyzed the main measures introduced by NBU when the Russian Federation invaded Ukraine.

Recent publications on changes in the situation of the Ukrainian financial system, and the banking sector in particular, mainly describe the measures taken by regulators. They also document proposals to ensure the financial system's stability. In contrast, this article analyzes how the models of banks' activities have changed at the micro level (reflected in the financial statements) *inter alia* in wartime.

Research methodology

In contrast to existing approaches (Ayadi and De Groen 2014; Farnè and Vouldis 2017; Hryckiewicz and Kozłowski 2017; Roengpitya et al. 2017) and similar to my previous publications (Kravchuk 2020; Kravchuk and Stoika 2021) a feature of this study is the use of a mixed approach to identify models of banking activities in Ukraine, i.e., accounting not only "choice variables" (with respect to banking activities and reflected in the composition of the balance sheet), but also "outcome" variables i.e., the results of the "choice" variables.

To identify different models of Ukrainian banks, the main indicators are highlighted (low-dimensional context of variables):

1. IL/A = Interbank lending/Total assets;
2. S/A = Securities/Total assets;
3. RL/A = Retail loans[2]/Total Assets;
4. D/Lb = Customer deposits/Total liabilities;
5. RD/D = Retail deposits (households)/Total customer deposits;
6. II/ICI = Interest income/Interest income + Commission income.

Variables were chosen based on an initial analysis of the structure of assets and liabilities in Ukraine's banking system as a whole. Its key features on 31.12.2022 (in contrast to the balance sheet structure of systemically important EU banks) are the absence of derivatives in the assets and liabilities of the balance sheet, as well as the minor role of debt securities as a source of banking funding (0.002% for the banking system as a whole, while the highest value is only 0.08% in Bank Avangard). This feature is probably positive for the current environment since the securities and derivatives market in Ukraine does not really operate in the period of martial law.

The correlation of the selected indicators is low ($|\rho| < 0.7$), and the coefficient of variation is > 10%, which allows them to be used for cluster analysis (Table 1).

2 Gross loans – loans not adjusted for reserves.

Table 1. Correlation matrix of banking ratios on 31.12.2022

Group of banks	IL/A	S/A	RL/A	D/Lb	RD/D	II/ICI
IL/A	1.00	– 0.20	– 0.15	0.14	– 0.19	0.18
S/A	– 0.20	1.00	– 0.42	– 0.19	– 0.51	0.10
RL/A	– 0.15	– 0.42	1.00	0.20	0.59	0.10
D/Lb	0.14	– 0.19	0.20	1.00	0.12	0.06
RD/D	– 0.19	– 0.51	0.59	0.12	1.00	– 0.20
II/ICI	0.18	0.10	0.10	0.06	– 0.20	1.00
Coefficient of variation, %	65.09	46.90	224.70	19.33	60.13	24.54

Source: author's elaboration based on data from NBU – National Bank of Ukraine (n.d.).

The following is a cluster analysis of the data set of these indicators for Ukrainian banks in different periods on a yearly basis (2013, 2019, 2021, 2022) to determine how various factors influence the modification of banking models (e.g., regulation and supervisory changes in 2014, the COVID–19 pandemic in 2020/2021, the ongoing war from 2022). Groups are identified using Ward's agglomerative hierarchical clustering algorithm. The distance is set to "Euclidean". Calculations are carried out in R using the NbClust package (Charrad et al. 2014). This research used the Tau (Rohlf 1974; Milligan 1981) index as the criterion for evaluating the optimal number of clusters.

The Tau index is computed between corresponding entries in two matrices. The first contains the distances between items, while the second 0/1 matrix indicates whether or not each pair of points is within the same cluster (Charrad et al. 2014, p. 10).

The Tau index is computed using the following equation:

$$Tau = \frac{s(+) - s(-)}{\left[\left(N_t\left(N_t - 1\right)/2 - t\right)\left(N_t - 1\right)/2\right)\right]^{1/2}},$$

where:

$s(+)$ represents the number of times two points not clustered together had a larger distance than two points that were in the same cluster, i.e., $s(+)$ is the number of concordant comparisons,

$s(–)$ represents the reverse outcome, i.e., $s(–)$ is the number of discordant comparisons.

Nt is the total number of distances and t is the number of comparisons of two pairs of points, where both pairs represent within-cluster comparisons or both pairs are between-cluster comparisons (Charrad et al. 2014, p. 10).

To analyze the main models of the Ukrainian banks, the following additional indicators are also used:

1. *L/A* = Loans[3]/Total assets;
2. *GS/A* = Internal government loan bonds (IGLB)/Total assets;
3. *OFA/A* = Others financial assets/Total assets;
4. *NBU/Lb* = Amounts due to the National Bank of Ukraine/Total liabilities;
5. *IB/Lb* = Interbank borrowing (Amounts due to banks)/Total liabilities;
6. *Dnc/D* = Customer deposit in national currency/Total customer deposits;
7. *L/D* = Loan[2]/Total customer deposits;
8. *NPL/L* = Non-performing loans/Loans;
9. *ROE*;
10. *ROA*.

The sample of banks covers all banks in Ukraine. The financial data of the banks were obtained from the database of the National Bank of Ukraine (n.d.).

Results

In this research, a business model is understood as a strategy that translates into similar balance sheet and income statement ratios.

Bank financial data on 31.12.2013 made it possible to identify the business models of 180 Ukrainian banks that were formed in the regulatory and economic conditions before the Revolution of Dignity in 2014. In the first stage, two banks were excluded from the sample, for which most of the indicators had a zero value. One group of banks was identified whose characteristic feature was a high OFA/A ratio (more than 20% of total assets). In the next stage, using six indicators of banking activity, four more groups of banks were identified based on cluster analysis (Table 2).

Table 2. Key indicators of banking clusters on 31.12.2013 (%)

Group of banks	*IL/A*	*S/A*	*RL/A*	*D/Lb*	*RD/D*	*II/ICI*
Group 1 (106) Universal banks						
mean	7.08	5.77	8.61	69.30	66.48	84.63

3 Gross loans – loans not adjusted for reserves.

Group of banks	*IL/A*	*S/A*	*RL/A*	*D/Lb*	*RD/D*	*II/ICI*
max	3.89	34.15	37.54	98.09	91.36	99.32
min	0.00	0.00	0.17	8.38	33.53	53.69
Group 2 (38) Corporate banks						
mean	3.72	7.15	4.13	87.10	27.97	87.18
max	54.45	40.39	16.64	99.94	55.55	99.93
min	0.00	0.00	0.00	66.02	0.00	60.60
Group 3 (18) Corporate-wholesale banks						
mean	5.18	20.28	1.21	37.73	18.60	90.76
max	30.60	73.30	6.74	78.87	51.25	99.76
min	0.00	0.00	0.00	0.58	0.00	64.37
Group 4 (5) Retail banks						
mean	3.86	0.10	69.58	57.81	88.27	65.80
max	8.24	0.47	80.58	89.74	95.33	98.94
min	1.31	0.00	52.44	11.96	73.02	38.85
Group 5 (11) Speculative banks						
mean	5.18	5.01	15.56	48.43	57.66	86.63
max	15.23	22.09	72.74	95.12	86.51	97.03
min	0.00	0.00	0.07	3.70	1.95	65.04

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

In Table 3, additional indicators are given to more clearly identify the specifics of the selected models.

The largest group was the universal banking model, in which the characteristic features were the diversification of the structure of assets and liabilities with predominant deposit-based funding (both corporate and retail deposits). Asset policy was mainly aimed at corporate lending. The credit portfolio's mean share of non-performing loans was about 12%. Investments in securities accounted for a small share of assets, mainly for liquidity management. In terms of income structure, interest income was significantly dominant.

The specifics of Group 2 (Corporate banks) involved funding their activities from corporate depositors, and their credit portfolio structure is dominated by corporate lending. Meanwhile, Group 3 (Corporate-wholesale banks) diversified their funding portfolio by actively using interbank markets (some banks also used resources from the Central bank or foreign parent banking institutions) and corporate depositors. The asset strategy was mainly aimed at corporate lending, and the share of securities

in assets is more than twice as high as for banks with universal and corporate models.

Table 3. Additional indicators of banking clusters on 31.12.2013 (%, mean values)

Group of banks	*L/A*	*GS/A*	*OFA/A*	*NBU/ Lb*	*IB/Lb*	*Dnc/D*	*L/D*	*NPL/L*	*ROE*	*ROA*
Group 1 (106) Universal banks	60.66	–	2.36	–	19.88	64.43	159.50	11.89	– 0.03	0.05
Group 2 (38) Corporate banks	64.13	–	1.41	–	6.73	76.90	117.56	6.20	4.02	0.64
Group 3 (18) Corporate-wholesale banks	38.23	–	0.89	–	35.01	72.15	556.35	8.82	– 16.07*	– 1.64
Group 4 (5) Retail banks	76.50	–	1.58	–	29.40	88.21	245.06	8.69	8.63	1.12
Group 5 (11) Speculative banks	35.19	–	34.38	–	18.15	60.84	93.04	16.90	0.61	0.05

* Without Credytprombank.
Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

The business model of Group 4 focused mostly on household loans (69.58% of total assets). This model was also the most profitable (with the highest *ROE* and *ROA* values among all groups). The last group was marked by the most opaque business model – 34% of the balance sheet comprised other financial assets. The mean share of non-performing loans in the credit portfolio was about 17%. This group included 11 banks, nine of which closed in subsequent years. Some models (universal, corporate and retail) are characterized by a high loan-to-deposit ratio (the mean value is more than 150%). It means that the banks may not have enough liquidity to cover unforeseen fund requirements.

The Revolution of Dignity in Ukraine in 2014 has played a significant role in modifying the business models of Ukrainian banks. The reform of the Central Bank, including improved banking supervision, led to the closure of a significant number of banks. On 31.12.2019, only 75 banks were operating in Ukraine. The key was a modification of existing business model variants (Table 4). In particular, there was no model of speculative opaque banks with a significant share of other financial assets in the balance sheet.

Table 4. Key indicators of banking clusters on 31.12.2019 (%)

Group of banks	*IL/A*	*S/A*	*RL/A*	*D/Lb*	*RD/D*	*II/ICI*
Group 1 (53) Universal banks						
mean	6.58	24.02	7.67	90.44	47.41	72.39
max	21.75	63.27	52.71	98.62	78.23	94.96
min	0.49	1.10	0.09	62.10	12.65	45.54
Group 2 (7) Corporate banks						
mean	7.49	21.20	3.45	47.89	43.85	86.76
max	11.49	47.01	19.65	73.38	72.62	91.57
min	1.65	0.00	0.00	2.98	21.57	76.74
Group 3 (9) Corporate-investment banks						
mean	11.10	57.70	0.84	70.02	1.70	88.38
max	26.47	76.16	5.87	98.29	8.44	99.85
min	0.01	18.23	0.00	19.52	0.00	46.53
Group 4 (3) Retail banks						
mean	3.34	4.87	76.14	92.66	89.03	84.27
max	5.82	5.96	83.60	93.76	99.37	89.32
min	0.99	3.77	68.70	92.10	92.10	80.63
Group 5 (3) Commission banks						
mean	4.74	10.55	8.23	78.75	38.49	17.87
max	12.82	23.27	17.67	87.90	50.16	23.43
min	0.01	0.00	3.09	67.65	24.68	13.71

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

In Table 5, additional indicators are given to more clearly identify the specifics of the selected models.

Universal banks were characterized by more dominant, deposit-based funding (both corporate and retail) compared to 2013 and diverse asset structures. There was a significantly larger share of securities in assets compared to 2013. In terms of income structure, the share of interest income decreased. In 2019, this model was much more profitable compared to 2013.

Corporate banks' lending operations were characterized by primarily cooperating mainly with corporate clients and maintaining a more diversified structure of banking funding – approximately 21% of total liabilities were interbank funds. A negative indication

concerning the rationality of using this banking model is that the mean share of non-performing loans in the credit portfolio was about 44%.

Table 5. Additional indicators of banking clusters on 31.12.2019 (%, mean values)

Group of banks	*GS/A*	*L/A*	*OFA/A*	*NBU/Lb*	*IB/Lb*	*Dnc/D*	*L/D*	*NPL/L*	*ROE*	*ROA*
Group 1 (53) Universal banks	7.90	48.13	0.60	0.21	1.31	65.84	79.92	23.77	9.65	1.37
Group 2 (7) Corporate banks	9.22	63.26	0.09	0.00	21.01	57.66	610.37	43.68	7.04	1.41
Group 3 (9) Corporate-investments banks	21.23	18.61	0.04	0.00	13.63	76.67	32.03	14.77	15.07	3.03
Group 4 (3) Retail banks	0.70	78.86	1.12	0.00	0.16	90.75	92.11	32.13	34.19	4.03
Group 5 (3) Commission banks	0.00	32.54	9.99	0.00	0.02	86.20	56.74	12.90	7.41	1.10

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

Another model at that time was corporate investment banking. Banks in this cluster invested more than 60% (mean value) of their assets in securities, and the share of government securities in assets was about 21%. Furthermore, the credit portfolio was significantly dominated by corporate loans. The funding of activities (in contrast to classical investment banks in international practice) in this model was carried out mainly by corporate deposits.

In contrast to 2013, retail banks (Group 5) were characterized by the use of retail deposit resources (83% of the total customer deposits) for household lending (the average value for the group was about 90% of the credit portfolio). This model was the most profitable (as of 2013).

In addition to the models found in articles by Ukrainian researchers (described in the literature review), we identify the commission banking model in 2019–2022. Its main feature was the organization of activities aimed at providing banking services that generate commission income.

In 2019, only the corporate model was characterized by a high value of the loan-to-deposit ratio (mean value is more than 610%) in contrast to 2013.

A negative feature of all banking models in 2019 is a significantly higher level of share of non-performing loans in the credit portfolio (mean value was 24%) compared to EU banking practice. This may be due to the improved quality of supervisory procedures

that Ukraine's central bank began using after reforming its model to international standards in 2014.

Analysis of the banks' financial dataset on 31.12.2021 makes it possible to determine the impact of the COVID–19 pandemic on how banks modified their business models in Ukraine. The number of banks had decreased to 71 compared to 2019 (Table 6).

Table 6. Key indicators of banking clusters on 31.12.2021 (%)

Group of banks	*IL/A*	*S/A*	*RL/A*	*D/Lb*	*RD/D*	*II/ICI*
Group 1 (43) Universal banks						
mean	9.55	32.10	5.46	80.78	40.20	71.97
max	30.35	56.98	25.59	98.82	70.37	92.61
min	0.69	0.00	0.00	0.78	18.39	37.76
Group 2 (9) Corporate investment banks						
mean	16.98	55.99	3.21	88.84	7.56	83.42
max	47.52	72.14	18.71	99.06	20.88	90.30
min	2.11	28.85	0.00	72.61	0.00	71.00
Group 3 (9) Wholesale funding banks						
mean	3.92	78.60	1.25	44.96	19.43	81.37
max	13.74	90.92	2.85	62.35	34.03	99.43
min	0.64	68.75	0.00	8.31	1.77	69.44
Group 4 (4) Retail banks						
mean	5.66	14.93	62.26	89.57	83.65	73.39
max	11.51	32.82	86.51	94.70	97.96	89.21
min	2.42	4.41	43.62	84.08	78.27	54.21
Group 5 (6) Commission banks						
mean	6.75	55.74	0.89	65.38	22.97	33.47
max	11.69	73.44	2.32	90.56	41.74	57.34
min	0.97	40.73	0.13	39.32	2.53	8.30

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

In Table 7, additional indicators are given to more clearly identify the specifics of the selected models.

Table 7. Additional indicators of banking clusters on 31.12.2021 (%, mean values)

Group of banks	*GS/A*	*L/A*	*OFA/A*	*NBU/Lb*	*IB/Lb*	*Dnc/D*	*L/D*	*NPL/L*	*ROE*	*ROA*
Group 1 (43) Universal banks	17.10	45.96	0.65	7.00	3.20	65.99	319.99	17.50	13.63	1.73
Group 2 (9) Corporate investment banks	26.96	20.25	0.17	4.82	3.92	68.39	27.17	16.78	12.24	1.52
Group 3 (9) Wholesale funding banks	67.27	7.60	0.12	40.38	4.82	79.61	38.59	10.52	2.86	– 1.01
Group 4 (4) Retail banks	5.20	67.08	2.30	2.35	0.52	84.33	85.92	18.83	36.12	4.96
Group 5 (6) Commission banks	37.99	19.52	4.24	17.35	3.99	65.38	30.98	30.42	29.96	4.04

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

The number of universal banks decreased from 53 to 43 in 2021 (Table 8). The universal model is characterized by financing banking activities from deposit sources during this period, and some banks had to take loans from the NBU. In the asset structure, the average share of government securities in assets increased (from 7.9% to 17.1%). The credit portfolio is dominated by corporate loans. In terms of income structure, the share of interest income is further reduced. The profitability of the model increased during the COVID–19 pandemic period. However, two banks, which had the universal banking model in 2019, could not quickly adapt to the changing market conditions, and they were closed by the NBU.

In the group with the corporate-investment banking model, only five banks maintained the same model in 2021, while four had modified their activities to the corporate-investment model. The share of government securities in assets had slightly increased for corporate investment banks, from 21% to almost 27%. This banking model was less profitable compared to 2019. As in previous periods, these banks were mostly funded by corporate deposits.

In 2021, we could not identify the corporate banking model from 2013–2019. Most banks from this group had modified to the universal model.

Table 8. Inter-cluster migration on 31.12.2021/31.12.2019

Group of banks	2019				
2021	Group 1 Universal (53)	Group 2 Corporate banks (7)	Group 3 Corporate-investment banks (9)	Group 4 Retail banks (3)	Group 5 Commission banks (3)
Group 1 (43) Universal banks	37	6	0	0	0
Group 2 (9) Corporate investment banks	4	0	5	0	0
Group 3 (9) Wholesale funding banks	6	1	2	0	0
Group 4 (4) Retail banks	1	0	0	3	0
Group 5 (6) Commission banks	3	0	1	0	2
Insolvent banks	2	0	1	0	1

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

During the COVID–19 pandemic period, we identified another banking model – wholesale funding banks (nine institutions, six of which used the universal model in 2019). A feature of most banks was significant financial support from the NBU, which was reflected in their balance sheet, indicating miscalculations in the construction and adaptation of models by these banks to the current environment. In assets structure dominated investment in the government securities – more than 67% of total assets.

Retail banks were still the most profitable (as was the case in 2013 and 2019). This model was partially modified in some banks based on the growing role of investments in securities (the maximum value was about 33% of assets). The commission banking model was used by six institutions, four of which had moved from other clusters (mainly from the universal banking model). By 2021, they had changed their operating format, focusing on banking products that generate commission income.

Evidence of the negative impact of COVID–19 on Ukrainian banking models: (1) a significant increase in the role of government securities in assets, caused by a decrease in credit activity due to an increase in their riskiness; (2) the use of central bank funds to manage liabilities (except for banks that use the retail business model). This confirms the deterioration in financing conditions in the deposit market. But at that time, the share of non-performing loans in credit portfolio for most banks (except for the commission model) had significantly decreased compared to 2019.

On February 24, 2022, Russia began its armed aggression against Ukraine. The NBU introduced a number of restrictions on how commercial banks function under martial

law. Analysis of banks' financial data from 31.12.2022 (Table 9) allows us to determine how banks' business models initially reacted to the situation. The number of banks decreased to 67 in comparison with the previous period (after the declaration of martial law, the licenses of two Russian banks were revoked).

Table 9. Key indicators of banking clusters on 31.12.2022 (%)

Group of banks	*IL/A*	*S/A*	*RL/A*	*D/Lb*	*RD/D*	*II/ICI*
Group 1 (44) Universal banks						
mean	12.65	36.17	5.76	87.64	41.14	80.24
max	30.83	71.43	37.75	98.89	81.30	97.18
min	2.78	7.40	0.01	61.02	13.20	57.01
Group 2 (10) Corporate investment banks						
mean	13.19	64.78	1.28	90.03	6.16	94.89
max	27.53	92.03	6.74	99.28	19.14	99.52
min	5.96	35.65	0.00	61.37	0.00	86.73
Group 3 (4) Wholesale funding banks						
mean	5.23	74.10	0.12	37.10	19.51	75.34
max	8.68	79.05	0.18	53.52	32.73	97.06
min	0.77	60.16	0.05	24.92	1.56	49.41
Group 5 (2) Retail banks						
mean	2.01	4.22	78.19	95.77	88.48	90.46
max	2.55	7.38	83.13	97.36	99.83	93.70
min	1.48	1.06	73.25	94.18	77.14	87.22
Group 5 (7) Commission banks						
mean	6.22	39.99	1.20	85.53	37.57	33.11
max	20.27	56.88	2.12	98.86	57.90	53.77
min	1.57	17.25	0.32	61.48	26.86	9.41

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

In Table 10, additional indicators are given to more clearly identify the specifics of the selected models.

Table 10. Additional indicators of banking clusters on 31.12.2022 (%, mean values)

Group of banks	*GS/A*	*L/A*	*OFA/A*	*NBU/Lb*	*IB/Lb*	*Dnc/D*	*L/D*	*NPL/L*	*ROE*	*ROA*
Group 1 (44) Universal banks	10.63	38.60	0.83	4.17	0.74	65.74	54.45	23.27	– 6.89	– 0.47
Group 2 (10) Corporate investment banks	17.05	15.46	0.11	1.49	3.42	74.80	18.28	25.85	9.16	0.05
Group 3 (4) Wholesale funding banks	36.50	8.04	1.32	30.10	4.80	82.03	90.09	28.70	– 12.13	– 3.50
Group 4 (2) Retail banks	0.9	80.74	0.58	0.00	0.07	91.04	83.85	52.34	– 94.38	– 8.42
Group 5 (7) Commission banks	12.30	25.19	2.59	1.95	0.00	71.83	32.89	26.42	23.16	4.19

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

The group of universal banks slightly decreased: 38 banks remained unchanged in their model, two banks moved to the commission model, three institutions were closed by the NBU, and six banks from other clusters migrated to the universal model (Table 11).

Table 11. Inter-clusters migration on 31.12.2022/31.12.2021

Group of banks	2021				
2022	Group 1 Universal (43)	Group 2 Corporate investment banks (9)	Group 3 Wholesale funding banks (9)	Group 4 Retail banks (4)	Group 5 Commission banks (6)
Group 1 Universal banks (44)	38	1	2	2	1
Group 2 Corporate-investment banks (10)	0	7	3	0	0
Group 3 Wholesale banks (4)	0	1	2	0	1
Group 4 Retail banks (2)	0	0	0	2	0
Group 5 Commission banks (7)	2	0	1	0	4
Insolvent banks	3	0	1	0	0

Source: author's elaboration based on data from National Bank of Ukraine (n.d.). In parentheses – the number of banks in the group.

In 2022, this model was characterized by a diversified asset structure, but the share of government bonds in assets had decreased significantly. The financing of activities was further dominated by deposits (both corporate and household). However, in contrast to the results of Zarutska et al. (2022, p. 16), who reported that the primary business

model of banks remained the classic model of corporate lending, with retail financing in the last eight months of 2022, our results indicate that retail financing did not dominate for the universal model at the end of 2022. In terms of income structure, the share of interest income had increased.

In 2022 (during wartime), fewer banks used mostly NBU funds to support their activities. At the end of 2022, there were four banks compared with nine in 2021. The corporate-investment model of banking in Ukraine is characterized by an increase in investments in securities (compared to 2021), but the share of government bonds in assets decreased significantly. The number of banks that used retail banking decreased, the share of the retail loan in total assets for these banks significantly increased, and retail deposits remained the main source of financing for their activities. However, this model is now unprofitable during wartime.

The most profitable model was commission banking, which is the least sensitive to the risk of changes in interest rates. The share of commission income is about 76% of the total interest and commission income. Funding of banking activities in this model is carried out partly based on customer deposits.

Most Ukrainian banks invested mainly in non-government securities. A comparison of S/A and GS/A ratios shows that a significant share of such instruments in investment portfolios was typical for all models. Non-government securities during wartime are low-liquid, and the current situation significantly increases the liquidity risk for Ukrainian banks. At the end of 2022, the NBU raised the minimum reserve requirements for banks, allowing up to 50% of these reserves to be formed in government securities. This may have an impact on modifications to the asset structure of most banks.

The *ROE* and *ROA* of all banking models decreased in wartime, and three banking models became unprofitable. Another negative feature of all banking models in 2022 is the significantly higher share of non-performing loans in the credit portfolio, especially for the retail banking model (mean value is about 52%) compared to 2021.

Conclusions

The research identified the key models of banking activity in Ukraine and demonstrated how they changed under the influence of the Revolution of Dignity, the COVID–19 pandemic, and the imposition of martial law.

The specific features of Ukrainian banks in all periods of analysis (in contrast to the balance sheet structure of systemically important EU banks) are the absence of derivatives in the assets and liabilities of the balance sheet, as well as the minor role of debt securities as a source of funding.

The actions of the National Bank of Ukraine in 2014 (after the Revolution of Dignity) had a positive impact on the models of Ukrainian banks. First of all, on 31.12.2019, there were no opaque banking models, the characteristic feature of which was the significant role of other financial assets in the balance sheet structure. At that time, the following specific models of banks were identified: universal banks, corporate banks, corporate investment banks, retail banks, and commission banks. The universal model was used by 71% of banks; few banks did not have deposits as the main source of funding. In contrast to classical investment banks in international practice, in the corporate-investment banking model in Ukraine, the funding of activities was carried out mainly by corporate deposits.

During the COVID–19 pandemic, banking business models were modified. In 2021, there was no corporate banking model, as there had been between 2013 and 2019. Most banks from this group had modified their activity to the universal model. Additionally, the specific wholesale funding model was identified, i.e., banks whose characteristic feature was a high share of central bank funding in liabilities (the mean value was 20% of total assets). The negative impact of COVID–19 on the Ukrainian economy was reflected in all banking models by the following: (1) a significant increase in the role of government securities in assets, which is caused by a decrease in lending due to an increase in their riskiness; (2) the use of central bank funds to manage liabilities, which was evidence of a deterioration in financing conditions in the deposit market.

In 2022, Ukrainian banks faced new challenges related to the introduction of martial law due to Russia's armed aggression. Five banking models were again identified: (1) universal banks, (2) wholesale funding banks, (3) corporate-investment banks, (4) retail banks, and (5) commission banks. The following main changes in the banking system of Ukraine at the end of 2022 (during the war) were identified: (1) fewer banks using mainly funds from the NBU to support their activities; (2) the closure by the NBU of only four banks during the year (including 2 with majority shareholders from Russia); (3) an increase in the share of the non-government debt securities portfolio in banks' assets; (4) declines in *ROE* and *ROA* for all banking models during the war, and three models became unprofitable; (5) the significantly higher share of non-performing loans in the credit portfolio for all banking models, especially for the retail banking model (the mean value is about 52%).

Given that Russia's war against Ukraine continues, it is most likely that the models of Ukrainian banks will continue to change to ensure financial stability during martial law. After the end of the war, and in light of Ukraine's declared trajectory towards EU integration, banking models will change significantly under the influence of the following two key factors: (1) participation in financing the reconstruction of the country;

(2) the need to comply with the requirements of European legal acts concerning banking activities, which will be implemented in Ukraine in the future.

The National Bank of Ukraine, using data on the modification of business models of commercial banks, should improve its banking supervision system, strengthening the preventive component based on changes in microprudential indicators, following the Basel III methodology.

The modification of Ukrainian banks' business models has not had a significant impact on the banking systems of Central and Eastern European countries due to the low level of financial capital of these countries in the banking sector of Ukraine. However, the development of this sector after the war could be an attractive investment object for financial institutions of the region.

The value-added of this research is the analysis of how the models of banks' activities in Ukraine have changed at the micro level (reflected in the financial statements), *inter alia*, in wartime.

References

Ayadi, R., De Groen, W. (2014), *Banking Business Models Monitor 2014 for Europe*, CEPS Paperbacks, https://ssrn.com/abstract=2510323 (accessed: 5.01.2023)

Charrad, M., Ghazzali, N., Boiteau, V., Niknafs, A. (2014), *NbClust: An R Package for Determining the Relevant Number of Clusters in a Data Set*, "Journal of Statistical Software", 61 (6), pp. 1–35, http://doi.org/10.18637/jss.v061.i06

Druhov, O., Druhova, V. (2022), *Banking system in Ukraine 2022: Before and in the Wartime*, "Bezpieczny Bank", 1, pp. 33–48.

Farnè, M., Vouldis, A. (2017), *Business models of the banks in the euro area*, "ECB Working Paper", 2070, http://doi.org/10.2866/386225

Hanafizadeh, P., Marjaie, S. (2021), *Exploring banking business model types: A cognitive view*, "Digital Business", 1, pp. 1–17, https://doi.org/10.1016/j.digbus.2021.100012

Hryckiewicz, A., Kozłowski, Ł. (2017), *Banking business models and the nature of financial crisis*, "Journal of International Money and Finance", 71, pp. 1–24, https://doi.org/10.1016/j.jimonfin.2016.10.008

Korneev, V. (2022), *Functioning of the financial system of Ukraine in extreme conditions of martial law*, "VUZF Review", 7 (2), pp. 6–16.

Kornyliuk, R., Kornyliuk, A. (2018), *Ukrainian Banks' Business Models under Systemic Risk*, "ICT in Education, Research, and Industrial Applications. Proc. 14th Int. Conf. ICTERI", pp. 124–138, https://www.researchgate.net/publication/325973869_Kornyliuk_R_Kornyliuk_A_2018_Ukrainian_Banks'_business_models_under_systemic_risk_CEUR_Workshop_Proceedings_Volume_2105_2018_Pages_124-138 (accessed: 10.01.2023).

Kravchuk, I. (2020), *Funding Strategies of G-SIBs*, "Management Issues", 18 (4), pp. 14–31, https://doi.org/10.7172/1644-9584.90.1

Kravchuk, I., Stoika, V. (2021), *Business Models of Banks for the Financial Markets in the EU*, "European Research Studies Journal", 24 (2B), pp. 371–382, https://doi.org/10.35808/ersj/2239

Lobozynska, S., Skomorovych, I., Vladychyn, U. (2022), *Activities of the National Bank of Ukraine under Martial Law*, "Bezpieczny Bank", 1, pp. 49–64, https://doi.org/10.30970/ves.2022.62.0.6207

Mergaerts, F., Vander Vennet, R. (2016), *Business models and bank performance: A long-term perspective*, "Journal of Financial Stability", 22, pp. 57–75, https://doi.org/10.1016/j.jfs.2015.12.002

Milligan, G. (1981), *A Monte Carlo Study of Thirty Internal Criterion Measures for Cluster*, "Analysis, Psychometrika", 46 (2), pp. 187–199, https://doi.org/10.1007/BF02293899

National Bank of Ukraine (n.d.), *Supervisory Data*, https://bank.gov.ua/ua/statistic/supervision-statist (accessed: 20.02.2023).

Onyshchenko, Y. (2015), *Banking business models in Ukrainian banking system*, "Baltic Journal of Economic Studies", 1 (2), pp. 115–121, https://doi.org/10.30525/2256-0742/2015-1-2-115-121

Onyshchenko, Y., Zaiats, E. (2019), *Theoretical approaches to defining the definition of "business model of the bank*, Proceedings of the Digital and Innovative Economy: Processes, Strategies, Technologies: International Scientific Conferencem Kielce, Poland, pp. 101–104.

Pshik, B., Oleynyuk, R. (2022), *Sytuacja finansowa na Ukrainie i środki zapewniające jej stabilność w czasie wojny*, "Bezpieczny Bank", 1, pp. 65–79.

Rashkovan, V., Pokidin, D. (2016), *Ukrainian Banks' Business Models Clustering: Application of Kohonen Neural Networks*, "Visnyk of the National Bank of Ukraine", 238, pp. 13–88, https://doi.org/10.26531/vnbu2016.238.013

Roengpitya, R., Tarashev, N., Tsatsaronis, K., Villegas, A. (2017), *Bank business models: popularity and performance*, "BIS Working Papers", 682.

Rohlf, F. (1974), *Methods of Comparing Classifications*, "Annual Review of Ecology and Systematics", 5, pp. 101–113, https://doi.org/10.1146/annurev.es.05.110174.000533

Vichi, M., Kiers, H.A.L. (2001), *Factorial k-means analysis for two-way data*, "Computational Statistics and Data Analysis", 37 (1), pp. 49–64, https://doi.org/10.1016/S0167-9473(00)00064-5

Zarutska, O., Ponomarova, O., Pavlov, R., Pavlova, T., Levkovich, T. (2022), *Changes in Ukrainian banks' business models in times of military crisis*, "Financial and Credit Activity. Problems of Theory and Practice", 6 (47), pp. 8–18, https://doi.org/10.55643/fcaptp.6.47.2022.3923

Zarutska, O., Pavlova, T., Sinyuk, A., Khmarskyi, V., Pawliszczy, D., Kesy, M. (2020), *The innovative approaches to estimating business models of modern banks*, "Marketing and Management of Innovations", 2, pp. 26–43, https://doi.org/10.21272/mmi.2020.2-02

Modele biznesowe ukraińskich banków: wpływ Rewolucji Godności, pandemii COVID–19 i agresji militarnej Rosji

Celem niniejszego artykułu jest identyfikacja kluczowych modeli działalności bankowej na Ukrainie i ich zmian pod wpływem Rewolucji Godności, pandemii COVID–19 i wprowadzenia stanu wojennego. Zaproponowana metoda badawcza wykorzystuje analizę skupień głównych wskaźników działalności bankowej na podstawie hierarchicznej metody aglomeracyjnej Warda i indeksu Tau jako kryterium oceny optymalnej liczby skupień. Badanie obejmuje wszystkie ukraińskie banki w latach 2013–2022.

Działania Narodowego Banku Ukrainy w 2014 r. (po Rewolucji Godności) miały pozytywny wpływ na modele ukraińskich banków: modele bankowe stały się bardziej transparentne i odporne na wstrząsy finansowe. W latach 2021–2022 zidentyfikowano pięć modeli bankowych: banki uniwersalne, banki finansowania hurtowego, banki korporacyjno-inwestycyjne, banki detaliczne oraz banki prowizyjne.

Negatywny wpływ COVID–19 na ukraińską gospodarkę znalazł odzwierciedlenie we wszystkich zidentyfikowanych modelach banków w następujący sposób: 1) znacząco wzrosła rola papierów wartościowych w aktywach z powodu spadku akcji kredytowej ze względu na wzrost jej ryzyka; 2) wzrosło wykorzystanie funduszy od banku centralnego do zarządzania zobowiązaniami, a to potwierdza pogorszenie warunków finansowania na rynku depozytów.

Zidentyfikowano następujące istotne zmiany w systemie bankowym Ukrainy pod koniec 2022 r. (w czasie wojny): 1) zmniejszenie liczby banków wykorzystujących głównie fundusze od NBU do wspierania swojej działalności; 2) wycofanie w ciągu roku tylko czterech banków przez Narodowy Bank Ukrainy (w tym dwóch z większościowymi akcjonariuszami z Rosji); 3) wzrost udziału portfela nieskarbowych dłużnych papierów wartościowych w aktywach banków; 4) spadki wartości wskaźników *ROE* i *ROA* we wszystkich modelach bankowych w czasie wojny, a trzy modele bankowe stały się nieopłacalne; 5) znacznie wyższy poziom udziału kredytów zagrożonych w portfelu kredytowym dla wszystkich modeli bankowych, zwłaszcza dla modelu bankowości detalicznej.

Wartością dodaną badania jest analiza zmian modeli działalności banków w Ukrainie na poziomie mikro (odzwierciedlonych w sprawozdaniach finansowych), zwłaszcza w czasie wojny.

Słowa kluczowe: bank, zarządzanie aktywami i pasywami, stan wojenny, bankowość korporacyjno-inwestycyjna, finansowanie depozytowe

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.08

The Development of the Cooperative Banking Sector in Selected Central and Eastern European Countries

Anna Nowacka https://orcid.org/0000-0001-9300-3646
Ph.D., Mazovian Academy in Plock, Faculty of Social Sciences, Plock, Poland
e-mail: a.nowacka@mazowiecka.edu.pl

Abstract

The study assesses the development of the cooperative banking sector in selected Central and Eastern European (CEE) countries against the average statistics of the segment in those countries. It also compares it to the largest European cooperative banking group in Germany. The article presents the results of an analysis of the cooperative banking sectors between 2016 and 2021 in Poland, Bulgaria, Romania, Hungary and Germany, all of which are members of the European Association of Cooperative Banks (EACB). The selection criterion was based on the availability of detailed data on cooperative banks published by the EACB on a temporal and spatial basis.

The empirical basis for the issues addressed in the article is a review of the reference literature and the comparative analysis of the development of the cooperative banking sector using a synthetic development indicator for the period 2016–2021.

According to the theoretical and empirical analysis, Romania demonstrates the lowest level of development of the cooperative banking segment. In turn, the Polish and Bulgarian cooperative banking sectors represents a higher level of development than the Romanian one. Hungary has reached the highest level of development in the group of Central and Eastern European countries. While comparing the CEE countries to the German cooperative banking sector, their development was almost one and a half times lower and, in the case of Romania, three times lower.

Keywords: cooperative banks, development, the Central and Eastern European countries, synthetic development indicator

JEL: G21, R11

Received: 23.03.2023. Verified: 1.08.2023. Accepted: 23.01.2024

Introduction

Over the years, cooperative banks in Europe have not only undergone changes, but many of them have even started to depart from cooperative principles. They are now displaying considerable diversity regarding their activities both in the banking service market and in the internal organisational structures they have established. There have been disparities in the organisation and the operating principles of cooperative banking structures taking shape in various European countries, following both the laws and the regulations in force in those countries, as well as the market strategy chosen by their owners and their management (Siudek 2007, p. 36).

The development of the cooperative banking sector, which is part of the banking system, is important both in the context of the development of the financial system as a whole and its relationship to economic growth. Theory and empirical research generally show that financial development can either stimulate or inhibit economic growth. However, it is much less common to encounter views that the above categories are not causally related to each other (Ramey and Ramey 1994, pp. 1–2; Kulawik 2007, p. 17; Dabusinskas, Kulikov, and Randveer 2013, pp. 4–5; Kata and Chmiel 2019, p. 80). Thus, banking activities contribute to socio-economic development, which becomes particularly important in the context of the role of cooperative banks in the banking system as local financial institutions (Giagnocavo, Gerez, and Sforzi 2012, p. 285). Their locations, mainly in rural areas, contribute to local economic development and help reduce financial exclusion by offering products and services to people of low material status. Van and Linh (2019, p. 10) stated that financial inclusion plays a significant role in economic development, especially in terms of GDP growth and reducing inequality and poverty in any country.

Banking sector development has been addressed in both the domestic and foreign literature. The review of the works published demonstrates that most authors present the results of analyses that refer to the entire banking sector and, most often, that of Western European countries. There is a lack of studies that compare the development of the cooperative banking sector, particularly in Central and Eastern Europe (CEE). The topics covered in the article, including the author's selection of diagnostic features of the synthetic indicator of the development of the cooperative banking sector, constitute the added value of the analysis of the development of financial institutions.

Characteristics of the cooperative banking systems in selected CEEan countries

The Hungarian savings cooperative banking system is based on a two-tier arrangement with a separate central institution. For years, those local institutions were engaged in deposit and credit activities. Between 1990 and 2004, intensive consolidation began, as a result of which, the number of savings cooperatives fell from 260 to 156 (i.e., by 40%). Attempts were made to improve the difficult situation of cooperative banks during the economic transition period, such as the establishment of the National Cooperative Banking Institution Protection Fund (OTIVA). The next step in the reform of the sector was marked by the adoption of the 'Act on the Integration of Credit Cooperatives and Amendments to the Economic Acts' ('Act on Cooperative Banks') in 2013. That reform established 12 regional cooperatives in 2018 and their further merger with the national Takarékbank. In addition to serving as the central bank for the affiliated local savings cooperatives, it also acted as an apex bank (Gal and Kovacs 2018, pp. 40–41; BS.net 2021). Unfortunately, those measures failed to result in any significant consolidation of the cooperative banking sector. It was exacerbated by the competitiveness of commercial banks (Kovacs 2020, p. 205), which was reflected in the dynamically decreasing number of those banks. In addition, the integration of the Hungarian banking system, which began in 2019 and involves the construction of a bank holding company that will be the second largest bank in Hungary, has led to the disappearance of typical cooperative banks. In effect, the number of institutions based on cooperative values and principles has been reduced to two (Bareith, Tatay, and Varga 2022, pp. 7–8).

Table 1. Number of cooperative banks and their branches in Hungary, 2016–2021

Years	2016	2017	2018	2019	2020	2021
Number of cooperative banks*	65	19	19	4	4	3
Number of branches	1,491	1,144	1,019	859	724	700

* There are discrepancies regarding the number of banks in different sources.
Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021.

The cooperative banks in Romania are categorised as non-bank financial institutions and are referred to as credit cooperatives (Pirvu and Banica 2016, p. 363). Should they meet the capital requirements on their own, they can operate as commercial banking institutions. There was a revival of the sector of cooperative credit institutions in Romania in the 1990s. Those cooperatives were not required to possess a banking licence or

meet capital requirements. In consequence, credit cooperatives were formed that were weak in terms of capital and staff (Gostomski 2012, p. 51).

Currently, the Romanian cooperative banking sector is a two-tier structure. It consists of cooperative banks, which function as regional universal banks, and the central financial institution, Banca Centrala Cooperatista CREDITCOOP. That institution encompasses all the cooperative banks and wields supervisory and control functions regarding the regional cooperative banks. Furthermore, it provides them with technical support and represents the common interests of the cooperative sector in legislative initiatives.

The characteristic feature of the Romanian cooperative banking sector is its highly centralised nature, which means that cooperative banks meet capital and liquidity requirements as a group rather than as individual entities. Unlike commercial banks, which operate as individual institutions, cooperative banks affiliated with CREDITCOOP operate as a federation. Banca Centrala Cooperatista is the guarantor of all liabilities, ensures the liquidity and the capital adequacy of each affiliated bank, and, if need be, provides financial support (World Bank Group 2020, p. 43). Since 1999, the number of cooperative banks in Romania has significantly decreased, from 565 to the current 34. However, strong consolidation is restricted by law, as the CREDITCOOP federation must include at least 30 banks (World Bank Group 2020, p. 43).

Table 2. Number of cooperative banks and their branches in Romania, 2016–2021

Years	2016	2017	2018	2019	2020	2021
Number of cooperative banks	41	41	40	38	36	34
Number of branches	744	744	738	740	732	727

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021.

The history of the cooperative banking sector in Bulgaria dates back to the early 20th century, with the first Bulgarian cooperative bank established in 1910. During World War 2 and throughout the Communist era, the sector remained under complete control of the state. It was not until the political transition and the economic transformation that the current cooperative banking sector was founded. It now consists of:

- The Central Cooperative Bank (CCB);
- The Agriculture Credit Cooperatives (ACCs).

The CCB was established in 1991 on the joint initiative of the Central Cooperative Union, regional cooperative unions, and more than 1,100 cooperative organisations. Its main

initial mission was to develop the cooperative system in Bulgaria. Over time, however, the CCB has changed its business model, moving towards becoming a universal commercial bank while maintaining offers aimed at customers related to agriculture or agri-food processing. Rather than being an association of local cooperative banks, the bank is a separate institution with numerous subsidiaries that operate commercially (Cotugno and Stefanelli 2016, p. 260; Central Cooperative Bank 2021).

Agricultural credit cooperatives, whose activities are based on cooperative principles and relevant legal acts, constitute Another separate part of the cooperative banking sector in Bulgaria. Those cooperatives are located in rural, sparsely populated areas which lack other financial service facilities. The number of institutions in the cooperative banking sector in Bulgaria is presented in Table 3.

Table 3. Number of cooperative banks and their branches in Bulgaria, 2016–2021

Years	2016	2017	2018	2019	2020	2021
Number of cooperative banks	–	–	–	–	–	–
Number of branches	306	310	308	304	297	294

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021.

Like other EU countries, the Polish cooperative banking sector operates within a two-tier organisational structure. The core of the sector comprises approximately 500 local cooperative banks connected to two affiliating banks (three cooperative banks operate independently):

- Bank BPS plc,
- SGB-Bank plc.

Affiliating banks perform numerous activities for and on behalf of cooperative banks, such as running bank accounts and interbank settlements, calculating and maintaining mandatory reserves, standardising and developing IT and telecommunications systems, as well as conducting marketing campaigns. Following the implementation of new EU and national regulations on prudential and liquidity standards, in 2015, cooperative and affiliating banks established two new organisational units in the form of cooperatives, i.e., Institutional Protection Systems (IPSs). Their primary task is to guarantee the solvency and liquidity of each and every participant in the System (Informacje KZBS, n.d.).

The reform of the political, social and economic systems, initiated between 1989 and 1990, yielded changes to the structure of banking cooperatives. There was an increase in the autonomy of individual banks, enabling them to broaden

the scope and focus of their activities. The following years saw the restructuring of the cooperative banking sector followed by strong consolidation (Pawlik et al. 2021, pp. 52–53). There was also a change in their organisational structure, from a three-tier to a two-tier structure, as well as in the number of cooperative banks, from 1,663 in 1993 to 511 in 2021.

Table 4. Number of cooperative banks and their branches in Poland, 2016–2021

Years	2016	2017	2018	2019	2020	2021
Number of cooperative banks	558	553	549	538	530	511
Number of branches	4,602	4,505	4.415	4,262	3,954	3,805

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021.

The cooperative banking sector in Germany is one of the largest of its kind in Europe. It operates within a single association (BVR) and has two tiers. The first tier comprises autonomous primary cooperatives (urban people's banks and rural Raiffeisen banks), the former postal savings and loan associations (now PSD), Sparda Banken (former railway workers' associations), and cooperative church banks. Cooperative banks provide services mainly in rural areas and small towns, while their presence in large urban areas is insignificant.

The second tier is the central bank, with its subsidiaries offering a variety of specialised financial services (Golec 2021, pp. 68–69). The central bank of the cooperative banks in Germany (DZ Bank) is of universal character and offers a wide range of financial services, e.g., insurance, participation units in investment funds, leasing, and factoring transactions. In addition, the bank is an IT infrastructure provider and acts as a process centre/data warehouse. DZ Bank, through the institutions that comprise the DZ Group, provides cooperative banks with a full range of banking, insurance, investment and mortgage services (Lepczyński and Gostomski 2018, p. 32; DZ Bank Group 2021, p. 11). The potential of the German cooperative banking segment is evidenced by the data in Table 5.

Table 5. Number of cooperative banks and their branches in Germany, 2016–2021

Years	2016	2017	2018	2019	2020	2021
Number of cooperative banks	972	915	875	841	814	772
Number of branches	11,787	11,108	10,520	9,344	8,544	8,074

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021.

The number of cooperative banks and their facilities experienced a steady decline between 2016 and 2021, just like in the other countries.

Multi-factor assessment of the development of the cooperative banking sector – the research method

The concept of financial development can be understood and presented in a number of ways. In its narrow sense, it refers to the reduction of transaction costs (the sum of the costs actually incurred and the time taken to complete financial transactions). In a broader sense, financial development is the long-term growth and improvement of financial markets, institutions and instruments to raise the efficiency of their functioning or application, and increase the volume of financial transactions (Kawa 2002, p. 130; Svirydzenka 2016, p. 4). The broader view of financial development linked to financial institutions constitutes the basis for further considerations.

Cooperative banks constitute a part of the banking sector, which, in turn, is a part of the financial market. Hence, the methodology for the development of the cooperative banking sector will be based on the concept of financial sector development, i.e., the development of the financial market and financial institutions (Sahay et al. 2015, p. 75; Gospodarchuk and Zeleneva 2022, p. 3; Khan 2022, p. 3). The level of development of each aspect is measured in three areas: access, depth (size), and efficiency (effectiveness)[1]. Khan (2022, p. 3) and Sayah et al. (2015, p. 75) proposed the following indicators to determine the level of financial development: the depth (size) of financial institutions, access to financial institutions, the efficiency of financial institutions, the development of financial institutions, the depth (size) of financial markets, access to financial markets, the efficiency of financial markets, the development of financial markets, and an overall indicator of financial development based on all the aspects above. Thus, the set of indicators makes it possible to measure both the level of development of financial markets and that of the financial institutions (Jankovic and Gligoric 2017, p. 103; Cave, Chaudhuri, and Kumbhakar 2020, pp. 1514–1515; Trinugroho et al. 2021, pp. 2–3; Gospodarchuk and Zeleneva 2022, p. 3). Nichkasova, Shmarlouskaya, and Sadvokassova (2022, p. 914) noted that the development of the financial institutions sector tends to be measured with banking sector development indicators due to the availability of statistical data. In addition, there are methods of multi-factor analysis used in comparative analyses of the level of development of complex phenomena (Kata and Chmiel 2019, p. 88).

1 These three components (sub-indicators) constitute the Financial Development Indicator, a measure of the development of financial institutions and financial markets, for which values are calculated basing on a set of selected sub-indicators. That is the measure proposed by the IMF (more in Development of the Financial System… 2015, pp. 32–35).

This study used a development template method from which the synthetic development indicator of the cooperative banking sector SWR_{CB} was calculated for selected CEE countries. Additionally, the average value of that measure was calculated for the countries included in the study. Developing the algorithm for the SWR_{CB} indicator imitated the measure of the level of development of the financial system proposed by the IMF, referred to as the Financial Development Indicator. That method belongs to the group of linear ordering techniques whose purpose is to order objects from the best to the worst, with the ordering criterion being the level of a complex phenomenon (Kowalewski 2003, p. 287). This method makes it possible not only to establish the rating of objects but also to assess the scale of differentiation of the phenomenon (Kata and Zaręba 2011, p. 174; Kata and Chmiel 2019, p. 88). The development of the cooperative banking sector was assessed through the prism of two groups of characteristics (Table 6).

Table 6. Sub-indicators used in the algorithm for the synthetic indicator of the development of a given country's cooperative banking sector

Area of the analysis	Variable/characteristic	Character of the variable
Size/ availability	x_1 – assets of cooperative banks in relation to GDP (%)	stimulant
	x_2 – assets of cooperative banks per 1 employee of the sector	stimulant
	x_3 – number of bank employees per 100 thousand inhabitants	stimulant
	x_4 – number of banking institutions per 100 thousand inhabitants	stimulant
	x_5 – number of ATMs per 100 thousand inhabitants	stimulant
Effectiveness and stability	x_6 – indicator of credits/deposits	nominant
	x_7 – indicator of costs/incomes	destimulant
	x_8 – share of customer credits (of non-financial sector) in total assets	stimulant
	x_9 – share of customer deposits (of non-financial sector) in total assets	stimulant
	x_{10} – financial result per employee in thousands of euros	stimulant

Source: own compilation based on: Kata and Zaręba 2011, p. 174; Kata and Chmiel 2019, p. 88; Paluch, Cymanow, and Cymanow-Sosin 2022, pp. 51–54.

There is a set of diagnostic features that characterise particular areas of cooperative banking activities. The selection of variables was conditioned by the availability of statistical data and based on a substantive criterion that considers the purpose and the subject of the study, as well as the time unit for which the study was conducted. Another important aspect of the analysis was the adoption of diagnostic variables that are reliable, accurate, comparable, relevant and complete (Młodak 2006, p. 55; Paluch, Cymanow, and Cymanow-Sosin 2022, pp. 52–53).

The first group of characteristics includes variables that pertain to the size of the banking sector and the availability of banking services to the country's population; the second group includes characteristics that represent the banking sector's economic efficiency and financial stability. The set of diagnostic variables can influence the development of the cooperative banking sector to different degrees and in different directions. Therefore, the following characteristics are distinguished: stimulants, nominants, and destimulants. Stimulants are the variables for which higher values in the studied objects are considered desirable from the perspective of the phenomenon in question, in contrast to destimulants, for which a decrease is seen as a positive trend. In the case of nominants, deviations in values in the object studied from the values (or a specified range of values) regarded as the most favourable are undesirable from the perspective of the phenomenon under consideration (Nowak 1997, pp. 117–118).

In the development template method, the values of the variables are assumed to be standardised. Standardising the variables usually involves transforming (stimulating) destimulants and nominants into stimulants (Młodak 2006, p. 60). Transforming the destimulant value (x_7) into stimulants for each year and for each country involved, subtracting this value from 100, which had been arbitrarily acknowledged. Nominants were also converted to stimulants. Again, 100 was assumed to be the desired value from which (x_6) for each year and each country was subtracted and further multiplied by –1.

The next stage involved determining the development template x_w, i.e., the abstract object with the best values for a given characteristic, which served as the reference point while examining the similarity of objects (countries). The maximum value for each variable x_{ij} was assumed as the template for that variable. The diagnostic traits were then standardised to unify the variables and to move their values to the interval (0; 1), in accordance with formula (1):

$$z_{ijt} = \frac{x_{ijt}}{\max\limits_{j,t}(x_{ijt})}, \tag{1}$$

where: x_{ijt} denotes the value of stimulant i (for $i = 1, 2, ..., n$) in country j ($j = 1, 2, ..., 5$) in year t, while z_{ijt} denotes the values of the subsequent stimulants standardised.

The final step was to determine for each object (i-country) a synthetic indicator of the development of the cooperative banking sector SWR_{CB}, i.e., development measure (2):

$$SWR_{CBj} = \frac{\sum_{j=1}^{k} z_{ij}}{10}. \tag{2}$$

It was assumed that all sub-measures that influence the development of the cooperative banking sector have the same weight, i.e. they have the same impact on the level of the complex phenomenon (Młodak 2006, p. 60; Kata and Chmiel 2019, p. 90).

Presentation of the findings

One of the criteria for assessing the development of the cooperative banking sector is the number of banks. It depends on the importance of the sector in the banking system and the size of the financial market in the country, which, in turn, is determined by the population and the area. In that context, what is worth noting is the accessibility of services. Therefore, the important measure will not only be the total number of cooperative banks, but also the number of branches, ATMs, and employees per 100,000 inhabitants (Table 7).

Table 7. Number of bank branches, ATMs, and employees per 100,000 inhabitants, 2016–2021

Countries/year	2016	2017	2018	2019	2020	2021
Number of branches per 100,000 inhabitants						
Romania	3.8	3.8	3.8	3.8	3.8	3.8
Bulgaria	4.3	4.4	4.4	4.3	4.3	4.3
Poland	12.1	11.9	11.6	11.2	10.4	10.1
Hungary	15.2	11.7	10.4	8.8	7.4	7.2
Germany	14.3	13.4	12.7	11.2	10.3	9.7
Number of ATMs per 100,000 inhabitants						
Romania	no data	no data	no data	no data	no data	no data
Bulgaria	7.7	8	8.1	8.4	8.1	8.2
Poland	10.2	10.2	10.7	no data	9.5	no data
Hungary	10.3	10.2	9.8	9.4	8.9	7.8
Germany	22.7	22.2	21.8	21.3	20.8	19.6
Number of employees in cooperative banks per 100,000 inhabitants						
Romania	10.2	9.9	9.6	9.4	9.2	8.9
Bulgaria	29.5	27.7	28	24.9	24.2	23.5
Poland	82.8	81.9	81.6	79.2	75.2	75.4
Hungary	83.9	68.5	75.4	67	51.5	44.0
Germany	220.7	214.4	210.2	209.8	207.2	205.1

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021; Reports of the World Bank, 2016–2021.

The European Association of Cooperative Banks data demonstrate that, between 2016 and 2021, Poland was the CEE leader regarding the number of cooperative banks, branches, ATMs, and employment in the sector. However, what is worth noting is the position of the Hungarian cooperative sector in 2016, whose performance then was comparable to that of the Polish cooperative banks. Hungary experienced the largest decrease in the indicators due to the transformation of the cooperative banking sector and the strong consolidation. In fact, all countries experienced a reduction in branches and the number of employees as a result of both technological progress towards virtualising customer service and expanding services in the electronic distribution channel. In the European Union, Germany ranks the highest in terms of the number of cooperative banks and their branches; however, regarding the number of branches per 100,000 inhabitants, the differences are much less significant, with figures similar to those for Poland. When juxtaposed with the number of ATMs, it may indicate a much greater use of the electronic channel in customer contact than in the other countries.

Another indicator of the development level of the cooperative banking sector, and its size in particular, is the ratio of assets to GDP and per employee (Table 8).

Table 8. The size of the assets of the cooperative bank sector, 2016–2021

Assets of the cooperative bank sector in relation to GDP (in %)						
Countries/year	2016	2017	2018	2019	2020	2021
Poland	8.4	8.9	8.4	8.8	9.1	8.9
Bulgaria	5.2	5.2	5.1	5.0	5.5	5.3
Romania	0.14	0.14	0.13	0.13	0.14	0.14
Hungary	6.2	5.8	5.7	5.3	7.2	7.3
Germany	38	38	38.4	39.8	43.3	43.5
Assets of the cooperative banking sector per employee in thousands of euros						
Poland	1,137	1,336	1,366	1,571	1,684	1,802
Bulgaria	1,207	1,413	1,462	1,796	2,025	2,334
Romania	122	134	151	169	184	202
Hungary	877	1,107	1,057	1,191	1,998	2,611
Germany	6,689	7,014	7,420	7,940	8,564	9,181

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021; Eurostat, n.d.

The volume of assets in Poland and Bulgaria has experienced a marginal increase, while Hungary experienced the highest dynamics. By contrast, those values considerably diverge, even by several times, from the asset size of the German cooperative banking

group. Among the CEE countries analysed, Poland recorded the highest values for the ratio of assets to GDP, the highest economic potential, and the largest financial market in this region. Romania, on the other hand, ranked the lowest. However, a higher asset/GDP ratio is not necessarily beneficial for the financial stability and development of the cooperative banking sector. Banking sectors with substantial assets are often strongly correlated with the presence of large financial institutions, which can, in turn, generate much higher risk levels regarding financial systems. Bulgaria and Hungary had the highest dynamics of changes in the ratio of assets to employment.

The efficiency of the banking institutions is usually assessed on the basis of financial ratios. The following measures were chosen for the analysis: Costs/Incomes (C/I) and financial results per employee (Table 9).

Table 9. Financial efficiency of the cooperative banking sector, 2016–2021

Cost/income ratio in %						
Countries/year	2016	2017	2018	2019	2020	2021
Romania	99.2	96.9	96.8	96.7	95.6	94.0
Bulgaria	60.1	59.5	72.3	71.5	66.1	79.8
Poland	70.0	65.8	69.8	66.6	74.8	72.5
Hungary	85.3	84.1	85.4	94.0	96.8	92.5
Germany	67.0	65.3	69.5	62.2	65.4	64.6
Financial result per employee in thousands of euros						
Romania	1.5	4.0	4.0	5.0	8.0	5.9
Bulgaria	66	92	86	103	59	80.4
Poland	47	55	37	54	39	59
Hungary	– 60.7	– 59	63	34	10	39.8
Germany	324	343	310	404	292	439

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021.

Romania was characterised by the highest C/I ratio – above 94%, which was similar to the value achieved by Hungary between 2019 and 2021. In Poland and Bulgaria, the Cost/Income ratio ranged from 60% to 80%, while in Germany, it did not exceed 70%. The increase in that parameter is not favourable as it may indicate unprofitable operations. It may also be related to consolidation in the sector, which took place with varying intensity in the individual countries of the CEE region. A decrease, on the other hand, indicates an increase in the profitability of operations and a decrease in operating costs. Analysis of the financial results of individual countries shows that Germany was by far more efficient (even several times)

regarding labour productivity and the scale of output. By contrast, the highest dynamics of change in that measure were observed in Hungary and Romania. Poland and Bulgaria experienced a decline in that parameter in 2020 (like Germany). It should also be acknowledged that the financial situation of not only cooperative banks but of the banking sector as a whole was affected by the COVID–19 pandemic, which is particularly evident in those countries whose potential of cooperative banking groups is larger (i.e., Germany, Poland, and Bulgaria).

Another important factor for the stability of the banking sector, which also demonstrates the efficiency of the banks in their financial intermediation function, is the ratio of credits to deposits and their share in total assets (Table 10).

Table 10. Credit/deposit ratio and share of credits vs. total assets in cooperative banks, 2016–2021

Credit/deposit ratio in %						
Countries/year	2016	2017	2018	2019	2020	2021
Romania	97.1	97.3	100	94.8	88.6	86.7
Bulgaria	48.4	45.5	45	52	43.2	43.5
Poland	71.9	66.5	66.8	63.3	55.7	45.4
Hungary	69.6	58.6	73.1	92.2	87.3	89.0
Germany	94.7	95.1	94.4	95.9	94.9	95.8
Share of customer credits (non-financial sector) in total assets in %						
Romania	69.4	70.1	73.4	71.7	66.9	66.5
Bulgaria	43.4	40.9	40.2	46.3	38.5	39.1
Poland	49.7	41.6	46.6	43.7	38.3	40.0
Hungary	48.3	45.7	51.3	53.5	79.4	81.2
Germany	60.3	61.3	61.5	61.0	60.3	60.3
Share of customer deposits (non-financial sector) in total assets in %						
Romania	71.4	72.0	73.4	75.6	75.5	76.7
Bulgaria	89.7	89.8	89.3	88.9	88.9	89.9
Poland	69.1	62.6	69.7	69.0	70.6	88.1
Hungary	69.4	78.1	70.1	58.0	90.9	91.2
Germany	63.7	64.4	65.1	63.6	63.6	62.9

Source: compilation based on the Annual Reports of the European Association of Cooperative Banks, 2016–2021.

Germany had the highest credit/deposit ratio, of approximately 96%. The other countries showed significant fluctuations. For example, Poland experienced a decrease from 71.9% to 45.4%, while Hungary saw an increase from 69.6% to 89%. Such a distribution

of results demonstrates that cooperative banks finance credit with their own financial resources rather than reporting the need for external financing, as it may pose a higher risk. When credits exceed deposits, financing with the funds from the banking system generates extra risk. The share of deposits in assets is higher than that for credits in all the countries. The most similar and stable magnitudes of those ratios can be observed in Germany. By contrast, in Bulgaria and Poland, there is a clear predominance on the deposit side, which may indicate the over-liquidity of the cooperative banking sector. Hungary has experienced a significant increase in the share of deposits and credits in total assets.

All the variables relating to the size, accessibility, efficiency and stability of the cooperative banking sector were standardised according to the methodology adopted. A synthetic development indicator was then calculated for each country (Chart 1).

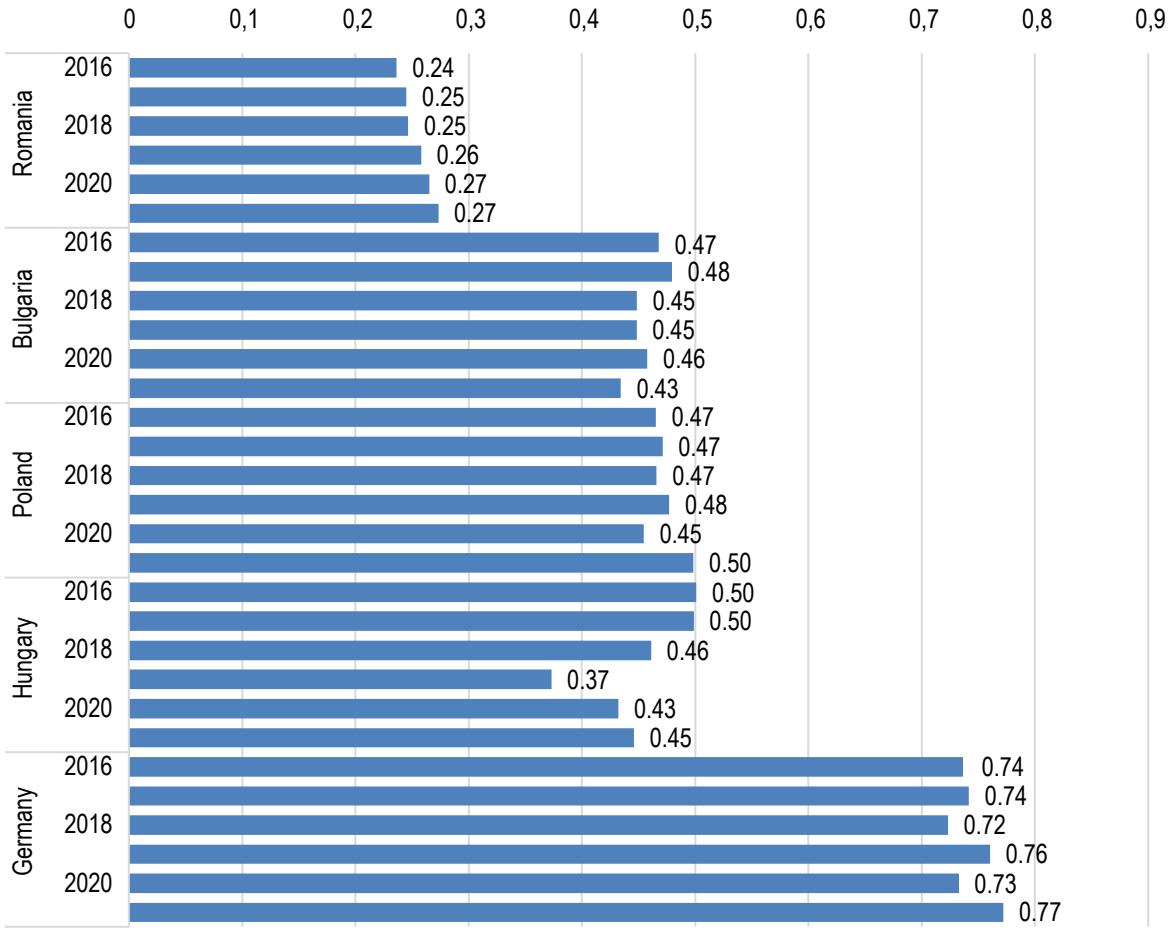

Chart 1. Synthetic development indicator of the cooperative banking sector (*SWRGB*) of CEE countries compared to Germany, 2016–2021

Source: own study.

Analysis of the synthetic indicator of the development of the cooperative banking sector *SWRGB* between 2016 and 2021 shows that the highest results were in Germany, ranging from 0.72 to 0.77. Among CEE countries, the indicator was lowest in Romania. In turn, the Polish and Bulgarian results reached similar levels, within the range of 0.43 to 0.48. Comparing the two countries shows that Bulgaria experienced the highest value in 2017, while in Poland, it occurred in 2019. On the other hand, Hungary saw the opposite trend, with the highest values recorded between 2016 and 2017, with the lowest in 2019. Taking the results obtained in Germany as the reference (template), the SWR_{CB} in Romania was about three times lower. Bulgaria and Poland, on the other hand, achieved fairly stable indicator values, as did Germany, while the distance between those countries was the smallest. Hungary, on the other hand, was characterised by a highly dynamic *SWRGB*, ranging from 0.50 to 0.38.

Summary of the research findings

The multi-factor analysis of the development of the cooperative banking sector shows that the differences between the EEC countries are not significant. The lowest level of development was recorded in Romania. The results obtained by Poland and Bulgaria indicate a higher level of development of this sector than in Romania. Hungary, on the other hand, was characterised by the highest dynamics of change and a deterioration in the synthetic indicator in recent years. Those results also reflect the peculiarities of changes and positions of the cooperative banking sector in the individual EEC countries. The distance of these countries compared to Germany is not significant, approximately one and a half times as high. Only Romania was much higher – nearly three times as high.

Conclusion

The presented characteristics of the cooperative banks, as well as the results of the research, not only diagnose the current state of affairs but, above all, exemplify the process and the pace of development of the sector in terms of geography and time. In turn, comparing the diagnostic features that depict the individual areas of activity of those cooperative banks with one of the largest cooperative groups in Europe illustrates their position in the European banking market. Hence, it can be concluded that CEE cooperative banks have undergone a dramatic change associated with the systemic transformation, which helped narrow the gap in their development compared to the cooperative sector in Germany.

The changes referred to the internal structure of the sector, its business models, and regulations, resulting in numerous instances of consolidation. Some common features of the cooperative banks in the CEE region of the 1990s include their fragmented internal structures, problems with capital requirements, and low profitability. The restructuring that occurred in all CEE countries significantly reduced the number of banks, branches and, consequently, the number of employees, which is demonstrated by the sub-studies in the areas of availability and size. It was further underpinned by the desire to reduce the cost of the banking activities stemming from the decline in interest margins due to the long-lasting low interest rates. All those changes led to an improvement in the economic situation of the sector. However, the detailed analysis of the parameters in the areas of efficiency and financial stability showed that the cooperative banking sectors in the individual CEE countries have improved their financial performance at a variety of rates and to a variety of extents. It must be borne in mind, however, that the cooperative banks had a substantial deposit base, allowing them to secure refinancing regardless of the international situation in the money and capital markets.

Acknowledgements

The article was written within the research project "Innovation in the cooperative banking sector and reduction of social exclusion", funded by the Minister of Education and Science program entitled "Science for Society" (contract no. NdS/550697/2022/2022).

References

Annual Reportsof European Association of Cooperative Banksin 2016–2021, *Key Statistics – Financial Indicators*, https://www.eacb.coop/en/cooperative-banks/key-figures.html (accessed: 5.01.2023).

Bareith, T., Tatay, T., Varga, J. (2022), *The Impact of Changes in Financial Supervision on the Profitability of the Hungarian Banking Sector*, "Economies", 10 (7), 176, https://doi.org/10.3390/economies10070176

BS.net (2021), *Węgierska droga konsolidacji sektora bankowości spółdzielczej*, https://bs.net.pl/wegierska-droga-konsolidacji-sektora-bankowosci-spoldzielczej/ (accessed: 12.12.2022).

Cave, J., Chaudhuri, K., Kumbhakar, S.C. (2020), *Do banking sector and stock market development matter for economic growth?*, "Empirical Economics", 59, pp. 1513–1535, https://doi.org/10.1007/s00181-019-01692-7

Central Cooperative Bank (2021), *Annual Report*, https://www.ccbank.bg/en/about-ccb/reports/annual-reports (accessed: 15.12.2022).

Cotugno, M., Stefanelli, V. (2016). *Bulgarian Cooperative Banking*, [in:] S. Karafolas (ed.), *Credit Cooperative Institutions in European Countries*, Springer, Kozani Greece, pp. 253–268.

Dabusinskas, A., Kulikov, D., Randveer, M. (2013), *The Impact of Volatility on Economic Growth*, "Bank of Estonia Working Paper", 7, pp. 1–21, https://haldus.eestipank.ee/sites/default/files/publication/wp7_2012.pdf (accessed: 12.12.2022).

Development of the Financial System in Poland 2014, NBP, Warsaw 2015.

DZ Bank Group (2021), *2021 Annual Report*, https://www.annualreports.com/Company/dz-bank (accessed: 28.12.2022).

Eurostat (n.d.), *Economy and finance*, Main GDP aggregates, https://ec.europa.eu/eurostat/databrowser/view/nama_10_gdp/default/table?lang=en (accessed: 20.01.2023).

Gal, Z., Kovacs, S.Z. (2018), *Corporate governance and local embeddedness of the Hungarian cooperative banking sector*, "Safe Bank", 2 (71), pp. 30–54, https://doi.org/10.26354/bb.2.2.71.2018

Giagnocavo, C., Gerez, S., Sforzi, J. (2012), *Cooperative bank strategies for social-economic problem solving: supporting social enterprise and local development*, "Annals of Public and Cooperative Economics", 83 (3), pp. 281–315, https://onlinelibrary.wiley.com/doi/full/10.1111/j.1467-8292.2012.00464.x (accessed: 12.02.2023).

Golec, M. (2021), *Sektor banków spółdzielczych*, [in:] A. Dąbrowska, L. Flejterski (eds.), *Niemiecki system bankowo-finansowy*, Wydawnictwo Wyższej Szkoły Bankowej, Poznań, pp. 60–74.

Gospodarchuk, G., Zeleneva, A. (2022), *Assessment of Financial Development of Countries Based on the Matrix of Financial Assets*, "Economies", 5, 122, https://doi.org/10.3390/economies10050122

Gostomski, E. (2012), *Bank i… nie bank*, "Nowoczesny Bank Spółdzielczy", 7–8, https://bank.pl/wp-content/uploads/2012/07/nbs.2012.07-08.051.pdf (accessed: 5.12.2022).

Informacje KZBS (n.d.), *Charakterystyka banków spółdzielczych*, https://www.kzbs.pl/Charakterystyka.html (accessed: 5.12.2022).

Jankovic, I., Gligoric, M. (2017), *Financial sector development and economic growth*, [in:] M. Cingula, M. Przygoda, K. Detelj (eds.), *Economic and Social Development: Book of Proceedings*, 23 International Scientific Conference on Economic and Social Development, Varazdin Development and Entrepreneurship Agency (VADEA), Madrid, pp. 100–109, https://www.esd-conference.com/upload/book_of_proceedings/Book_of_Proceedings_esdMadrid_2017_Online.pdf (accessed: 14.01.2023).

Kata, R., Chmiel, J. (2019), *Rozwój sektora bankowego w krajach Europy środkowo-wschodniej*, "Polityki Europejskie. Finanse i Marketing", 21 (70), pp. 80–93, https://doi.org/10.22630/PEFIM.2019.21.70.7

Kata,R., Zaręba,L.(2011), *Wieloczynnikowa analiza rozwoju rynku bankowości detalicznej w Europie środkowej i wschodniej*, "Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach', pp. 169–178, https://www.ue.katowice.pl/fileadmin/_migrated/content_uploads/SE_080.pdf (accessed: 1.12.2022).

Kawa, P. (2002), *Rozwój finansowy a wzrost gospodarczy – ujęcie teoretyczne i wyniki badań empirycznych. Implikacje dla polityki ekonomicznej*, "Zeszyty Naukowe Akademii Ekonomicznej w Krakowie", 600, pp. 129–140, https://r.uek.krakow.pl/bitstream/123456789/1226/1/15273.pdf (accessed: 7.01.2023).

Khan, H. H. (2022), *Bank competition, financial development and macroeconomic stability: Empirical evidence from emerging economies*, "Economic Systems", 46, pp. 1–13, https://doi.org/10.1016/j.ecosys.2022.101022

Kovacs, S. Z. (2020), *Hungarian cooperative banks and financial exclusion after new integration processes*, [in:] Z. Gal, S.Z. Kovacs, B. Pager (eds.), *Flows of Resources in the Regional Economy in the Age of Digitalisation*, Proceedings of the 7th CERS Conference, Hungarian Regional Science Association, Pecs, pp. 204–216, http://real.mtak.hu/116284/ (accessed: 5.12.2022).

Kowalewski, G. (2003), *Metody porządkowania liniowego*, [in:] J. Dziechciarz (ed.), *Ekonometria, metody, przykłady, zadania*, Wydawnictwo Akademii Ekonomicznej, Wrocław, pp. 287–304.

Kulawik, J. (2007), *Globalizacja finansowa a funkcjonowanie i rozwój banków*, IERiGŻ-PIB, Warszawa.

Lepczyński, B., Gostomski, E. (2018), *Tendencje rozwojowe oraz sytuacja ekonomiczna niemieckiego i polskiego sektora bankowości spółdzielczej w latach 2010–2017 – analiza porównawcza*, "Bezpieczny Bank", 3 (72), pp. 23–54, https://doi.org/10.26354/bb.2.3.72.2018

Młodak, A. (2006), *Analiza taksonomiczna w statystyce regionalnej*, Difin, Warszawa.

Nichkasova, Y., Shmarlouskaya, H., Sadvokassova, K. (2022), *Financial market sustainable development of Kazakhstan: Scenario approach based on fuzzy cognitive maps*, "Journal of Sustainable Finance & Investment", 12, pp. 912–933, https://doi.org/10.1080/20430795.2020.1812293

Nowak, E. (1997), *Wielowymiarowa analiza porównawcza w modelowaniu kondycji finansowej przedsiębiorstw*, "Annales Universitatis Mariae Curie-Skłodowska. Sectio H, Oeconomia", 31, pp. 111–123, https://docplayer.pl/67010065-Edward-nowak-wielowymiarowa-analiza-porownawcza-w-modelowaniu-kondycji-finansowej-przedsiebiorstw.html (accessed: 5.12.2022).

Paluch, Ł., Cymanow, P., Cymanow-Sosin, K. (2022), *Wybrane aspekty funkcjonowania bankowości spółdzielczej w Polsce. Perspektywa społeczno-ekonomiczna, menadżerska i medialno-wizerunkowa*, Homini, Kraków.

Pawlik, A., Karpińska, U., Dziekański, P., Adamczyk, A. (2021), *Bankowość spółdzielcza w rozwoju regionalnym*, Wydawnictwo Uniwersytetu Jana Kochanowskiego w Kielcach, Kielce.

Pirvu, D., Banica, L. (2016), *The Credit Cooperative System in Romania*, [in:] S. Karafolas (ed.), *Credit Cooperative Institutions in European Countries. Contributions to Economics*, Springer, Cham, pp. 363–378, https://doi.org/10.1007/978-3-319-28784-3_20

Ramey, G., Ramey, V.A. (1994), *Cross-country evidence on the link between volatility and growth*, "NBER Working Paper", National Bureau of Economic Research, 4959, pp. 1–28, https://doi.org/10.3386/w4959

Reports of the World Bank in 2016–2021. Population total. Data, https://data.worldbank.org/indicator/SP.POP.TOTL (accessed: 5.01.2023).

Sahay, R., Čihák, M., N'Diaye, P., Barajas, A., Bi, R., Ayala, D., Gao, Y., Kyobe, A., Nguyen, L., Saborowski, C., Svirydzenka, K., Reza Yousefi, S. (2015), *Rethinking financial deepening:*

Stability and growth in emerging markets, "Revista de Economía Institucional", 17 (33), pp. 73–107, https://doi.org/10.18601/01245996.v17n33.04

Siudek, T. (2007), *Systemy bakowości spółdzielczej w wybranych krajach Unii Europejskiej*, "Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego", 63, pp. 35–48, https://sj.wne.sggw.pl/pdf/EIOGZ_2007_n63_s35.pdf (accessed: 18.12.2022).

Svirydzenka, K. (2016), *Introducing a New Broad-based Index of Financial Development*, "IMF Working Paper", International Monetary Fund, WP/16/5, https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Introducing-a-New-Broad-based-Index-of-Financial-Development-43621 (accessed: 18.12.2022).

Trinugroho, I., Law, S.H., Lee, W.C., Wiwoho, J., Sergi, B. (2021), *Effect of financial development on innovation: Roles of market institutions*, "Economic Modelling", 103, pp. 1–16, https://doi.org/10.1016/j.econmod.2021.105598

Van, D.T.T., Linh, N.H. (2019), *The Impacts of Financial Inclusion on Economic Development: Cases in Asian-Pacific Countries*, "Comparative Economic Research. Central and Eastern Europe", 22 (1), pp. 7–16, https://doi.org/10.2478/cer-2019-0001

World Bank Group (2020), *Financial inclusion in Romania: issues and opportunities*, https://openknowledge.worldbank.org/handle/10986/33629 (accessed: 20.12.2022).

Rozwój sektora banków spółdzielczych w wybranych krajach Europy Środkowej i Wschodniej

Celem opracowania jest ocena rozwoju sektora banków spółdzielczych w wybranych krajach Europy Środkowej i Wschodniej na tle przeciętnych statystyk segmentu w tych krajach i w odniesieniu do największej europejskiej spółdzielczej grupy bankowej w Niemczech. W niniejszym artykule zaprezentowano wyniki analizy sektora banków spółdzielczych w następujących krajach: Polsce, Bułgarii, Rumunii i na Węgrzech oraz w Niemczech, które są członkami Europejskiego Stowarzyszenia Banków Spółdzielczych (EACB). Kryterium doboru wynikało z dostępności szczegółowych danych dotyczących banków spółdzielczych, publikowanych przez EACB w ujęciu czasowym i przestrzennym. Okres analiz obejmował lata 2016–2021.

Podstawą empiryczną problematyki poruszonej w artykule jest przegląd literatury przedmiotu oraz analiza porównawcza rozwoju sektora banków spółdzielczych z wykorzystaniem syntetycznego wskaźnika rozwoju we wskazanych krajach w latach 2016–2021.

Analizy teoretyczna i empiryczna wskazują, że Rumunię cechuje najniższy poziom rozwoju segmentu bankowości spółdzielczej. Natomiast polski i bułgarski spółdzielczy sektor bankowy rozwijały się na podobnym poziomie. Największą dynamiką zmian w tej grupie krajów Europy Środkowej i Wschodniej wyróżniały się Węgry. Porównując te kraje do niemieckiego sektora banków spółdzielczych, należy zauważyć, że ich poziom rozwoju był prawie półtora raza niższy, a w przypadku Rumunii nawet trzykrotnie niższy w latach 2016–2021.

Słowa kluczowe: banki spółdzielcze, rozwój, kraje Europy Środkowej i Wschodniej, syntetyczny wskaźnik rozwoju

Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 1, 2024
https://doi.org/10.18778/1508-2008.27.09

The Interactions between Labour Market Policies and Income Inequalities in Groups of European Union Countries

Agnieszka Szulc-Obłoza https://orcid.org/0000-0002-7281-6813
Ph.D., Nicolaus Copernicus University in Toruń, Faculty of Economic Sciences and Management
Department of Economics, Toruń, Poland, e-mail: aszulc@umk.pl – corresponding author

Małgorzata Szczepaniak https://orcid.org/0000-0001-6007-8430
Ph.D., Nicolaus Copernicus University in Toruń, Faculty of Economic Sciences and Management
Department of Economics, Toruń, Poland, e-mail: m.szczepaniak@umk.pl

Abstract

Social cohesion and a sustainable labour market remain the aims of sustainable development policy. However, income inequalities and labour market policies are more often separately analysed. To fill the identified research gap, our article presents the results of an analysis of interactions between active and passive labour market policies and income inequalities in the European Union. The 27 countries were divided into two clusters based on their active and passive labour market policy (LMP) expenditures in 2019. These clusters sustain the basis for analysing the interactions between LMP and income inequalities in its different measures. The results reveal that labour market interventions interact with income inequalities, decreasing disposable income inequalities (equalising the disposable income after transfers and taxes) and therefore contributing to social cohesion. This paper concerns social cohesion as the manifestation of intragenerational justice.

Keywords: income inequalities, labour market policy, sustainable labour market, social cohesion, sustainable development

JEL: D63, J08, J65

Received: 27.02.2023. Verified: 1.08.2023. Accepted: 15.12.2023

Introduction

Decreasing income inequalities together with sustainable development that ensures social inclusion are among the main aims of macroeconomic policy, not only in the European Union (European Commission 2020) but also worldwide (Sachs 2012). Income inequalities are considered a critical economic and social problem because increasing income inequalities may make it difficult to achieve policy goals, such as social cohesion and sustainable development (Easterly 2007; OECD 2015). The United Nations' Sustainable Development Goals (SDGs) focus on implementing fiscal, wage, and social protection policies to achieve greater equality (SDG 10, Reduce inequality within and among countries, Target 10.4) and a full, productive employment and decent work for all (SDG 8, Target 8.5). In turn, sustainable development constitutes the vision of a sustainable world.

From a labour market perspective, a sustainable labour market policy (LMP) must contribute to sustainable development by considering trade-offs between the ecological, economic, and social dimensions. It must also consider intra and intergenerational justice. In the context of intragenerational justice, an LMP should be targeted to ensure employment opportunities for everyone who wants to be hired, and support those who cannot work or cannot find work (Berg 2015; Lubk 2016). Intragenerational justice is also implemented into active and passive labour market policies. Interventions and supports are undertaken to equalise chances in the labour market. Income inequalities are affected by earnings from work, but they also result from individuals' competitiveness in the labour market (Castellano, Musella, and Punzo 2017). Unemployed people and members of their households are deprived of earnings and do not have a chance to develop human capital. Together with other social protection policies, sustainable labour market policies play an important role in achieving social cohesion, constituting an important mechanism for reducing income inequality and economic insecurity, and supporting both vertical and horizontal redistribution (Betcherman 2012; International Labour Organization 2021).

The article presents the results of an analysis of the interactions between active and passive LMPs and income inequalities in clusters of European Union (EU) countries in 2019. To better understand those links, different measures of income inequality are used, namely the Gini index and S80/S20, which are based on various concepts of income, i.e. market, disposable income, and labour income. It is of particular importance because this may prioritise different LMP suggestions to achieve sustainable development. The study analyses the 27 EU countries in 2019. The specified research questions (RQ) are as follows:

- **RQ1**: What are the characteristics of the groups when labour market policies are considered (active and passive)?

- **RQ2**: Which income inequality measure (evaluation variables) significantly differentiates the groups?
- **RQ3**: How are labour income policies (active and passive) related to the different income inequalities measures in the groups?

Overall, the contributions of the study are twofold. First, the results offer a multidimensional perspective of income inequality measures and their relationships with labour market policies from both active and passive perspectives. This method of analysis goes far beyond income inequality analyses by integrating more dimensions of income. In addition to disposable and market income inequality measures, labour income inequality is also considered. Second, we conduct a hierarchical cluster analysis and test the significance of evaluative variables in the identified clusters. So far, to the best of our knowledge, no analysis on this topic has been conducted for the groups of EU countries identified by the hierarchical cluster method; our article fills this research gap. Analyses of LMPs and income inequalities are separately widely considered; therefore, this study of their interactions in the groups of EU countries in the context of sustainable development using the hierarchical cluster method provides a novel approach.

The remainder of the article is structured as follows. Section 2 discusses the literature review concerning the relationships between labour market policies and income inequalities. The methodology and data are described in sections 3 and 4, respectively. The results of the empirical analysis are presented in section 5. The last section offers concluding remarks.

Relationships between income inequalities and labour market policies – a literature review

LMP is seen as part of a broader social protection system (International Labour Organization 2012). It should focus on equality of opportunity and, at the same time, equality of outcomes (Berg 2015). In the context of sustainability, a deeper consideration of social equity aspects in labour market policies is needed. A sustainable LMP that focuses on intragenerational justice must ensure that employment is possible for anyone eager to work and sustain the guarantee of income (Lubk 2016; Taubner, Tideman, and Nyman 2021).

The standard classification of labour market policies distinguishes "active" and "passive" intervention. Active intervention is undertaken to increase the probability that the unemployed get jobs, earnings and productivity. Beyond economic objectives, there are also social ones, which highlight improving inclusion and participation associated with productive employment (Romero and Kuddo 2019). The OECD defines active labour market

programmes as interventions which aim to improve individuals' chances of finding gainful employment or increase their earnings capacity. Achieving these goals requires actively supporting the integration and reintegration of individuals into the workforce as quickly as possible while ensuring the best possible job match. In contrast, passive support provides income replacement during unemployment or job search periods. Thus, passive support is considered an income maintenance programme or compensatory LMP (OECD 2018). The main aim of unemployment benefits, also called out-of-work income support and early retirement, is to guarantee against poverty (European Commission 2017b). Passive support is a social instrument rather than a way of reducing unemployment by increasing the chances of finding a job (Lubk 2016).

Individuals' labour market situation is the main driver of disposable income inequality. Two main dimensions matter in this respect: the quantity and the quality of jobs. The share of people out of work, either because they are unemployed or inactive, shifts many people to the bottom of the income ladder. On the other hand, the quality of employment matters, as those in the most precarious forms of work, such as temporary workers, part-time workers or the self-employed, also drive inequality up. This implies that with the right LMP mix, it is possible to do well across all dimensions of labour market performance and decrease income inequalities. However, more inclusive LMPs are needed to break the circle of increasing employment and higher income gaps (OECD 2017). Effective active LMPs, implemented within a mutual obligations framework of rights and duties, are instrumental in integrating job seekers into good-quality employment and limiting the long-term impact of unemployment on income trajectories (OECD 2017).

LMPs, as institutional determinants of the labour market, directly influence not only labour market determinants (e.g. unemployment rate and labour force participation rate) but also income inequalities (Offe 2010; Szczepaniak and Szulc-Obłoza 2019). However, the direction of this relationship is not clear in the literature. On the one hand, active LMPs result in a more elastic labour market and higher market income inequalities because of more competitive rules rewarding those who are better educated and qualified (Koeniger, Leonardi, and Nunziata 2004). Education and active LMPs, however, reduce disposable income inequality (Sakamoto 2021). On the other hand, passive LMPs may decrease income inequalities directly through social transfers for the unemployed (Burniaux, Padrini, and Brandt 2006; Checchi and Garcia-Peñalosa 2008).

Low levels of social protection may lead to wider wage dispersion and less unemployment simultaneously. The level of qualifications in the labour market, as well as the institutional framework (the rigidities of LMP regulations), play an important role in determining income inequalities (Adsera and Boix 2000). The positive role of LMPs in reducing income inequalities is that they improve equity and social justice among

labour force participants (Amadeo and Pero 2000). An effective LMP focuses on integrating jobseekers into good-quality employment while limiting the impact of unemployment on income (Thevenot 2018). However, if those policies reduce participation in the labour market, the resulting increase in taxes needed to finance the unemployment benefits may increase income inequalities (Berg 2015). From the perspective of sustainable development, an important role of the LMPs is to ensure decent jobs and economic safety. LMPs may, directly and indirectly, affect income inequalities (Checchi and Garcia-Peñalosa 2010) and protect against the widening dispersion of labour income (OECD 2012).

Methodology

Clustering is the statistical grouping of objects into a limited number of groups known as clusters. It is used to find homogenous subsets, which can be processed and analysed in different ways. The groups are not defined in advance but are discovered during the operation. The groups are combinations of objects with similar characteristics, which are separated from objects with different characteristics (Bijnen 1973; Kaufmann and Rousseeuw 2005; Tuffery 2011). The distance used is the Squared Euclidean distance (Hennig et al. 2015; IBM documentation 2022).

The research employs agglomerative partitioning methods based on the concept of distance and clustering through similarity aggregation. These methods allow the algorithm to automatically determine the optimal number of clusters (Tuffery 2011; Han, Kamber, and Pei 2012). The agglomerative hierarchical clustering method (the bottom-up approach) starts with each country forming a separate group and iteratively merges clusters into larger clusters (Han, Kamber, and Pei 2012). The general procedure of agglomerative hierarchical clustering used is as follows:

- **Step 1.** The initial clusters are the observations.
- **Step 2.** The distances between clusters are calculated.
- **Step 3.** The two clusters that are closest together are merged and replaced with a single cluster.
- **Step 4.** The procedure is started again at step 2 until there is only one cluster, which contains all the observations (Tuffery 2011).

A tree structure (dendrogram) is used to represent the sequence of hierarchical clustering. This tree can be cut at a greater or lesser height to obtain a smaller or larger number of clusters. The main criterion is the loss of the between-cluster sum of squares (semi-partial R^2). Since this loss must be as small as possible, the tree diagram is cut at a level where the height of the branches is large (Tuffery 2011). The Ward

method matches the purpose of the clustering very closely. The concept of distance corresponding to the objective of the smallest decrease in the between-cluster sum of squares is the Ward distance between two clusters. It is defined as the reduction in the between-cluster sum of squares that occurs when these clusters are merged. The Ward method is the most popular method for agglomerative hierarchical clustering because it is effective when applied to real problems (Tuffery 2011).

Results

LMP and income inequalities–data

LMP interventions may be characterised by active and passive LMP spending. Active interventions (LMP 2_7), called LMP measures, cover training, employment incentives, supported employment and rehabilitation, direct job creation and start-up incentives (European Commission 2017a). Each category is sequentially numbered. In turn, a passive policy (LMP 8_9), known as LMP supports, includes unemployment benefits and early retirement (Eurostat, 2021). In the article, both measures of expenditures are characterised by the purchasing power standard (PPS) per person wanting to work. Among the 27 analysed countries, Denmark stands out with intensive active interventions. Conversely, in terms of passive policy, the Netherlands and France provide the most extensive supports (Table 1). The minimum active and passive LMPs are noticed in Romania, while small active intervention is also seen in Cyprus and passive intervention in Malta.

Table 1. Labour market policy expenditure in PPS per person wanting to work in the European Union, 2019

Country	LMP_2_7_PPS	LMP_8_9_PPS
Austria	2996.72	7337.45
Belgium	3790.71	7138.98
Bulgaria	701.95	1614.84
Croatia	1354.91	847.69
Cyprus	168.10	2361.86
Czechia	2333.47	2094.66
Denmark	**7824.68**	5425.44
Estonia	1756.37	2098.27
Finland	4014.78	5969.01
France	2632.63	**10295.14**
Germany	2383.74	6675.69

Country	LMP_2_7_PPS	LMP_8_9_PPS
Greece	769.62	1 290.75
Hungary	2 852.00	1 177.43
Ireland	2 134.90	4 553.11
Italy	583.42	3 676.29
Latvia	319.25	1 383.70
Lithuania	918.67	2 384.52
Luxembourg	6 108.68	5 846.60
Malta	618.85	246.94
Netherlands	3 315.79	**10 545.93**
Poland	1 235.53	614.98
Portugal	1 086.35	3 530.42
Romania	**164.49**	**227.61**
Slovakia	955.65	1 662.42
Slovenia	921.85	2 583.43
Spain	1 618.32	4 373.51
Sweden	4 446.38	2 452.20
Min	164.49	227.61
Max	7 824.68	10 545.93
Mean	2 148.44	3 644.77
Median	1 618.32	2 452.20

Source: Eurostat 2022a (online data codes: LMP_IND_EXP).

Income inequalities are a multidimensional issue and should be considered from different angles, particularly when their interactions with LMPs are considered. Among the factors that affect income inequalities are tax and transfer policies, which the LMPs are part of (e.g. taxes on labour income, unemployment benefits among the influence of the institutions on the labour market, skill differentials, and education and health policies) (Atkinson 1996). What is more, LMPs affect income inequalities depending on what income approach is considered, e.g. individual labour income or market income (active LMP), or disposable income (passive LMP).

Therefore, different income inequality measures were used in the analysis depending on income concepts (Table 2), including or excluding tax and transfer policies. Household disposable income is calculated by adding together the individual income received by all household members from labour and capital plus income received at the household level after paying taxes and receiving social transfers. To consider the impact of differences in household size and composition, the total disposable household income is

"equivalised". The equivalised income attributed to each household member is calculated by dividing the total household disposable income by the equivalisation factor. Equivalisation factors can be determined in various ways. Eurostat applies an equivalisation factor calculated according to the OECD-modified scale, giving a weight of 1.0 to the first person aged 14 or more, 0.5 to other people aged 14 or more, and 0.3 to people aged 0–13. Two Gini coefficients and three income quintile share ratios for market income, labour income and disposable income are compared (Table 2).

Table 2. Measures of income inequalities depending on income concepts

Variable	Symbol	Source
Gini coefficient of equivalised disposable income before social transfers (pensions included in social transfers)	Gini_bst	Eurostat, EU-SILC survey
Gini coefficient of equivalised disposable income	Gini_di	Eurostat, EU-SILC survey
Income quintile share ratio S80/S20 for disposable income	S80/S20_di	Eurostat, EU-SILC survey
Income quintile share ratio S80/S20 for gross market income	S80/S20_mi	Eurostat, EU-SILC survey
Income quintile share ratio s80/s20 for labour income*	S80/S20_li	Ilostat, Labour income distribution

* 2017 – latest available; own calculations based on Ilostat 2022.
Source: Eurostat 2022b; ILO 2022.

Table 3 shows the huge diversity of income inequalities in EU countries. Some Central and Eastern European (CEE) countries, such as Slovakia, Slovenia, and Czechia, have the lowest income inequalities, whichever income concepts are used. By contrast, another CEE country, Bulgaria, is characterised by the highest income inequalities in both disposable income measures (Gini and S80/S20), although it does not have high labour-income inequalities. In this case, it is ranked 7th in the EU, below the EU average. Germany has average disposable income inequalities (Gini coefficient, S80/S20), the highest in the EU before social transfer income inequalities and labour income inequalities, however. Market income inequalities measured by S80/S20 are highest in Ireland, although the disposable income inequalities measured by S80/S20 rank it 7th in the EU.

Table 3. Gini and S80/S20 in European Union countries in 2019

Country	Gini_di	Gini_bst	S80_S20_di	S80_S20_li	S80_S20_mi
Slovakia	**22.80**	**39.10**	**3.34**	**3.94**	**4.72**
Slovenia	23.90	42.70	3.39	4.42	6.25
Czechia	24.00	42.10	3.34	4.43	5.03
Belgium	25.10	46.20	3.61	4.37	10.59

Country	Gini_di	Gini_bst	S80_S20_di	S80_S20_li	S80_S20_mi
Finland	26.20	48.70	3.69	4.59	9.65
Netherlands	26.80	46.40	3.94	7.69	8.75
Austria	27.50	47.60	4.17	9.68	8.72
Denmark	27.50	48.60	4.09	5.56	11.14
Hungary	28.00	47.90	4.23	4.98	7.99
Ireland	28.30	47.10	4.03	6.41	**16.61**
Poland	28.50	46.50	4.37	5.68	6.40
France	29.20	51.00	4.27	5.78	8.11
Germany	29.70	**55.40**	4.89	**11.17**	8.28
Estonia	30.50	44.50	5.08	9.14	7.59
Greece	31.00	55.10	5.11	6.16	6.93
Portugal	31.90	55.00	5.16	6.56	8.58
Luxembourg	32.30	52.30	5.34	6.42	8.43
Italy	32.80	47.90	6.01	7.18	9.49
Spain	33.00	48.40	5.94	8.21	10.28
Romania	34.80	52.10	7.08	4.17	12.73
Latvia	35.20	47.70	6.54	7.91	9.50
Lithuania	35.40	50.30	6.44	9.03	10.40
Bulgaria	**40.80**	54.50	**8.10**	5.47	11.48
Min	22.80	39.10	3.34	3.94	4.72
Max	40.80	55.40	8.10	11.17	16.61
Mean	29.79	48.57	4.88	6.48	9.03
Median	29.20	47.90	4.37	6.16	8.58

Note: Minimum and maximum values in each column are in bold. Countries are ranked by increasing the Gini coefficient of equivalised disposable income in 2019.
Source: Eurostat 2022b; ILO 2022.

Total market income (including capital income) is more concentrated than when only labour income is taken into consideration. However, income dispersion mainly reflects labour market income, shaped by the differences in regulations and policies on the labour market (OECD 2012). What is more, the disposable income inequalities are lowest because of the redistributing effect of tax and transfer policies (Szczepaniak 2020). Both the Gini coefficient (EU mean = 30.0) and S80/S20 ratio for disposable income (EU mean = 4.9) are lower than Gini before social transfers (EU mean = 48.6) and S80/S20 for market income (EU mean = 9.0), and labour income only (EU mean =6.5).

Cluster analysis

Active intervention and passive supports were treated as independent characteristics of LMP. The dendrogram was built using hierarchical cluster analysis in SPSS Software. Grouping was performed using the squared Euclidean distance and Ward's minimum variance method (Ward 1963; Everitt et al. 2011; Murtagh and Legendre 2011). The countries were grouped into clusters based on two predictors: active and passive LMP. The two groups were distinguished based on the distance between clusters observed on the dendrogram – the tree diagram was cut at a level where the height of the branches was large. The results are presented in the dendrogram (Figure 1).

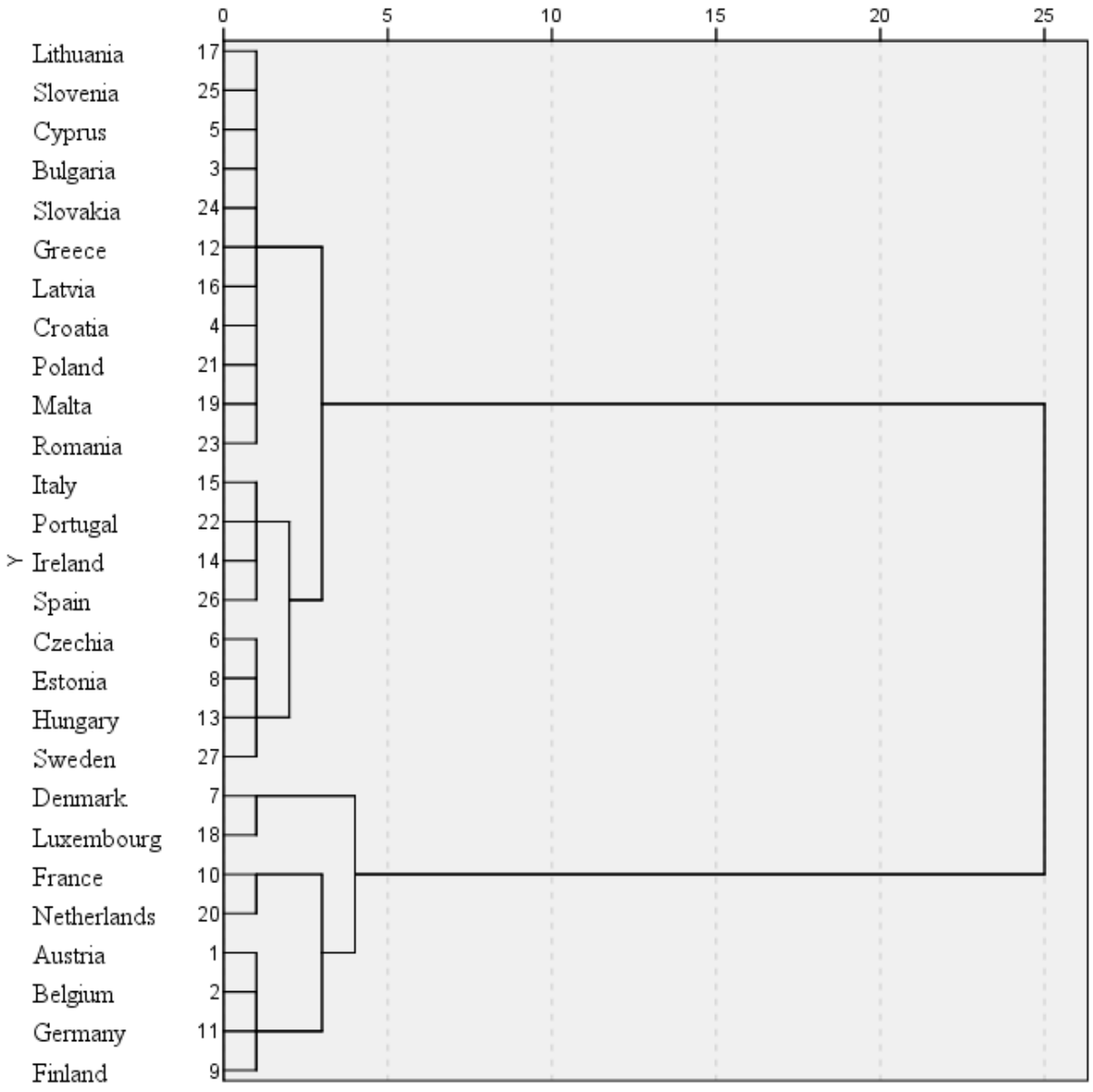

Figure 1. The dendrogram of the European Union countries using the Ward linkage method

Source: own calculations in SPSS software.

Two clusters in the dendrogram were distinguished; the first one includes eight countries, and the second has 19 countries. Two clusters may also be recognised based on the scatter plot, including active and passive LMP (Figure 2). The first group (eight countries) is marked in blue, and the second group (19 countries) is in red.

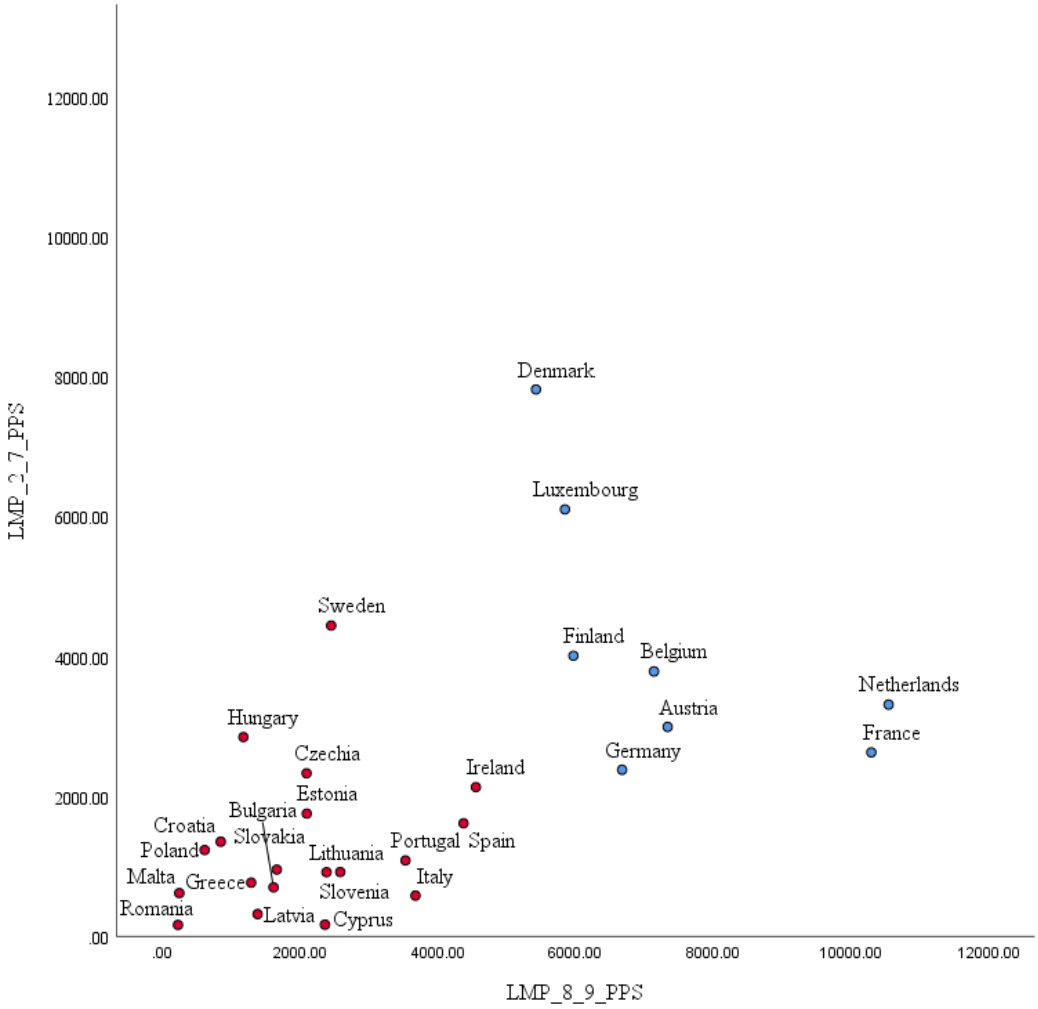

Figure 2. Expenditures for active interventions and passive support in the European Union countries

Source: Eurostat 2022a (online data codes: LMP_IND_EXP).

The first group (the smaller, blue one) stands out due to its extensive expenditure on active and passive LMP. In turn, the second cluster of 19 countries is characterised by minor policy intervention (Table 4).

Table 4. Descriptive statistics of expenditure for active and passive labour market policies in two clusters of European Union countries

Characteristics	LMP_2_7_PPS		LMP_8_9_PPS	
	Cluster 1	Cluster 2	Cluster 1	Cluster 2
Mean	4133.47	1312.64	7404.28	2061.82
Median	3553.25	955.65	6907.34	2094.66
Min	2383.74	164.49	5425.44	227.61
Max	7824.68	4446.38	10545.93	4553.11
Range	5440.94	4281.89	5120.49	4325.50
Skewness	1.34	1.64	1.00	0.50
Kurtosis	0.98	3.28	–0.53	–0.40

Source: own calculations based on Eurostat 2022a (online data codes: LMP_IND_EXP).

For active interventions, the mean of the first group was 4133.47 compared to the mean of the second group, which was 1312.64. The median in the first group was 3553.25, and only 955.65 in the second. In both cases, more than 50% of countries in each group had expenditures for active interventions less than the average for the particular group. In light of the expenditures for passive supports, there is a substantial difference in the means between the first group (7404.28) and the second one (2061.82). Including the median, in the first group amounted to 6907.34 and in the second group – 2094.66. Interestingly, including passive LMP in the second group, 50% of countries in that group noted larger-than-average interventions for the group (2061.82). In the case of active policies in both clusters, leptokurtic distributions were noted. In terms of passive supports, platykurtic distributions were observed in both groups (Table 4).

In the first group, Denmark and Luxembourg stand out as having extensive expenditures for active interventions (LMP_2_7). However, in the second group, Sweden stands out as having a large active LMP (Figure 2).

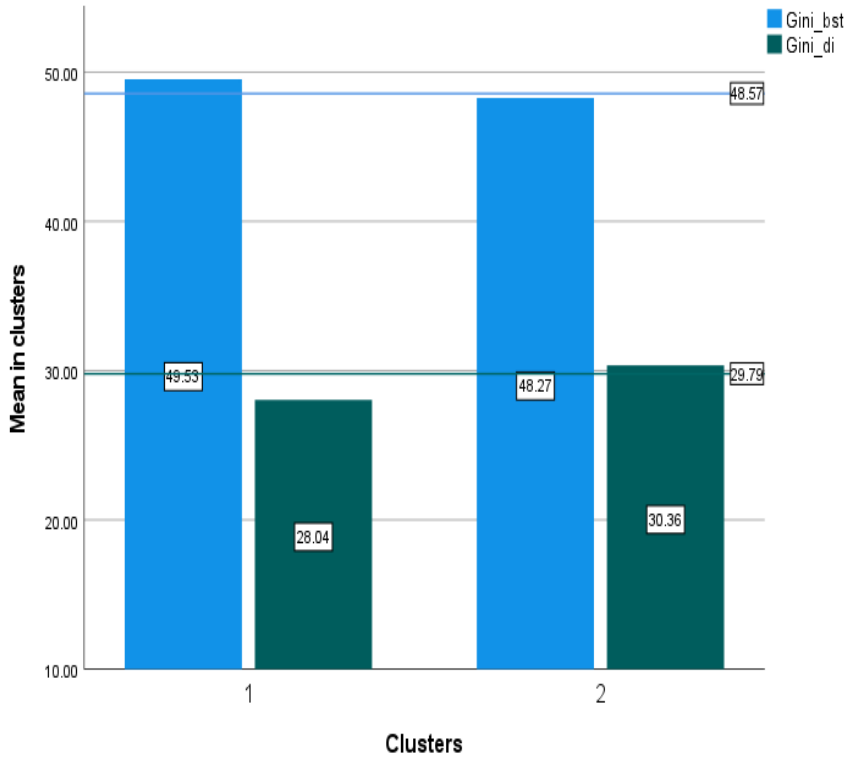

Figure 3. Gini coefficients as evaluation variables in clusters relative to the EU mean

Note: reference lines were added to the y-axis as means for all the EU countries in 2019.
Source: own calculations based on Eurostat 2022b.

Comparing the Gini coefficients in the identified clusters revealed that the Gini coefficient of income before social transfers is higher on average in the first cluster than in the second. However, the Gini coefficient of disposable income is much lower in the first group than in the second. In the group of the countries in the first cluster, which were characterised by both high active and passive LMPs, the extent to which relatively higher market income inequalities decreased was higher. As a result, in the first cluster, relatively high active and passive LMPs are associated with relatively lower disposable income inequalities (Figure 3).

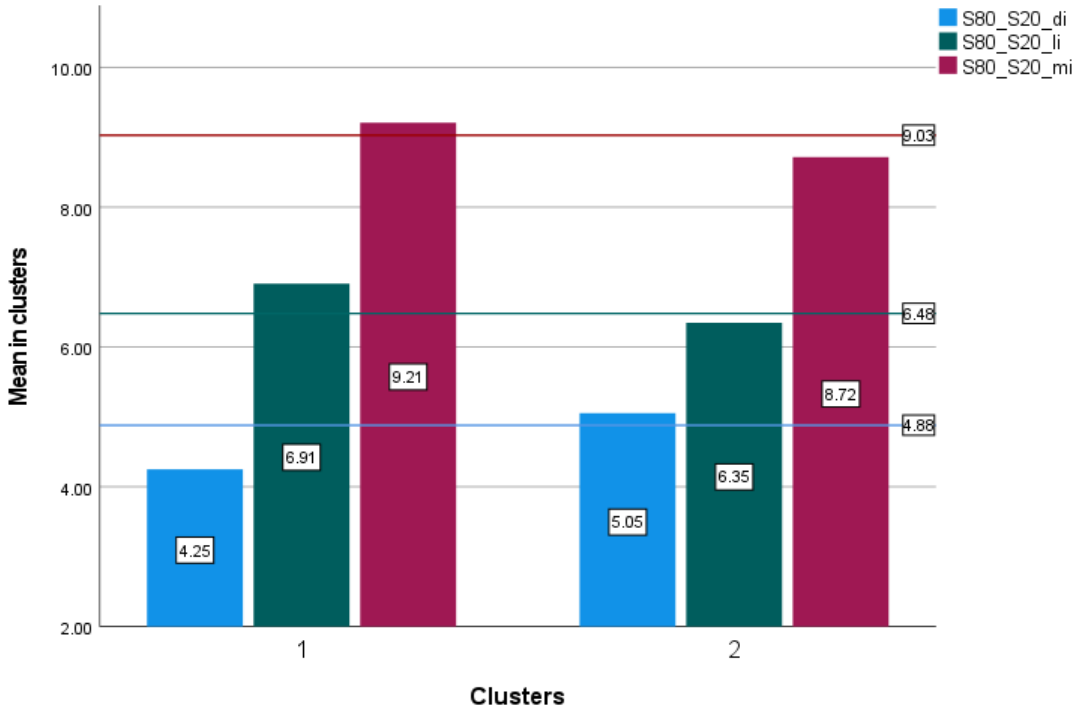

Figure 4. S80/S20 ratios as evaluation variables in clusters relative to the EU mean

Note: reference lines were added to the y-axis as means for all the EU countries in 2019.
Source: own calculations based on Eurostat 2022b; ILO 2022.

Comparing the S80/S20 ratios for different income concepts (disposable income, labour income, market income) reveals phenomena similar to the Gini analysis (Figure 4). In the first cluster, the S80/S20 ratio of market income is, on average, relatively higher than in the second cluster. At the same time, the disposable income S80/S20 is much lower in the first cluster than in the second. It demonstrated that for the group of countries characterised by both high active and passive LMPs, the difference between market and disposable inequalities is higher, even though market income inequalities are initially higher in the first group. What is more, when the labour income S80/S20 is considered, it is, on average, higher in the first group than in the second, and the difference between disposable income is also higher in this group. It demonstrates that in the group of countries with high active and passive LMPs (1st cluster), the labour market inequalities decreased to the greatest extent. The difference between market income inequalities and disposable income inequalities, as well as the difference between labour income inequalities and disposable income inequalities, is higher in the first cluster.

To analyse the significant difference between clusters via characteristics of inequalities, the Independent-Samples T-Test was applied. The results of testing the two independent sample means revealed that only S80/S20_di significantly differentiated the clusters (p-value = 0.039). Other characteristics, i.e. GINI_bst, GINI di, S80/S20_li and S80/S20_mi using the Independent-Samples T Test, were identified as not significant with the 95% confidence interval.

However, this disposable income inequality measure reflects the effectiveness of social policies. As it significantly differentiates the clusters identified based on active and passive LMPs, it reflects the effectiveness of those policies in the groups. In the group of high active and passive LMPs, disposable income inequalities (S80/S20_di) were low. By contrast, in group 2 (characterised by low active and passive LMPs), the disposable income inequalities (S80/S20_di) were high. The results demonstrate that LMPs, both active and passive, interact with income inequalities, decreasing disposable income inequalities (equalising the disposable income after transfers and taxes) and therefore contributing to social cohesion.

Discussion and conclusion

The ongoing discussion about the interaction between income inequalities and LMPs is ambiguous, and the results are mixed in the literature. A factor that possibly results in this inconclusiveness is the choice of income concept to measure income inequalities. Most often, disposable income inequalities are considered when their links to LMPs are considered (Checchi and Garcia-Peñalosa 2008; OECD 2012). Although some active LMPs may be associated with concepts related to labour income or market income inequalities, such as motivating individuals to develop their personal qualifications and education for higher future earnings (European Commission 2017a; Romero and Kuddo 2019), there is no evidence that active LMPs reduce market income inequalities (Sakamoto 2021). We considered different income inequality measures, such as market income, disposable income, and labour income, which sustains the novelty of the analysis.

To answer RQ1, we first compared two clusters of countries based on the hierarchical cluster analysis. The first group was characterised as having extensive expenditures for LMPs (active and passive), while the second group had minor expenditures for LMPs. The results of the research allowed us to answer RQ3 and revealed that high active and passive LMPs are related to high market income (as well as only labour income) inequalities on the one hand, and low disposable income inequalities on the other. Countries with relatively low active and passive LMPs were characterised by relatively lower market income inequalities and higher disposable income inequalities, revealing the smaller role that LMPs played in tackling inequalities. The statistically significant relationships between disposable income inequalities and LMPs in the two groups confirmed that LMP reduced the unequal distribution of income, both when only labour income is considered as well as when market income is considered. Identifying the income quintile share ratio S80/S20 for disposable income as the only measure of income inequalities that significantly differentiates the groups allowed us to answer RQ2.

In the sense of the significant links between LMPs and disposable income inequalities, our results are in line with the majority of previous studies (Checchi and Garcia-Peñalosa

2008; 2010; Sakamoto 2021). However, given the adopted method, we were not able to distinguish between the active and passive LMPs' relationships with income inequalities or to confirm if active (Sakamoto 2021) or passive LMPs (Burniaux, Padrini, and Brandt 2006; Checchi and Garcia-Peñalosa 2008) play a more important role in tackling income inequalities to achieve social cohesion.

The interactions between LMPs and income inequalities demonstrated that LMPs play a significant complementary role as a social protection system (ILO 2012; Sakamoto 2021), protecting against high labour market income dispersion (OECD 2012) and decreasing disposable income inequalities. Hence, by improving chances of finding gainful employment, assuring out-of-work income support, and allowing early retirement, active and passive LMPs contribute to intragenerational justice, which is part of the sustainable labour market. Therefore, LMPs that help reduce disposable income inequalities in the groups of EU countries are sustainable because they play an important role in social cohesion.

References

Adsera, A., Boix, C. (2000), *Must we choose? European unemployment, American inequality, and the impact of education and labor market institutions*, "European Journal of Political Economy", 16 (4), pp. 611–638, https://doi.org/10.1016/S0176-2680(00)00019-7

Amadeo, E.J., Pero, V. (2000), *Adjustment, stabilisation and the structure of employment in Brazil*, "The Journal of Development Studies", 36 (4), pp. 20–148, https://doi.org/10.1080/00220380008422640

Atkinson, A. (1996), *Seeking to explain the distribution of income*, [in:] J. Hills (ed.), *New inequalities: the changing distributions of income and wealth in the United Kingdom*, Cambridge University Press, Cambridge–New York, pp. 19–48, https://doi.org/10.1017/CBO9780511521935.002

Berg, J. (ed.) (2015), *Labour Markets, Institutions and Inequality. Buiding Just Societies in the 21st Century*, Edward Elgar Publishing, Cheltenham–Northamption–Geneva, https://doi.org/10.4337/9781784712105

Betcherman, G. (2012), *Labor market institutions: A review of the literature*, "World Bank Policy Research Working Paper", 6276.

Bijnen, E.J. (1973), *Cluster analysis. Survey and evaluation of techniques*, Springer, Dordrecht, https://doi.org/10.1007/978-94-011-6782-6

Burniaux, J., Padrini, F., Brandt, N. (2006), *Labour Market Performance, Income Inequality and poverty in OECD countries*, "OECD Economic Department Working Papers", 500, OECD, Paris.

Castellano, R., Musella, G., Punzo, G. (2017), *Structure of the labour market and wage inequality: evidence from European countries*, "Quality & Quantity – International Journal of Methodology", 51 (5), pp. 2191–2218, https://doi.org/10.1007/s11135-016-0381-7

Checchi, D., García-Peñalosa, C. (2008), *Labour market institutions and income inequality*, "LIS Working Paper Series", 470, Luxembourg Income Study, Luxembourg, https://doi.org/10.1111/j.1468-0327.2008.00209.x

Checchi, D., Garcia-Peñalosa, C. (2010), *Labour Market Institutions and the Personal Distribustion of Income in OECD Countries*, "IZA Discussion Paper", 1681.

Easterly, W. (2007), *Inequality does cause underdevelopment: Insights from a new instrument*, "Journal of Development Economics", 84 (2), pp. 755–776, https://doi.org/10.1016/j.jdeveco.2006.11.002

European Commission (2010), *Europe 2020: a strategy for smart, sustainable and inclusive growth*, COM (2020) final.

European Commission (2017a), *European Semester: Thematic factsheet – Active labour market policies*, https://commission.europa.eu/content/thematic-factsheets/labour-markets-and-skills_en (accessed: 10.01.2022).

European Commission (2017b), *European Semester: Thematic factsheet – Unemployment benefits*, https://commission.europa.eu/content/thematic-factsheets/labour-markets-and-skills_en (accessed: 10.01.2022).

European Commission (2020), *Employment and Social Developments in Europe*, https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8342&furtherPubs=yes (accessed: 20.01.2022).

Eurostat (2021), *Labour market policy (source: DG EMPL) (lmp)*, https://ec.europa.eu/employment_social/employment_analysis/lmp/lmp_esms.htm (accessed: 22.11.2021).

Eurostat (2022a), *LMP expenditure*, online data codes: LMP_IND_EXP, https://webgate.ec.europa.eu/empl/redisstat/databrowser/view/LMP_IND_EXP/default/table (accessed: 10.01.2022).

Eurostat (2022b), *Data Browser*, https://ec.europa.eu/eurostat/databrowser/view/ILC_DI11/default/table?lang=en&category=livcon.ilc.ilc_ie.ilc_iei (accessed: 2.02.2022).

Everitt, B., Landau, S., Leese, M., Stahl, D. (2011), *Cluster analysis*, Wiley, Chichester, https://doi.org/10.1002/9780470977811

Han, J., Kamber, M., Pei, J. (2012), *Data Mining: Concepts and Techniques*, Elsevier, Amsterdam.

Hennig, C., Meila, M., Murtagh, F., Rocci, R. (2015), *Handbook of Cluster Analysis*, Chapman and Hall, New York, https://doi.org/10.1201/b19706

IBM documentation (2022), *Hierarchical Cluster Analysis Method*, https://www.ibm.com/docs/en/spss-statistics/28.0.0?topic=analysis-hierarchical-cluster-method (accessed: 15.12.2021).

Ilostat (2022), *Labour income distribution*, https://ilostat.ilo.org/data/ (accessed: 2.02.2022).

International Labour Organization (2012), *The strategy of the International Labour Organization Social security for all. Building social protection floors and comprehensive social security systems*, International Labour Office, Social Security Department, Geneva.

International Labour Organization (2021), *World Social Protection Report 2020–22: Social protection at the crossroads – in pursuit of a better future*, International Labour Office, Geneva.

Kaufmann, L., Rousseeuw, P.J. (2005), *Finding Groups in Data: An Introduction to Cluster Analysis*, Wiley Series in Probability and Statistics, Hoboken.

Koeniger, W., Leonardi, M., Nunziata, L. (2004), *Labour Market Institutions and Wage Inequality*, "IZA Discussion Paper", 1291, https://doi.org/10.2139/ssrn.588141

Lubk, C. (2016), *Sustainability and Labor*, [in:] C. Lubk, *The Concept of Sustainability and Its Application to Labor Market Policy. A Discussion of Political Feasibility, Implementation, and Measurability*, Springer, Germany, pp. 107–130, https://doi.org/10.1007/978-3-658-16383-9_4

Murtagh, F., Legendre, P. (2011), *Ward's Hierarchical Clustering Method: Clustering Criterion and Agglomerative Algorithm*, "Journal of Classification", 31 (3), pp. 274–295, https://doi.org/10.1007/s00357-014-9161-z

OECD (2012), *Inequality in labour income – What are its drivers and how can it be reduced?*, "OECD Economics Department Policy Notes", 8.

OECD (2015), *In It Together: Why Less Inequality Benefits All?*, OECD Publishing, Paris, https://doi.org/10.1787/9789264235120-en

OECD (2017), *Labour market structure and wages: policies to reduce inequality in OECD countries*, Jobs and Incomes Division, United Nations, Expert meeting on policies to tackle inequality, https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2018/06/celine-paper.pdf (accessed: 22.11.2021).

OECD (2018), *Methodological and operational issues encountered in OECD work with LMP data*, https://www.oecd.org/els/emp/OECD-2018-Methodological%20and%20operational%20issues%20encountered%20in%20OECD%20work%20with%20LMP%20data%20FINAL.pdf (accessed: 10.01.2022).

Offe, C. (2010), *Inequality and the Labour Market – Theories, opinions, models, and practices of unequal distribution and how they can be justified*, "Zeitschrift für Arbeitsmarkt, Forschung", 43, pp. 39–52, https://doi.org/10.1007/s12651-010-0030-x

Romero, J.M., Kuddo, A. (2019), *Moving forward with ALMPs: Active labor policy and the changing nature of labor markets*, "Social Protection and Jobs, Discussion Paper", 1936, https://doi.org/10.1596/33081

Sachs, J.P. (2012), *From Millennium Development Goals to Sustainable Development Goals*, "The Lancet", 379 (9832), pp. 2206–2211, https://doi.org/10.1016/S0140-6736(12)60685-0

Sakamoto, T. (2021), *Do social investment policies reduce income inequality? An analysis of industrial countries*, "Journal of European Social Policy", 31 (4), https://doi.org/10.1177/09589287211018146

Szczepaniak, M. (2020), *Redistribution and the alleviation of income inequalities: the case of the European Union*, "Economics and Law", 19 (1), pp. 149–161, https://doi.org/10.12775/EiP.2020.011

Szczepaniak, M. Szulc-Obłoza, A. (2019), *Labour market institutions and income inequalities across the European Union*, "Economics and Law", 18 (3), pp. 365–377, https://doi.org/10.12775/EiP.2019.025

Taubner, H., Tideman, M., Nyman C.S. (2021), *Employment Sustainability for People with Intellectual Disability: A Systematic Review*, "Journal of Occupational Rehabilitation", 32, pp. 353–364, https://doi.org/10.1007/s10926-021-10020-9

Thevenot, C. (2018), *Labour market structure and wages: policies to reduce inequality in OECD countries*, Jobs and Income Division United Nations, Expert meeting on policies to tackle inequality, June, https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2018/06/7-2.pdf (accessed: 20.11.2021).

Tuffery, S. (2011), *Data Mining and Statistics for Decision Making*, Wiley, Chichester, https://doi.org/10.1002/9780470979174

Ward, J.H. (1963), *Hierarchical Grouping to Optimise an Objective Function*, "Journal of the American Statistical Association", 301 (58), https://doi.org/10.1080/01621459.1963.10500845

Interakcje między polityką rynku pracy a nierównościami dochodowymi w grupach krajów Unii Europejskiej

Spójność społeczna i zrównoważony rynek pracy pozostają celami polityki zrównoważonego rozwoju. Jednak nierówności dochodowe i polityka rynku pracy są częściej analizowane oddzielnie. Aby wypełnić zidentyfikowaną lukę, artykuł przedstawia wyniki analizy interakcji między aktywnymi i pasywnymi politykami rynku pracy a nierównościami dochodowymi w krajach Unii Europejskiej. 27 krajów podzielono na dwa klastry na podstawie wydatków na aktywną i pasywną politykę rynku pracy w 2019 roku. Klastry te stanowią podstawę do analizy interakcji pomiędzy polityką rynku pracy a nierównościami dochodowymi scharakteryzowanymi różnymi miernikami. Wyniki wykazują, że interwencje na rynku pracy wchodzą w interakcje z nierównościami dochodowymi, zmniejszając nierówności dochodu rozporządzalnego, a więc przyczyniają się do spójności społecznej. Spójność społeczna jest rozumiana jako przejaw sprawiedliwości wewnątrzpokoleniowej.

Słowa kluczowe: nierówności dochodowe, polityka rynku pracy, zrównoważony rynek pracy, spójność społeczna, zrównoważony rozwój