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Wydawnictwo UWM

ul. Jana Heweliusza 14, 10-718 Olsztyn

phone: 89 523 36 61, fax 89 523 34 38

www.uwm.edu.pl/wydawnictwo/

e-mail: wydawca@uwm.edu.pl

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TABLE OF CONTENTS

R. Warżała – <i>The Importance of Services in Shaping the Volatility and Synchronization of Regional Business Cycles: a Comparative Analysis of the Polish and Portuguese Economies</i>	5
A. Panuciak – <i>Review of Migration Studies Conducted by the National Bank of Poland: Methodical Evolution and Research Challenges</i>	27
J. Dynowska, K. Krysztofiak – <i>Segmented Reporting and its Changes as a Result of the Covid-19 Pandemic in the Construction and Real Estate Industry</i>	41
A. Jaskólska – <i>The Essence of Sustainable Development and its Importance for Future Generations</i>	53
W. Barańska – <i>The Impact of Salary and Non-Salary Motivation on the Work Efficiency of Generation Z</i>	67
N. Kubica – <i>Assessment of Information Transmission in the Process of Implementing the Deposit-Refund System as a Tool for Sustainable Development</i>	81
L. Sozansky – <i>Output Multipliers in the Economies of Germany, Poland and Slovakia: a Comparative Input-Output Analysis</i>	97

SPIS TREŚCI

R. Warżała – <i>Rola usług w kształtowaniu zmienności i synchronizacji regionalnych cykli koniunkturalnych na przykładzie gospodarek Polski i Portugalii</i>	5
A. Panuciak – <i>Przegląd badań migracyjnych Narodowego Banku Polskiego: ewolucja metodyczna i wyzwania badawcze</i>	27
J. Dynowska, K. Krysztofiak – <i>Sprawozdawczość w układzie segmentowym i jej zmiany na skutek pandemii Covid-19 w branży budownictwa i nieruchomości</i>	41
A. Jaskólska – <i>Istota zrównoważonego rozwoju i jego znaczenie dla przyszłych pokoleń</i>	53
W. Barańska – <i>Wpływ motywacji płacowej i pozapłacowej na efektywność pracy pokolenia Z</i>	67
N. Kubica – <i>Ocena przekazywania informacji w procesie wdrażania systemu kaucyjnego jako narzędzia zrównoważonego rozwoju</i>	81
L. Sozansky – <i>Mnożniki produkcji globalnej w gospodarkach Niemiec, Polski i Słowacji: porównawcza analiza input-output</i>	97



THE IMPORTANCE OF SERVICES IN SHAPING THE VOLATILITY AND SYNCHRONIZATION OF REGIONAL BUSINESS CYCLES: A COMPARATIVE ANALYSIS OF THE POLISH AND PORTUGUESE ECONOMIES

Rafał Warzala

Faculty of Economic Sciences
University of Warmia and Mazury in Olsztyn
ORCID: <https://orcid.org/0000-0001-8677-977X>
e-mail: rafal.warzala@uwm.edu.pl

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Key words: business cycle, region, economic volatility, GDP structure.

Abstract

The aim of this article is to assess the role of services in stabilizing the volatility and the degree of synchronization of regional business cycles. The existing literature points to the relevance of services in smoothing business cycles. However, services can also play a negative role in stabilizing the economy, as the COVID-19 pandemic demonstrated. Among a variety of services, tourism plays a special role; it can act as a stabilizer during a typical business cycle or become a source of strain in the event of an exogenous shock, such as the COVID-19 pandemic.

The study focuses on the regions of two countries – Poland and Portugal – which differ in both the share and the structure of services in their regional GDP, which affects their resistance to changes in the economic environment. To examine this, such parameters of analysed business cycles were calculated, like: cycle length, phase length, coherence ratio, standard deviation ratio, coefficient of variation ratio, mean delay, cross-correlation ratio and average amplitude of upward and downward phases. The conducted analysis has shown that Polish and Portuguese regions exhibit varying degrees of resilience to business cycle fluctuations. Differences are also observed in the level of synchronization of regional cycles in both countries. Overall, the higher share of services in the regional GDP of Portugal translates into greater resilience to cyclical changes compared to the volatility observed in Polish regions. At the same time, Portuguese regions are more synchronized in terms of the phases of the business cycle. This may stem from the relatively higher share of services in GDP, particularly tourism services, in Portugal's economy (11.9% of GDP) compared with Poland (2.2%).

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ROLA USŁUG W KSZTAŁTOWANIU ZMIENNOŚCI I SYNCHRONIZACJI REGIONALNYCH CYKLI KONIUNKTURALNYCH NA PRZYKŁADZIE GOSPODAREK POLSKI I PORTUGALII

Rafał Warzała

Wydział Nauk Ekonomicznych
Uniwersytet Warmińsko-Mazurski w Olsztynie

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Słowa kluczowe: cykl koniunkturalny, region, zmienność gospodarcza, struktura PKB.

Abstrakt

Celem artykułu jest ocena roli i znaczenia sektora usług w stabilizowaniu zmienności i poziomu synchronizacji regionalnych cykli koniunkturalnych. Aktualne wyniki badań opisane w literaturze wskazują na istotność sektora usług w łagodzeniu wahań koniunkturalnych. Jednakże usługi mogą również odgrywać negatywną rolę w stabilizacji koniunktury, czego przykładem był okres pandemii COVID-19. Spośród zróżnicowanego typu usług, na szczególną uwagę zasługuje turystyka, która jak to wynika z badań – może pełnić rolę stabilizatora koniunktury, ale może również stanowić obciążenie lub też być przyczyną tzw. szoków egzogenicznych, jak podczas pandemii COVID-19.

Przedmiotem badania są regiony dwóch krajów – Polski i Portugalii – które różnią się pod względem udziału usług oraz ich struktury w PKB. Ma to wpływ na stopień odporności regionalnych gospodarek na zmiany w otoczeniu ekonomicznym. Aby zweryfikować powyższe twierdzenia, dokonano pomiaru takich parametrów cykli, jak: długość cyklu, długość fazy, współczynnik koherencji, poziom odchylenia standardowego, współczynnik zmienności, średnie przesunięcie fazowe, współczynnik korelacji krzyżowej oraz średnia amplituda faz wzrostowych i spadkowych. Przeprowadzona analiza wykazała, że polskie i portugalskie regiony wykazują zróżnicowaną odporność na wahania koniunktury. Zróżnicowanie dotyczy również stopnia synchronizacji cykli regionalnych w obu krajach. Ogólnie wyższy udział usług w regionalnym PKB Portugalii przekłada się na wyższą odporność na zmiany koniunkturalne, w porównaniu do zmienności koniunkturalnej polskich regionów. Jednocześnie regiony portugalskie są bardziej zsynchronizowane pod względem faz przebiegu cyklu koniunkturalnego. Może to wynikać z wyższego przeciętnie udziału sektora usług w PKB, a zwłaszcza usług turystycznych w gospodarce Portugalii (11,9% PKB), w porównaniu do gospodarki Polskiej (2,2% PKB).

Introduction

Economies all over the world experience various disturbances caused by endogenous or exogenous shocks. The impact of these shocks depends on many factors, one of the most important being the structure of GDP-specifically, the share of services within it. As existing literature indicates, services are inherently business cycle stabilizers. However, in certain circumstances, such as the COVID-19 pandemic, a high share of services can constitute a significant strain on local or regional economies. This is because many services require face-to-face contact, which may be limited or even prohibited during such crises. Consequently, this leads to higher business cycle volatility at both national and

regional levels. A prime example is the tourism sector, which in many European countries is the most crucial component of the service sector. In a situation where a single service branch holds a dominant position, a demand shock can lead to a sharp crisis in the local or regional economy.

Considering these circumstances, a general question arises regarding the importance of the service sector's share in GDP structure in relation to the volatility and synchronization of business cycles on a regional scale.

The aim of the article is to assess the role of services in stabilizing the volatility and the degree of synchronization of regional business cycles. A secondary objective is to examine differences in the morphological structure of business cycles between regions with a relatively high share of services in GDP – where tourism services play a significant role – and those with a lower share of services in GDP, including a lower share of tourism in the economy. The empirical basis for this assessment is provided by the regional economies of two countries – Portugal and Poland

Although the literature indicates that tourism services are procyclical and may contribute to high business cycle volatility (Kozić *et al.*, 2022, p. 35; Duarte *et al.*, 2024, p. 16), the specific characteristics of tourism in Portugal – reflected in a considerably longer tourist season compared to Poland, and, in island areas as well as in regions hosting the country's major tourist attractions, in year-round tourism activity – suggest that this sector may enhance the resilience of individual regions to cyclical fluctuations.

Business cycles constitute an inherent element of the economic development of both countries and regions. Within the framework of European integration, the synchronization of business cycles is one of the key criteria for monetary integration, as it facilitates a closer alignment of supranational monetary policy with the prevailing phase of the business cycle (Artis & Zhang, 1997, p. 17). In practice, however, this criterion is not always fulfilled (Artis, 2003, p. 23; Warząła, 2016, p. 146). This applies both to countries and to regions, which – under the EU's regional policy – possess a high degree of autonomy. Empirical findings indicate that while some regions display an increasing synchronization of cyclical fluctuations (Marelli, 2007, p. 31; Barrios & Lucio, 2003, p. 14), others exhibit divergence in this respect (Krugman, 1991, p. 32; Krugman, 1993, p. 6; Carlino & Sill, 2001, p. 448; p. 8; Crone, 2003, p. 12). The underlying causes of such heterogeneity may include differences in the level of economic development, reflected in the differentiated structure of regional GDP, the nature and extent of interregional linkages, the degree of openness of a given region to foreign trade, as well as the strength of production chain connections between regions. Furthermore, the geographical location of a region, including its touristic and natural attractiveness, also plays a significant role (Khmeleva *et al.*, 2023).

Poland's economy is dominated by services but retains a comparatively large manufacturing sector (industrial value added remains sizable). According to the Polish Central Statistical Office services are the largest component of GDP

while industry/manufacturing still account for a substantial part of value added, reflecting Poland's continued specialization in tradable manufactured goods. According to the most recent data from the Ministry of Sport and Tourism, the share of tourism in Poland's GDP, calculated in line with the Tourism Satellite Account methodology, amounted to 2.2% of GDP in 2019¹. This sectoral mix tends to increase cyclical volatility relative to economies where services dominate more fully.

Portugal records a larger services share of GDP than many EU countries, and tourism has become a major contributor to growth. According to recent national estimates of Tourism Satellite Account given by the Turismo de Portugal the total contribution of tourism activity reached €34 billion in 2024, equivalent to 11.9% of national GDP². The Portuguese economy therefore combines a high services share with a non-negligible concentration in tourism services.

Regional Business Cycles: A Literature Review

Most analyses focus on the relationship between regional and nationwide business cycles. Some researchers suggest that the national business cycle reflects an average of cyclical changes across individual regions. However, this aggregated approach to analyzing business cycles overlooks the specific characteristics of different regions and, consequently, obscures information about how regional fluctuations respond to changes in global economic activity (Valencia-Beltran, 2024; Duran & Fratesi, 2023).

Sectoral Composition and Volatility of Business Cycles

A central insight from the literature is that not all sectors of the economy contribute equally to cyclical fluctuations. Consumer durables and investment goods are more volatile than services or nondurable consumption, since expenditures on durable items can be postponed in response to shocks. As a result, economies with a larger share of durables in GDP experience sharper recessions and stronger recoveries (Lubiński, 2004, p. 79; Kahn, 2008, p. 6). Stock and Watson (1999, pp. 6-12) provide early evidence for the U.S., demonstrating that durable goods are markedly more procyclical than nondurables and services.

The structural transformation from manufacturing to services has been a key driver of declining volatility in advanced economies. Moro (2012, p. 28)

¹ Retrieved from <https://www.gov.pl/web/sport/rachunek-satelitarny-turystyki-dla-polski-za-lata-2018-i-2019> (1.09.2025). For Poland, these represent the latest available data.

² Retrieved from <https://www.turismodeportugal.pt/en/Noticias/Pages/turismo-mantem-dinamismo-2024-conta-satelite.aspx>. (1.09.2025).

quantifies this effect for the United States, showing that the falling share of manufacturing explains a substantial part of the “Great Moderation” in GDP volatility since the mid-1980s. Relatedly, Jaimovich and Siu (2009, p. 31) argue that demographic changes, which shift labour supply across sectors, interact with structural change to reduce aggregate volatility. These findings suggest that GDP composition, shaped by both secular and demographic forces, systematically influences macroeconomic stability. The conclusions of Török *et al.* (2022), derived from an analysis of Romanian regions, also seem to confirm this statement.

In multi-sector economies, shocks don’t stay local: production networks transmit them via intermediate-input trade. Early and subsequent work shows that a few “core” sectors or highly connected nodes can disproportionately move the aggregate cycle; decompositions of industrial production attribute a sizeable share of aggregate variance to common factors consistent with network propagation (Fatás, 1997, p. 15; Horváth, 2000, p. 4; Foerster *et al.*, 2008, p. 19; Masahiro *et al.*, 2025, p. 26). Relatively recent research indicates the role of fiscal policy in stimulating regional economies, both in the consumption and investment areas (Coppola *et al.*, 2024).

GDP Structure and Synchronization of Business Cycles

Another important strand of research concerns the relationship between GDP structure and cross-country or interregional business cycle synchronization. A common finding is that countries with more similar production structures exhibit higher cyclical co-movement. Di Giovanni and Levchenko (2010, p. 58) show that vertical production linkages – captured by input-output relationships across sectors – explain a large part of international synchronization, especially among economies integrated into global value chains. Baxter and Kouparitsas (2005, p. 34) confirm these results using robust regressions across many country pairs, concluding that sectoral similarity is a consistent determinant of comovement, even after controlling for trade intensity and financial linkages.

Trade structure also plays a role. Kose and Yi (2006, p. 11) argue that bilateral trade intensity raises cycle correlation, particularly when countries specialize in similar sectors. Building on this, Imbs (2004, p. 38) emphasizes that both trade and financial integration contribute to synchronization, but that specialization patterns shape whether integration amplifies or reduces co-movement. More recent work by Kalemli-Özcan, Papaioannou, and Peydró (2013, p. 26) suggests that common global shocks transmitted through vertically linked industries are particularly important for small open economies. The significance of the service sector and emerging industrial branches is also emphasized in recent studies (Smolińska-Bryza *et al.*, 2025).

European evidence is especially relevant. Montoya and de Haan (2008, p. 42) examine regional cycles within the euro area and find that, while synchronization has increased overall, important heterogeneity remains: some regions with less diversified industrial structures exhibit lower correlation with the euro-area benchmark. Similarly, Barrios and Lucio (2003, p. 9) find that deeper trade integration between Spain and Portugal increased cycle synchronization, but that sectoral asymmetries continue to generate divergence at the regional level. Analyses of the Chinese and Mexican economies also confirm the conclusion that regional business cycles tend to diverge, due to growing regional autonomy (China) and regional localization (Mexico) (Padilla & Quintero-Otero, 2023).

The convergence of regional (or national) business cycles is also one of the key criteria of the optimum currency area (OCA) theory. Many authors argue that business cycles across countries (or regions) within an optimum currency area should be synchronised (McKinnon, 2002, p. 343). The problem of asymmetric economic shocks following accession to the euro area has been extensively examined by member states. For supranational (as well as national) monetary policy to be effective and appropriate, business cycle fluctuations need to be more synchronised. Moreover, according to OCA theory, if fiscal policy is subject to strict controls and harmonisation at the supranational level, the effects of such instruments should be predictable and similar across the common currency area (Frenkel & Nickel, 2002, p. 169). Recent research shows that among Eurozone member states, the process of regional divergence is also increasing (Jokubaitis & Celov, 2023).

Asymmetries across Sectors and Regions

Differences in sectoral composition not only affect volatility but also create asymmetric responses to shocks. Carlino and Sill (2001, p. 452) show that U.S. regional cycles diverge significantly from the national cycle, partly because of variations in industrial composition. Economies with a larger share of cyclical sectors (e.g., construction, manufacturing, and durable goods) tend to exhibit stronger responses to global shocks. In contrast, regions specialized in less cyclical sectors (e.g., public services, healthcare) are more insulated. In this context, several indicators have been proposed in the literature to examine the rate of convergence of individual regional components (Crone, 2003, p. 41).

Krugman (1993, p. 38) provides a theoretical perspective, arguing that economic integration can foster regional concentration of industry, thereby increasing exposure to sector-specific shocks and generating divergent cycles. By contrast, Frankel and Rose (1998, p. 29) propose that integration fosters trade intensification, which should increase synchronization *ex post*, even if initial specialization creates divergence. This debate remains central in the literature

on optimum currency areas (OCA), where structural asymmetries are seen as a source of vulnerability to asymmetric shocks. Current research seems to confirm that point of view. However, other factors are cited as evidence of divergence (Beck & Okhrimenko, 2024).

Conversely, evidence from Frankel and Rose (1998, p. 74) and Barrios and Lucio (2003, p. 41) suggests that deepening integration and policy coordination can gradually align business cycles through greater trade intensity and common policy frameworks. In this sense, the long-run relationship between GDP structure and cycle synchronization is endogenous to integration itself. Contrary to this conclusion, Duran and Fratesi (2023), using Italy as an example, argue that although the country has been unified since 1861, the nature of regional business cycles continues to vary, despite the increasing autonomy granted to regions in recent decades. This phenomenon persists regardless of EU and Eurozone membership and must be taken into consideration when conducting fiscal or monetary policy.

Effectiveness of the union's economic policy instruments

The dependence of business cycles on GDP structure has important implications for economic policy. In monetary unions, such as the euro area, heterogeneity in sectoral composition may limit the effectiveness of common monetary policy, since shocks propagate differently across regions. Frenkel and Nickel (2002, p. 58) note that fiscal policy coordination becomes crucial in such contexts, as national instruments may be constrained while cyclical divergences persist. Moreover, if specialization increases with integration – as Krugman (1991, p. 4) warns – the potential for asymmetric shocks rises, raising questions about the resilience of a currency area.

Apart from the occurrence of business shocks, the OCA theory emphasises that no less important than other conditions is the way in which economies react to disturbances, which is determined by the effectiveness of the union's economic policy instruments. If a shock is positive in one country while negative in another, the harmonisation of economic policies would be meaningless (Weimann, 2003, p. 37).

Studies conducted in the EU area demonstrate ambiguous effects of deepening international specialisation. This conclusion also derives from the work of Montoya and de Haan. In their 2007 paper, using the correlation coefficient of regional cycles with the euro area benchmark, they found that synchronisation increased on average over the period considered, with some exceptions. However, the correlation of the business cycle in certain regions with the reference cycle remained low or even declined (Montoya & de Haan, 2007, p. 58). Moreover, as Anagnostou, Panteladis, and Tsiapa (2014, p. 89) conclude, the EU business

cycle benchmark exerts a greater influence on more developed regions, whereas it has little or no effect on less developed ones. Although the transmitted values of euro area shocks are very small overall, their impact tends to be greater in more developed regions than in less developed regions.

There are also studies in the literature demonstrating that a uniform monetary policy, conducted in the absence of business cycle convergence, is inappropriate for all members of a common currency area and, sooner or later, leads to national or regional “asymmetric shocks” (Correia & Gouveia, 2013, p. 48).

Methodology for the identification of regional business cycles

The objectives of the study in Poland concern the morphological features of regional business cycles, represented by 16 administratively separate government units, i.e., provinces³. The data for Poland’s regions were obtained from the Central Statistical Office of Poland. In the case of Portugal, 7 NUTS II units were analysed, based on data from the Portuguese Statistical Office. The period of analysis covers a dynamic series of regional gross domestic product at quarterly intervals, from the first quarter of 2000 to the fourth quarter of 2022. The choice of this time span was determined by the availability of comparable statistical data. Moreover, the 23-year period makes it possible to identify several complete business cycles and to assess differences in their morphological structure. The business cycle model adopted in this study is the growth cycle. This method enables the identification of business cycles even during long periods of continuous growth, when the analysis of absolute values does not yield clear results (Drozdowicz-Bieć, 2012, p. 15).

The first stage of business cycle analysis involves eliminating seasonal fluctuations from the raw time series. To remove seasonality, the TRAMO/SEATS method was applied, as recommended by Eurostat (Grudkowska & Paśnicka, 2007, p. 8, 9).

To extract the cyclical component from the deseasonalised empirical data obtained using the TRAMO/SEATS method, the Christiano–Fitzgerald asymmetric filter was applied. This econometric tool makes it possible to evaluate cycles at both the beginning and the end of a time series (Christiano & Fitzgerald, 1999, p. 5; Adamowicz *et al.*, 2008, p. 12). To identify turning points, the Bry–Boschan method was adopted (Bry & Boschan, 1971, p. 21; Adamowicz *et al.*, 2008, p. 13).

The analysis of the morphological features of business cycles also employs measures of variability and dispersion, such as the length of individual phases

³ According to Eurostat nomenclature both polish provinces and Portuguese regions represent NUTS II administrative areas.

and cycles, standard deviation, variability ratio, amplitude factors, as well as cross-correlation analysis. Based on the obtained results, the morphological features of regional GDP series were examined for 16 voivodships in Poland and, for comparison, 7 regions in Portugal.

The subject of this study was the share of services in GDP and its impact on business cycle volatility from a regional perspective. Particular emphasis was placed on the significance of tourism services in GDP. However, tourism is not directly isolated within standard statistical classifications due to its extensive linkages with other economic sectors. Consequently, the share of tourism services was calculated as the difference between the total share of services in regional GDP and the specific service categories listed in statistics, such as: trade, repair, transportation, storage, accommodation, food service activities, information, and communication. The author is fully aware of the limitations of this method; however, given that only general data on the overall share of tourism in the GDP of both countries was available, and considering the publicly available information on the role of tourism in the economies of Poland and Portugal, the aforementioned approach was the only feasible method to apply.

Empirical Analysis of Regional Business Cycle Convergence in Poland and Portugal

An analysis of the development levels of Polish and Portuguese regions, measured in terms of GDP per capita, indicates that, on average, the two countries are broadly comparable. However, when disaggregated to the regional level, Poland exhibits considerably greater internal disparities. Out of its 16 regions, only three (excluding the capital city, which in 2018 was separated from the Mazowieckie voivodeship) record a per capita income above the national average. The standard deviation of regional GDP in Poland amounts to 3,607 euro, while the coefficient of variation reaches 14.7%. The GDP per capita values for the Polish regions are presented in Table 1.

When assessing the level of regional disparities in terms of development and the structure of regional GDP, several issues stand out. The first concerns the level of development and the GDP structure of the Mazowieckie province after excluding the metropolitan area of the capital. In this configuration, its level of development corresponds to that of the Łódzkie voivodeship, whereas its GDP structure is entirely distinct from that of other regions of Poland. The share of agriculture (including forestry, hunting, and fisheries) exceeds 10%, while the share of industry together with construction is also the highest in Poland, surpassing 45%. The remaining part – around 43% – is accounted for by services, which is the lowest value among all regions in the country. A structure similar to that of Mazowieckie is found in the Warmińsko-Mazurskie and Podlaskie

Table 1

The value and structure of regional GDP in Poland in 2022 (in %)

No.	Country/Voivodeship	GDP per capita (in euro PPS)	Total	Agri- culture	Industry and Con- struction	Services	
						Trade, repair, transportation, storage, accommodation, food activities, information, communication	Total services
POLAND		28,200	100.0	3.1	33.9	28.7	63.0
1.	Dolnośląskie	30,300	100.0	1.3	41.7	24.4	57.0
2.	Kujawsko-Pomorskie	23,400	100.0	5.0	36.1	28.2	58.9
3.	Łódzkie	26,500	100.0	6.5	27.8	26.5	65.7
4.	Lubelskie	19,700	100.0	3.2	40.6	27.4	56.2
5.	Lubuskie	22,900	100.0	4.4	34.6	26.0	61.0
6.	Małopolskie	25,000	100.0	1.2	30.6	30.4	68.2
7.	Mazowieckie	26,500	100.0	10.6	45.5	20.6	43.9
8.	Opolskie	22,900	100.0	3.7	40.8	23.8	55.5
9.	Podkarpackie	20,000	100.0	1.6	38.5	26.5	59.9
10.	Podlaskie	21,800	100.0	8.7	30.1	27.4	61.2
11.	Pomorskie	27,700	100.0	2.3	37.1	29.0	60.6
12.	Śląskie	29,500	100.0	0.8	41.8	26.4	57.4
13.	Świętokrzyskie	20,600	100.0	5.0	35.2	26.5	59.8
14.	Warmińsko-Mazurskie	20,100	100.0	7.1	33.3	24.4	59.6
15.	Wielkopolskie	29,400	100.0	4.4	34.6	30.7	61.0
16.	Zachodniopomorskie	23,100	100.0	4.0	31.3	28.1	64.7

Source: Retrieved from https://ec.europa.eu/eurostat/databrowser/view/nama_10r_2gdp__custom_17992719/default/table; <https://stat.gov.pl/obszary-tematyczne/rachunki-narodowe/rachunki-regionalne/produkt-krajowy-brutto-i-wartosc-dodana-brutto-w-przekroju-regionow-w-2022-r-,7,7.html>, (7.07.2025).

voivodeships. These last two regions belong to the least developed in terms of GDP per capita, whereas Mazowieckie, without Warsaw, has managed to maintain an average level of development thanks to the high share of industry and construction in GDP. The influence of the Warsaw metropolis on the region is undoubtedly significant.

The lowest share of agriculture in GDP is observed in three regions of southern Poland, namely Śląskie, Małopolskie, and Dolnośląskie. A slightly higher share of the agricultural sector is found in the Pomorskie and Wielkopolskie voivodeships. All five of these regions record the highest levels of GDP per capita.

This is the result of the strong contribution of industry, construction, and broadly defined services to their regional economies. The remaining Polish regions, in which the share of services in GDP exceeds 60%, represent either a medium level of development (Lubuskie, Łódzkie, Zachodniopomorskie) or a low level of development (Podlaskie).

In Portugal, three out of eight regions also exceed the national average in terms of GDP per capita. Overall, Portuguese regions display a higher degree of variation in development levels, as evidenced by a standard deviation of 5,960 euro and a coefficient of variation of 20.8%. However, once the capital region (Lisbon Area) is excluded from the comparison – analogous to the case of Poland – these measures decline significantly. The standard deviation then falls to 2,451 euro, while the coefficient of variation decreases to 9.1%. Both figures are then substantially lower than the corresponding indicators observed in Poland. The GDP per capita values for the Portuguese regions are presented in Table 2.

Table 2

The value and structure of regional GDP in Portugal in 2022 (in %)

No.	Country/Region	GDP per capita (in euro PPS)	Total	Agricul- ture	Industry and Con- struction	Services	
						Trade, repair, trans- portation, storage, accommodation, food activities, informa- tion, communication	Total services
PORTUGAL		27,800	100.0	2.4	20.9	28.4	76.7
1.	Continental Area	27,900	100.0	2.4	21.4	28.3	76.2
2.	North	23,900	100.0	1.6	29.5	24.4	68.9
3.	Central	24,400	100.0	3.6	31.6	25.2	64.8
4.	Lisbon Area	43,300	100.0	0.2	9.7	32.4	90.1
5.	Alentejo	26,500	100.0	12.2	26.3	23.1	61.5
6.	Algarve	30,200	100.0	3.6	10.2	42.1	86.2
7.	Azores	24,200	100.0	6.3	12.3	26.9	81.4
8.	Madeira	29,500	100.0	1.6	11.1	35.8	87.3

Source: own calculations based on: Statistics Portugal. Retrieved from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=cn_quadros&boui=248020715 (08.07.2025).

Regarding the Portuguese regions, a lower degree of developmental disparity is observed, provided that the metropolitan area of Lisbon (Lisbon Area) is excluded from the analysis. Moreover, all Portuguese regions are characterised by a comparatively higher share of services in GDP (76.7%).

To assess the importance of the services sector in GDP and its impact on the course and morphology of business cycle fluctuations, a separate aggregation was

made within this sector, comprising transport, repair, storage, accommodation, food service, as well as information and communication services. The purpose of this procedure was to capture the role and significance of tourism in the economies of individual regions of the country.

When comparing this segment of the services sector, it should be noted that, at the national level, its share in GDP does not differ significantly between the two countries (Poland: 28.7%, Portugal: 28.4%). Slightly greater differences can be observed in certain regions – namely those most frequently visited in both Poland and Portugal. In Poland, the regions of Małopolskie, Pomorskie, and Wielkopolskie recorded shares of the services subsector above the national average, although the difference was relatively small (ranging from 0.3 to 2 pp.). In Portugal, however, the share of this subsector of services was more heterogeneous. The highest shares were recorded in three regions: Lisbon Area, Algarve, and Madeira. These three regions are the most prominent tourist destinations in the entire country. The remaining regions displayed a share of this services subsector below the national average.

An initial examination of the regional GDP structure makes it possible to assess the scale of diversity among regional economies. Provinces with an above-average share of agriculture in GDP include Kujawsko-Pomorskie, Podlaskie, Mazowieckie⁴, Warmińsko-Mazurskie, Lubelskie, Lubuskie, Łódzkie, Opolskie, Świętokrzyskie, and Wielkopolskie. By contrast, Podlaskie, Lubelskie, and Zachodniopomorskie also record a significantly smaller share of industry in GDP. The regional GDP structure of Polish provinces is presented in Table 1.

In terms of sectoral specialisation⁵, Lubelskie is dominated by mining and the chemical industry, while Podlaskie specialises in agri-food, wood, and machinery production. In Świętokrzyskie, the share of agriculture is close to the national average, but the share of construction is higher than in most other provinces. Podkarpackie, in turn, has the smallest share of agriculture but the largest share of industry among the eastern provinces, with major sectors including aviation, electrical engineering, automotive, chemicals, and food processing.

These structural differences may help explain the varied course of business cycle fluctuations across the regions studied. The analysis of business cycle morphology will allow us to assess the sensitivity of individual Polish provinces to volatility in both the national and supranational economy.

As shown in Table 2, in comparison with the Polish regional GDP structure, the Portuguese regions appear more specialised. This is because in every regional

⁴ In accordance with the new NUTS 2016 classification, which has been in force since 1 January 2018 under Commission Regulation (EU) 2016/2066 of 21 November 2016 amending the annexes to Regulation (EC) No 1059/2003 of the European Parliament and of the Council on the establishment of a common classification of territorial units for statistics (NUTS), the Mazowieckie Voivodeship was divided into two separate statistical units at the NUTS 2 level.

⁵ The information on the shares of individual sectors in the regional economies was obtained from regional statistical offices.

economy, the services sector accounts for at least 61.5% of total GDP (Alentejo). The highest service shares are recorded in Madeira (87.3%), Algarve (86.2%), and the Lisbon Area (90.1%), all of which are largely driven by tourism⁶.

By contrast, the share of agriculture (including hunting and fishing) ranges from 0.2% in the Lisbon area to 6.3% in the Azores and 12.2% in the Alentejo region. A greater reliance on services and a smaller share of agriculture result in a relatively lower share of industry compared with the Polish economy. The Portuguese economy is best known for tourism, fishing, and fruit production. The regional GDP structure of Portuguese provinces is presented in Table 2.

The economic structure of Portuguese regions is dominated by services and the production of non-durable goods, particularly food. Within the service sector, tourism plays a leading role, with seasonality being its main drawback in terms of business cycle stabilisation. While in Poland the tourist season is relatively short (3–4 months), in Portugal it lasts considerably longer (6–8 months). Moreover, in some regions (e.g., Madeira and Lisbon) there is sustained tourist demand throughout the entire year, with only minor and short-lived fluctuations⁷.

To describe the degree of comovement between the GDP time series of individual Polish regions and the national business cycle, the coherence coefficient was calculated. Coherence is a frequency-domain function that indicates the correlation coefficient between two stochastic processes as a function of frequency. As shown in Table 3, the GDP time series most coherent with the reference series (Poland) are found in Lubuskie (0.66), Łódzkie (0.65), Zachodniopomorskie (0.52), and Śląskie (0.57). In contrast, the most dissimilar to the reference series are Małopolskie (0.12) and Świętokrzyskie (0.18).

Apart from the coherence ratio, cross-correlation (i.e., correlation with a shift) was also calculated for individual regions. Cross-correlation measures the similarity between two series as a function of the displacement of one relative to the other. It indicates the maximum correlation value with respect to a time shift between the two series.

Some regions tend to lead the business cycle phases relative to the reference series (Kujawsko-Pomorskie, Lubelskie, Mazowieckie, Podkarpackie, Świętokrzyskie, Wielkopolskie), while others tend to lag (Dolnośląskie, Łódzkie, Małopolskie). In six Polish regions, fluctuations are almost coincident with the reference series, namely in Lubuskie, Opolskie, Podlaskie, Pomorskie, Śląskie, and Warmińsko-Mazurskie.

⁶ According to the Portuguese Statistical Office, the share of tourism in the country's GDP in 2024 amounted to 11.9%. Regarding the share of tourism services in the economies of individual regions of Portugal, no official data are available. However, information provided by local tourism institutions indicates that in 2024 this share was 29% in the Algarve, 22.7% in Madeira, and 10.6% in the Azores.

⁷ Retrieved from <https://invest.turismodeportugal.pt/en/portugal-de-relance/analise-regional/> (9.09.2025).

Table 3

Regional bivariate statistics with the Poland GDP reference series

Voivodeship time series	Coherence Ratio	Mean Delay	Cross-correlation		
			r_0	$r_{\max}$	$t_{\max}^{(1)}$
Dolnośląskie	0.36	−0.64	0.59	0.65	−1
Kujawsko-Pomorskie	0.47	0.71	0.53	0.70	1
Łódzkie	0.65	−0.42	0.74	0.77	−1
Lubelskie	0.40	0.54	0.59	0.64	1
Lubuskie	0.66	−0.07	0.84	0.84	0
Małopolskie	0.12	−0.58	0.23	0.27	−1
Mazowieckie	0.54	0.42	0.69	0.72	1
Opolskie	0.39	−0.23	0.53	0.53	0
Podkarpackie	0.31	0.56	0.50	0.54	1
Podlaskie	0.28	0.13	0.51	0.51	0
Pomorskie	0.53	−0.38	0.68	0.68	0
Śląskie	0.57	−0.34	0.73	0.73	0
Świętokrzyskie	0.18	0.63	0.35	0.39	1
Warmińsko-Mazurskie	0.41	0.16	0.56	0.58	0
Wielkopolskie	0.48	0.42	0.67	0.71	1
Zachodniopomorskie	0.52	−0.84	0.64	−0.75	4

(1) The + (−) sign refers to a lead (lag) in quarters with respect to the reference series.
Source: own elaborations based on: “Monthly Reports on the socio-economic situation of Dolnośląskie, Kujawsko-Pomorskie, Lubelskie, Lubuskie, Łódzkie, Małopolskie, Mazowieckie, Opolskie, Podkarpackie, Podlaskie, Pomorskie, Śląskie, Świętokrzyskie, Warmińsko-Mazurskie, Wielkopolskie and Zachodniopomorskie Province”, Local Data Bank, Regional Statistical Office.

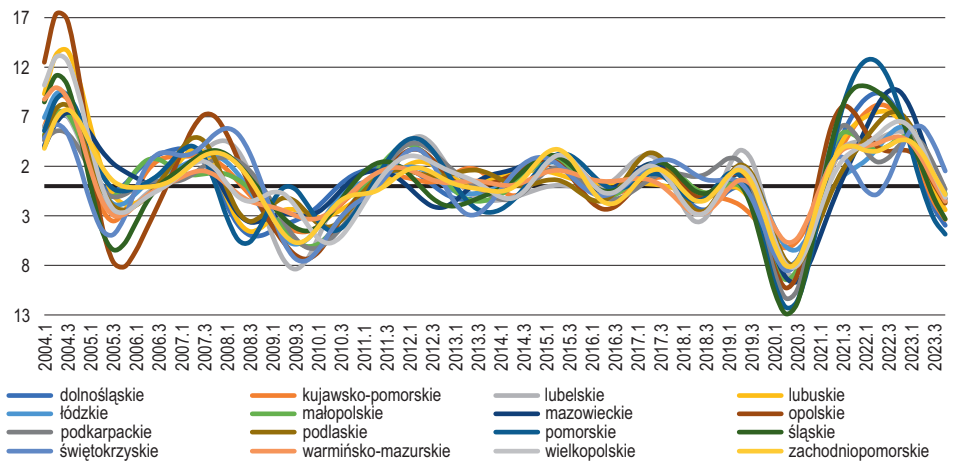


Fig. 1. Business Cycles in Polish Regions, 2004–2024

Source: own calculations based on the data from Statistics Poland (GUS).

The highest levels of cross-correlation were recorded in Lubuskie (0.84), Łódzkie (0.77), Śląskie (0.73), and Mazowieckie (0.72). The Zachodniopomorskie province, however, displayed a four-month lag relative to the average business cycle and a relatively high but negative cross-correlation coefficient (−0.75). This region can therefore be regarded as one of the most dissimilar with respect to national business cycle fluctuations.

In comparison with Polish regions, Portuguese regional business cycles are more synchronised. The lowest coherence ratio was 0.5, observed for Madeira. Only two regions displayed a one-quarter shift relative to the reference series: the Central region, whose business cycle led the reference GDP series by one quarter, and Madeira, whose business fluctuations lagged by one quarter behind Portugal's overall GDP series.

The cross-correlation ratios were generally high, with slightly lower values recorded in the island regions and in the south (Algarve). All bivariate statistics are presented in Table 4.

Table 4

Regional bivariate statistics with the Portugal GDP reference series

Regional time series	Coherence Ratio	Mean Delay	Cross-correlation		
			r_0	$r_{\max}$	$t_{\max}^{(1)}$
Continental Area	1.00	0.01	0.98	0.98	0
North	0.93	−0.02	0.95	0.95	0
Central	0.78	0.19	0.86	0.88	1
Lisbon Area	0.91	−0.01	0.94	0.94	0
Alentejo	0.85	0.02	0.91	0.91	0
Algarve	0.66	−0.09	0.79	0.79	0
Azores	0.79	−0.20	0.87	0.87	0
Madeira	0.50	−0.29	0.68	0.71	−1

⁽¹⁾ The + (−) sign refers to a lead (lag) in quarters with respect to the reference series.

Source: own calculations based on: Statistics Portugal. Retrieved from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=cn_quadros&boui=248020715 (08.07.2025).

Most regional business cycles in Poland lasted around ten quarters. The longest average cycles were observed in Małopolskie, Mazowieckie, Opolskie, and Świętokrzyskie, while the shortest were found in Dolnośląskie, Łódzkie, Podkarpackie, Pomorskie, Warmińsko-Mazurskie, and Wielkopolskie. In most regions, the upward phases of the business cycle were longer than the downward ones. The opposite pattern was observed in Kujawsko-Pomorskie, Lubuskie, Opolskie, and Wielkopolskie.

In Portugal, the average duration of regional business cycles was about eleven quarters. The shortest cycles were identified in the Lisbon area and

the Azores (ten quarters), while the longest occurred in the southern region of Algarve (sixteen quarters). In all regions except Alentejo, the upward phase was on average longer than the downward one.

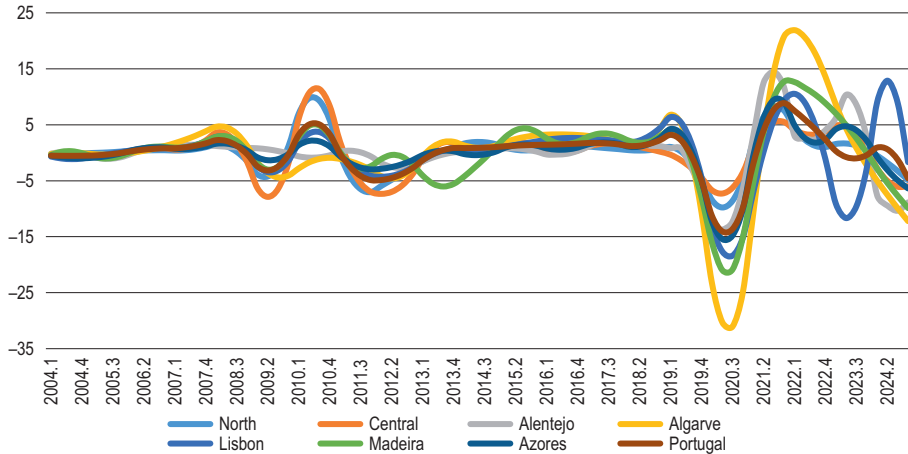


Fig. 2. Business Cycles in Portugal Regions, 2004–2023

Source: own calculations based on the data from Statistics Portugal.

Apart from length and coherence, regional business cycles also differ in terms of volatility and standard deviation. An analysis of the average standard deviation across regions makes it possible to identify provinces characterised by more balanced business cycles, namely Kujawsko-Pomorskie (6.63), Śląskie (6.85), Lubelskie (7.01), Lubuskie (7.06), Opolskie (7.14), and Podkarpackie (7.69). A similar pattern is observed when considering the coefficient of variation.

By contrast, regions with relatively high levels of standard deviation include Mazowieckie (10.20), Wielkopolskie (8.75), Podlaskie (8.47), Małopolskie (8.04), Zachodniopomorskie (8.03), Warmińsko-Mazurskie (7.85), and Świętokrzyskie (7.62). This may result from a relatively higher degree of specialisation. An exception is observed in Małopolskie, Wielkopolskie, and Warmińsko-Mazurskie, where this relationship is less clear.

Differences in volatility are also reflected in the average amplitude of fluctuations. The highest amplitudes of upward and downward deviations are found in regions with relatively high sensitivity to business cycle fluctuations, i.e., regions with a higher degree of specialisation. Such characteristics were observed in Dolnośląskie, Kujawsko-Pomorskie, Lubelskie, Mazowieckie, Małopolskie, Opolskie, Podlaskie, Pomorskie, Wielkopolskie, and Zachodniopomorskie.

Some of these regions (e.g., Lubelskie, Opolskie, Pomorskie) display relatively low standard deviation levels, which can be interpreted as relatively balanced average business cycle fluctuations. In contrast, the remaining regions are characterised by more heterogeneous business cycle patterns.

Table 5

The intensity of the Poland GDP time series and the individual provinces

Country/Voivodeship	Standard Deviation (in p.p.)	Coefficient of Variation (in %)	Average Amplitude (in %)		
			Upward Phases	Downward Phases	Cycles
POLAND	6.88	6.72	2.3	2.4	-0.1
Dolnośląskie	7.36	6.75	2.9	2.6	0.3
Kujawsko-Pomorskie	6.63	6.04	2.8	2.7	0.1
Łódzkie	7.24	6.58	2.4	2.7	-0.3
Lubelskie	7.01	6.37	2.8	3.1	-0.3
Lubuskie	7.06	6.42	2.7	2.8	-0.1
Małopolskie	8.04	7.18	2.1	2.5	-0.4
Mazowieckie	10.20	9.08	2.9	2.8	0.1
Opolskie	7.14	6.56	2.9	2.4	0.5
Podkarpackie	7.69	7.03	2.0	2.0	0.0
Podlaskie	8.47	7.74	2.9	2.9	0.0
Pomorskie	7.59	6.93	2.9	2.7	0.2
Śląskie	6.85	6.27	2.8	2.7	0.1
Świętokrzyskie	7.62	7.04	2.6	2.4	0.2
Warmińsko-Mazurskie	7.85	7.19	2.3	2.5	-0.2
Wielkopolskie	8.75	7.96	2.7	2.9	-0.2
Zachodniopomorskie	8.03	7.26	2.7	2.8	-0.1

The + (-) sign refers to a lead (lag) in quarters with respect to the reference series.

Source: as in Table 3.

The analysis of the morphological structure of regional business cycles in Portugal reveals a positive impact of services on the variability and dynamics of cyclical fluctuations. The average standard deviation of the national business cycle in Portugal amounts to 1.92 percentage points, which is significantly lower than the corresponding indicator for Poland. Cyclical variability in Portuguese regions ranges from 1.80 in the Central region to 5.26 in Madeira. Similar values were observed for the coefficient of variation across regional economies. Consequently, the amplitudes of both contractionary and expansionary phases were also relatively low. On this basis, it can be concluded that a higher share of services in GDP – both at the national level and in individual regions – contributes to stabilising cyclical fluctuations and thereby enhances resilience to external economic shocks. As is well known, in the case of Portugal, this is primarily associated with the predominance of tourism services, whose contribution to GDP is several times higher than in Poland. The indicators of the morphological structure of regional business cycles in Portugal are presented in Table 6.

Table 6

The intensity of the Portugal GDP time series and the individual regions

Country/Region	Standard Deviation (in p.p.)	Coefficient of Variation (in %)	Average Amplitude (in %)		
			Upward Phases	Downward Phases	Cycles
PORTUGAL	1.92	1.92	1.4	1.5	-0.1
Continental Area	1.91	1.91	1.4	1.5	-0.1
North	2.18	2.17	1.6	1.5	0.1
Central	1.80	1.80	1.4	1.2	0.2
Lisbon Area	2.00	1.99	1.7	1.8	0.1
Alentejo	2.42	2.43	2.3	2.5	-0.2
Algarve	2.98	2.97	2.4	2.5	-0.1
Azores	2.36	2.34	1.9	1.8	0.1
Madeira	5.26	5.23	2.9	2.4	0.5

Source: own calculations based on: Statistics Portugal. Retrieved from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=cn_quadros&boui=248020715 (8.07.2025).

The differing morphological structures of regional cycles in the countries under study, and consequently their varying sensitivity to business cycle fluctuations, may also be explained by the relatively low share of industry and construction in GDP, as observed in Portugal's regions. As highlighted earlier and confirmed by previous research (Fatás, 1997; Horváth, 2000; Moro, 2012), industry constitutes the most procyclical component of GDP and is highly sensitive to cyclical fluctuations. Construction, by contrast, responds strongly to changes in economic policy, particularly monetary policy (Warżala, 2016). In Portugal, the combined share of these two sectors averages around 20% of GDP; however, in some of the country's most prominent tourist regions – such as the Algarve, Lisbon Area, Madeira, and the Azores – it does not exceed 12%. This structural characteristic may help to explain the lower amplitude of cyclical fluctuations observed both nationally and, in those regions, where the shares of industry and construction are smallest.

In Poland, by comparison, the average contribution of the two sectors reaches 33.9%, and in certain regions (Lubelskie, Opolskie, Mazowieckie, Śląskie) it exceeds 40%. Coupled with the previously noted regional specialization in specific branches of industry, this structural profile may contribute to larger cyclical amplitudes, driven by so-called asymmetric shocks.

The analysis seems to confirm the conclusion drawn from the literature review: countries with a larger share of services in their GDP appear less sensitive to business cycle fluctuations. This research finds this to be the case for Portugal. Although the total share of services in Portugal is similar to that of Poland,

the structure of these services is substantially different. Portugal's business cycles are smoother and longer and demonstrate a higher level of synchronization.

The analysis highlights substantial regional variation in business cycle dynamics between two economies with broadly comparable levels of development but markedly different GDP structures, namely Poland and Portugal.

Both countries exhibit heterogeneity in terms of GDP composition, both at the aggregate and regional levels. Nationally, Poland is characterised by a lower share of services and a higher contribution of industry and construction, while agriculture also accounts for a relatively larger proportion of output. These structural characteristics shape the morphology of regional cycles.

By contrast, in Portugal the combined share of industry and construction is roughly half that observed in Poland, with services assuming a dominant role in value added. Within the services sector, tourism is the most significant component. As shown in earlier studies, the seasonal nature of tourism tends to amplify cyclical fluctuations rather than dampen them. Nevertheless, in some regions the tourist season is sufficiently extended to provide a stabilising effect on local cycles.

A key limitation for deeper empirical investigation is the absence of regional-level data on the contribution of tourism to GDP in either country (tourism satellite accounts are only available at the national level). Nonetheless, aggregate data on tourism's share in GDP allow for meaningful cross-country comparison. As an imperfect but informative proxy, this study employs the contribution of a subsector of services that includes transport, accommodation, food services, information, and communication.

Overall, Polish regions display a lower degree of synchronisation with the national cycle than Portuguese regions. This finding may have important implications for Poland's prospective accession to the euro area, though it warrants further investigation.

In terms of the morphology of regional cycles, the results show that Polish regions experience greater amplitudes, shorter fluctuation intervals, and more pronounced phase shifts than their Portuguese counterparts. This reflects the relatively larger role of procyclical sectors – industry and construction – in Polish regional economies. Furthermore, Poland's provinces exhibit pronounced sectoral specialisation, as outlined in regional development strategies, which increases their exposure to asymmetric shocks. Tourism, while present in Polish regions, exerts a largely procyclical influence due to its high seasonality. In Portugal, by contrast, the longer duration of tourist demand throughout the year contributes to a more stabilising effect on regional and national cycles.

The above conclusions regarding the degree of synchronization and the morphology of regional cycles at the national level are significant from the perspective of economic policy, i.e. fiscal and monetary policy, which requires adjustment to ongoing cyclical developments. This issue will be the subject of future research.

Conclusions

The findings that emerge from my research lead to several conclusions. First, the structure of GDP has a crucial impact on business cycle morphology. A comparison of two different countries with respect to their GDP structures showed that countries with a higher share of services (and a higher share of tourism) are generally less affected by global economic disturbances. Thus, it can be concluded that the structure of GDP, rather than its level, is more important in influencing business fluctuations. Such economies demonstrate smoother and longer regional business cycles that are more resilient to external economic shocks. These conclusions are universal in nature and do not apply to specific cases, such as the crisis caused by the COVID-19 pandemic. During that period, a high share of services was a strain on the economy, as it was linked to restrictions such as the ban on direct human contact.

The second conclusion is that regions in countries with a higher share of services also demonstrate a higher level of business cycle synchronization at the regional level. This is an important issue when central authorities undertake anticyclical monetary or fiscal policies at the national level. It is also a crucial criterion for conducting adequate monetary policy at the Eurozone level.

For local or regional authorities, the results of my research indicate that to avoid serious demand or supply shocks, regional economies should be diversified in terms of their GDP structure. While services can act as an economic stabilizer, in specific and unfavourable circumstances – like the COVID-19 pandemic – they can also present a real problem for the local labour market. The strong performance of regions with more diversified structures highlights economic diversification as a key source of resilience. Accordingly, policy frameworks should emphasize support for broad-based regional development, including measures that encourage SME activity and the expansion of service clusters, particularly in regions with highly concentrated production structures.

The research needs to be continued, as only tourism services were investigated. In the next stage of the study, financial, digital, and other types of services should also be examined in the context of regional and national resilience to business cycle fluctuations.

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REVIEW OF MIGRATION STUDIES CONDUCTED BY THE NATIONAL BANK OF POLAND: METHODOLOGICAL EVOLUTION AND RESEARCH CHALLENGES

Adam Panuciak

Faculty of Economics and Finance in Warsaw
Nicolaus Copernicus Superior School

ORCID: <https://orcid.org/0009-0009-8761-1974>

e-mail: a.panuciak@gmail.com

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Abstract

The aim of this article is to present the evolution of migration research conducted by the National Bank of Poland (NBP) in the period 2007–2025 and to identify the main methodological challenges arising under conditions of external shocks. The paper reviews research approaches applied both to Polish emigrants residing abroad and to foreign nationals working in Poland. Particular attention is devoted to methodologies used in studies of immigrants from Ukraine, due to their dominant share in the structure of migration inflows. Data on Ukrainian citizens currently constitute an important component of Poland's balance of payments estimates, including workers' remittances and compensation of employees. The findings highlight the necessity of combining survey data with administrative registers and point to the need for further development of migration research at NBP in the context of a changing geopolitical environment.

PRZEGLĄD BADAŃ MIGRACYJNYCH NARODOWEGO BANKU POLSKIEGO: EWOLUCJA METODYCZNA I WYZWANIA BADAWCZE

Adam Panuciak

Kolegium Ekonomii i Zarządzania w Warszawie
Szkoła Główna Mikołaja Kopernika

Kody JEL: F22, C83, J61.

Słowa kluczowe: Narodowy Bank Polski, badania migracyjne, bilans płatniczy.

Abstrakt

Celem niniejszego artykułu jest przedstawienie ewolucji kierunków badań migracyjnych prowadzonych przez Narodowy Bank Polski (NBP) w latach 2007–2025 oraz identyfikacja głównych wyzwań metodycznych w warunkach szoków zewnętrznych. Artykuł dokonuje przeglądu podejść badawczych stosowanych zarówno wobec polskich emigrantów, jak i cudzoziemców pracujących w Polsce. W artykule szczególną uwagę poświęcono metodom badania imigrantów z Ukrainy ze względu na dominujący udział tej grupy w strukturze napływu. Dane o obywatelach Ukrainy stanowią obecnie istotny element szacunków bilansu płatniczego Polski (w tym przekazów pieniężnych i wynagrodzeń pracowników). Wnioski z analizy wskazują na konieczność łączenia danych ankietowych z rejestrami administracyjnymi oraz dalszy rozwój badań migracyjnych w NBP w zmieniającym się otoczeniu geopolitycznym.

Introduction

Contemporary migration processes, encompassing both emigration and immigration, significantly shape the socio-economic situation of developed countries, including Poland. Migrants participate in international flows of labour and capital, affect labour markets, and generate substantial financial transfers that are of importance for the balance of payments.

Poland has for many years experienced a relatively high level of emigration. According to data from the Statistics Poland (GUS, 2025), nearly 1.5 million Polish citizens stayed abroad temporarily for 12 months or longer. Approximately 94% of Polish emigrants resided in European countries, with the largest concentrations recorded in the United Kingdom (415 thousand), Germany (407 thousand), and the Netherlands (132 thousand). The most dynamic growth in Polish emigration, similarly to that observed among emigrants from other Central and Eastern European countries, occurred after accession to the European Union in 2004 (Orgańskiak-Krzykowska & Machnis-Walasek, 2016, p. 92). This accession was associated with the introduction of new legal regulations that guaranteed citizens of the Member States the freedom of movement and residence within the territory of the EU (Arts. 20 & 21 TFEU), including the right to take up employment in other Member States (Art. 45 TFEU). At the same time,

because of pre-accession negotiations, some Member States were allowed to apply transitional periods regulating access of citizens of the new Member States to their labour markets.

At the same time, a significant phenomenon has been the inflow of immigrants to Poland, particularly from Eastern European countries. In recent years, immigration has partially offset demographic challenges such as declining fertility rates, population ageing, and a lower number of marriages, leading to a positive net migration balance (Fihel *et al.*, 2023, p. 265). These changes underscore the need for systematic monitoring of migration flows, both from the perspective of the labour market and macroeconomic stability.

In response to the growing importance of migration, the National Bank of Poland conducts regular migration surveys, coordinated by the Statistics Department in cooperation with other NBP units. Their aim is to provide data necessary for analytical purposes, including the compilation of the balance of payments, in particular information related to employee compensation and migrants' remittance transfers (NBP, 2024, p. 4), in accordance with the statutory mandate of the central bank (Act of 29 August 1997, *Journal of Laws* of 2020, item 2027). This information is used, *inter alia*, to analyse the impact of migration on the labour market, inflation dynamics, and overall economic equilibrium. The provision of data from migration surveys strengthens the position of the NBP as a key provider of statistical data, alongside the Statistics Poland and the Social Insurance Institution (ZUS). Of particular importance is the analysis of the evolution of NBP migration surveys in the years 2007–2025, a period marked by significant external shocks such as the COVID-19 pandemic and mass migration related to Russia's aggression against Ukraine. These developments necessitated flexible adjustments to the tools and methods applied in migration research.

NBP migration surveys cover both Polish emigrants and foreign nationals undertaking employment in Poland, with a particular focus on immigrants from Ukraine, who have constituted the dominant inflow group in recent years. According to data from the ZUS, at the end of the third quarter of 2025 the number of registered foreign nationals paying contributions to pension and social security amounted to nearly 1.3 million persons, of whom 66% were Ukrainian citizens (ZUS, 2025). Including in the statistics also individuals, including children from Ukraine, holding residence permits in Poland increases the number of foreign nationals from that country to over 1.5 million (Urząd do Spraw Cudzoziemców, 2025), and this figure has increased fivefold over the past four years. The growing scale and changing structure of migration have highlighted the need to integrate survey data with administrative registers.

The aim of this article is to present the evolution of methodological approaches applied in NBP migration surveys in the years 2007–2025 and to identify key research challenges arising from the dynamically changing economic and geopolitical environment.

The evolution of NBP migration surveys and methodical challenges

The National Bank of Poland applies diversified research approaches and evolving methodical frameworks in migration surveys, adapted to changing external conditions, the scope of the research, and the characteristics of the migrant populations under study. A major challenge in conducting these surveys has been sudden migration shocks affecting the Polish economy, including Poland's accession to the European Union and the subsequent intensification of labour emigration, the armed conflict in Ukraine in 2014 accompanied by increased immigration, the COVID-19 pandemic, and the outbreak of the full-scale war in Ukraine in 2022. These developments necessitated continuous improvement of research instruments, measurement scope, and data sources, through the development and modification of survey-based studies, which enable the collection of information unavailable in administrative registers. In the years 2007–2025, the NBP conducted migration surveys covering both emigrants residing abroad and immigrants undertaking employment in Poland, gradually adjusting research methods to evolving conditions.

Research on Polish emigration abroad

Research on Polish emigration abroad constituted the first area of migration studies conducted by the National Bank of Poland (Tab. 1). In the years 2007–2012, these studies focused on Polish emigrants in the United Kingdom and Ireland, reflecting the mass influx of Poles to these countries following the opening of their labour markets. The research employed questionnaire-based interviews carried out as part of diagnostic surveys.

In subsequent years, the geographic scope of the surveys was gradually expanded. In 2009, the Netherlands was included in the research, and in 2010 – Germany, marking the first pilot survey conducted in this region. Early editions of the surveys focused primarily on the analysis of emigrants' labour market activity, migration motives, and remittance behaviours, providing information relevant for Poland's balance of payments statistics.

In 2016–2018, further survey editions were conducted, with particular attention to Poles residing in the United Kingdom, due to the need to assess their migration plans in the context of the country's exit from the European Union, initiated by the referendum of 23 June 2016. The objectives of the surveys included, among others, determining the scale at which temporary emigration was transitioning into settlement migration, identifying changes in remittance patterns, and evaluating the impact of wage differentials and labour market conditions on Polish migration decisions.

Table 1

NBP studies of Poles abroad

Year	Country	Methods/Techniques	Sample Size	Authors
2007	United Kingdom	Quantitative, PAPI	800	Hołda <i>et al.</i> (2011, p. 16), Chmielewska (2015, p. 69-71)
	Ireland	Quantitative, PAPI	800	
2008	United Kingdom	Quantitative, PAPI	1500	
	Ireland	Quantitative, PAPI	1000	
2009	United Kingdom	Quantitative, PAPI	1500	
	Ireland	Quantitative, PAPI	1000	
	Netherlands	Quantitative, PAPI	700	Chmielewska (2015, p. 69-71)
	Germany	Quantitative, PAPI	300	
2010	United Kingdom	Quantitative, PAPI	1500	
	Ireland	Quantitative, PAPI	1000	
	Netherlands	Quantitative, PAPI	700	
	Germany	Quantitative, PAPI	1500	
2011, 2012, 2014	United Kingdom	Quantitative, CAPI	1500	
	Ireland	Quantitative, CAPI	1000	
	Netherlands	Quantitative, CAPI	700	
	Germany	Quantitative, CAPI	1500	
2016	United Kingdom	Quantitative, CAPI	1500	Chmielewska <i>et al.</i> (2017, p. 36)
	Ireland	Quantitative, CAPI	1000	
	Netherlands	Quantitative, CAPI	700	
	Germany	Quantitative, CAPI	1500	
2018	United Kingdom	Quantitative, CAPI	1500	Chmielewska <i>et al.</i> (2019a, p. 46)
	Norway	Quantitative, CAPI	700	
	Netherlands	Quantitative, CAPI	700	
	Germany	Quantitative, CAPI	1500	
2022	United Kingdom	Quantitative, CAPI	1000	Chmielewska-Kalińska <i>et al.</i> (2023a, p. 47)
	Netherlands	Quantitative, CAPI	500	
	Germany	Quantitative, CAPI	1000	
2024	Germany	Quantitative, CAWI	400, 1000	N/A
2025	Germany	Quantitative, CAWI	400, 1000	N/A

Source: own study based on secondary data from various NBP and OBMF reports.

In all survey editions, a stratified purposive sampling method was applied, with regions covered by the survey serving as strata. Within each stratum, respondents were selected according to a specified age structure, considering minimum criteria for gender, occupation, and employment sector. These criteria were adjusted for the specific characteristics of the labour markets in each country, allowing for a more accurate representation of the surveyed emigrant populations.

Continuing the principle of survey cyclicity (on average every two years), in 2018 another edition of the emigration surveys was conducted in four countries. Ireland was replaced by Norway, justified by the observed decline in the number of emigrants heading to Ireland and the growing importance of Norway as a destination for Polish labour migration. The research objectives included, among others, assessing the impact of Polish then-record low unemployment on migration decisions, analysing the characteristics of emigration to Norway, identifying trends in remittance transfers, and evaluating the effect of Brexit on the situation of emigrants in the United Kingdom. Methodically, the survey maintained continuity with previous editions. It examined the specific features of Polish emigration to Norway, trends in remittance behaviour, and whether Brexit had altered emigrants' plans and their circumstances in the UK. The emigration survey followed similar methodological assumptions to the previous edition of studies abroad. In 2020, due to constraints resulting from the COVID-19 pandemic, surveys on Polish emigration were not conducted. The next edition was carried out in 2022, representing the most recent emigration study published as a technical report.

Research on immigration of foreign nationals to Poland

Since 2012, the scope of migration surveys conducted by the National Bank of Poland has been expanded to include the immigration of foreign nationals to Poland, initially focusing on citizens of Ukraine, Belarus, and Russia, who at that time constituted the dominant groups of labour migrants (Górny *et al.*, 2013) (Tab. 2). The main objective of the 2012 survey was to assess the scale and nature of labour immigration from Ukraine, estimate the volume of remittance transfers, and test selected methodological solutions in the study of migrant populations.

The survey compared two sampling strategies: purposive stratified sampling, based on criteria such as citizenship or employment sector, and Respondent Driven Sampling (RDS), a chain-referral method utilizing migrants' social networks and an incentive system. RDS is a more formalized method than the "snowball" approach and, when certain assumptions are met, allows for unbiased estimation of population parameters (Gile, 2011), making it a useful tool for studying hard-to-reach groups. RDS was applied in subsequent survey editions until 2020, when its use was limited by rising costs and pandemic-related restrictions that hindered respondent recruitment.

In the 2015 survey, designed to capture a new wave of migration after 2014, a mixed-methods approach was employed. The quantitative component targeted Ukrainian immigrants residing in Warsaw, excluding migrants who had arrived for non-labour purposes. The qualitative component included

Table 2

NBP studies of foreigners in Poland

Year	Country	Methods/Techniques	Sample Size	Authors
2012	Ukrainians	Quantitative, RDS, PAPI	500	Górny <i>et al.</i> (2013, p. 16)
	Belarusians	Quantitative, RDS, PAPI	500	
	Russians	Quantitative, RDS, PAPI	500	
2015	Ukrainians (WAW)	Quantitative, RDS, PAPI	710	Chmielewska <i>et al.</i> (2016, p. 32)
	Local authorities	Qualitative, Interviews	62	
2016,	Ukrainians (WAW)	Quantitative, RDS, PAPI	400	Chmielewska <i>et al.</i> (2018, p. 35)
2017	Ukrainians (LUB)	Quantitative, RDS, PAPI	400	
2018,	Ukrainians (WRO)	Quantitative, RDS, PAPI	500	Chmielewska <i>et al.</i> (2019b, p. 8)
2019	Ukrainians (BDG)	Quantitative, RDS, PAPI	310	
2019	Ukrainians (WAW)	Quantitative, RDS, PAPI	1319	Górny <i>et al.</i> (2020, p. 17)
2019,	Ukrainians	Quantitative, PAPI	2981	Strzelecki (2020, p. 21)
	Polish entrepreneurs	Quantitative, CATI, CAWI	159	
2020	Ukrainians (WAW)	Quantitative, RDS, CATI/CAWI	296	Górny <i>et al.</i> (2021, p. 21)
	Ukrainians (WRO)	Quantitative, RDS, PAPI	510	Strzelecki & Dudek (2021, p. 5)
2022	Ukrainians	Quantitative, PAPI	3165	Chmielewska-Kalińska <i>et al.</i> (2022, p. 6)
	Ukrainians	Quantitative, PAPI	3934	Chmielewska-Kalińska <i>et al.</i> (2023b, p. 6)
2023	Ukrainians	Quantitative, PAPI	3658	Dudek <i>et al.</i> (2023, p. 45)
2024	Ukrainians	Quantitative, PAPI	3778	Dudek <i>et al.</i> (2024a, p. 30)
	Belarusians	Quantitative, PAPI	775	Dudek <i>et al.</i> (2024b, p. 40)
2025	Ukrainians	Quantitative, PAPI	3965	Dudek & Strzelecki (2025a, p.71)
	Belarusians	Quantitative, PAPI	750	Dudek & Strzelecki (2025b, p. 28)

Source: own study based on secondary data from various NBP reports.

62 in-depth interviews with local authorities and employers in the Grójec and Płońsk regions. The questions addressed the socio-economic characteristics of migrants and remittance transfers.

In response to the mass migration triggered by the war in Ukraine, the NBP launched a nationwide survey encompassing both labour migrants who arrived before 24 February 2022 and war refugees, reflecting the distinction between voluntary and forced migration. This distinction has been widely discussed

in the scholarly literature (Carling, 2024). In the initial waves of migration, the predominant motivation was the pursuit of improved economic conditions, whereas after the outbreak of the war, migration patterns changed, transforming into a different form of mobility (King *et al.*, 2022, p. 6, 7).

In surveys conducted after 2022, results were weighted based on the PESEL-UKR register, which improved the representativeness of the findings, particularly for the population of forced migrants. The survey was repeated in 2023, expanding its thematic scope to include the participation of immigrant children in the Polish education system, while maintaining comparable methodological assumptions. In 2024, the scope of the research was further extended to include immigrants from Belarus, who constituted the second-largest group of foreign nationals in Poland (Dolińska & Makaro, 2024, p. 5). At the same time, studies among Ukrainian citizens were continued, with the scope broadened to cover issues of social integration, economic self-sufficiency, and regional diversity. Since 2025, the National Bank of Poland's immigration surveys have been conducted based on the established methodology, with an increased focus on regional analyses carried out in collaboration with staff from NBP's regional branches.

Methodical challenges in migration studies conducted by the NBP

The most recent immigration surveys conducted between 2022 and 2025 revealed a range of organizational and methodological challenges that significantly affected the implementation and conduct of interviews (Tab. 3). A systematic decline in respondents' willingness to participate in the surveys was observed, with some cases marked by distrust toward interviewers and doubts regarding the purpose of the study. Significant support in contacting respondents was provided by foundations and non-governmental organizations, which enjoyed the trust of immigrants and often acted as mediators, facilitating access to the surveyed population.

Another important challenge was the logistical difficulty of reaching immigrants employed in small towns. The increasing dispersion of the target population complicated fieldwork. Additionally, restrictions stemming from sampling criteria, particularly limits on the number of respondents that could be recruited within a single institution or workplace, proved difficult to implement in practice. During the surveys, a need for modifications to research instruments was also noted, such as the introduction of electronic questionnaire versions and the shortening of survey questions to improve response rates.

Table 3

Methodical challenges in migration studies conducted by the NBP and mitigation measures

Methodical Challenge	Challenge Description	Mitigation Strategy
Declining participation	Distrust of researchers, privacy concerns, lack of time or motivation	Engaging new organizations and associations to mediate with respondents; providing small incentives for participation
Sudden migration changes	Rapid shocks (COVID-19, Ukraine war) limited previous research frameworks	Flexible study design, nationwide surveys, rapid adaptation of tools, increased survey frequency
Hard-to-reach populations	Migrants in agriculture, informal sectors, smaller towns, mobile or wealthy	Introduction of electronic forms (from 2025); use of social organizations and local institutions as intermediaries
High costs of RDS sampling	Respondent Driven Sampling (RDS) is costly and operationally challenging	Gradual shift from RDS after 2020 to standardized methods supported by administrative data
Maintaining longitudinal comparability	Expanding survey scope risks losing comparability between waves	Keep core questionnaire constant, add thematic modules for emerging topics
Regional migration differences	Significant regional variation reduces usefulness of national averages	Strengthen regional analyses; involve regional branches of NBP in data collection
Sensitivity of questions	Respondents reluctant to answer questions on wages or percentages	Anonymous surveys with confidentiality statement; use Likert scales for sensitive items

Source: own elaboration based on feedback from NBP regional branches.

Practical implications

The results of the survey have not only cognitive value but also significant practical importance, as they constitute one of the primary sources of information used to estimate the components of the current account of the balance of payments. In balance of payments statistics, migration processes are reflected in four main items. These are, respectively: compensation of employees (definition according to BPM6, A5.12), expenditures of seasonal and border workers (BPM6, 4.125), taxes and social contributions (BPM6, 12.28), and workers' remittances (BPM6, 12.22). In accordance with balance of payments principles, all transactions between residents and non-residents of a given country are recorded, including those involving institutions, international organizations, and individuals (BPM6, 2009, p. 7).

A resident is defined as an individual whose centre of economic interests is located within a given country and who resides there for a minimum of 12 months. Migration surveys are an important source of information on the structure

and characteristics of specific migrant groups, which is applied in estimating inflows and outflows within the balance of payments. They allow for the determination of key economic parameters, such as average wage levels, the frequency of financial transfers, and living costs. These data, supplemented with administrative information (e.g., from ZUS, GUS, and various ministries), form the basis for estimating individual components of the balance of payments.

The presented data (Tab. 4) and (Tab. 5) illustrate outflows from Poland related to the employment of foreign workers, including Ukrainian citizens, in the years 2014–2024.

Table 4

Outflows from Poland related to the employment of foreign workers

Bln PLN	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Compensation of employees	6.3	8.9	13.9	22.8	25.5	28.5	27.9	32.5	40.0	39.2	24.3
Taxes and social contributions paid abroad	0.4	0.8	1.2	1.9	2.6	3.0	2.5	3.3	5.4	5.4	4.3
Expenditures of seasonal and border workers	2.1	3.0	4.7	7.8	8.7	9.7	9.5	11.1	13.6	13.4	8.3
Workers' remittances	0.6	0.8	0.8	1.1	1.6	2.3	2.9	3.9	5.3	7.7	6.8
Personal remittances	4.4	5.9	8.8	14.2	15.9	18.1	18.8	22.0	26.2	28.1	18.5

Source: own elaboration based on NBP balance of payments data.

Table 5

Outflows from Poland related to the employment of Ukrainian workers

Bln PLN	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Compensation of employees	5.4	8.0	12.6	20.7	22.6	24.9	24.0	26.7	27.5	23.6	16.3
Taxes and social contributions paid abroad	0.1	0.4	0.7	1.4	1.8	2.1	1.7	2.1	3.3	2.9	2.1
Expenditures of seasonal and border workers	1.9	2.8	4.3	7.1	7.7	8.5	8.2	9.1	9.4	8.1	5.6
Workers' remittances	0.1	0.2	0.3	0.5	0.9	1.3	1.8	2.5	3.4	4.9	4.3
Personal remittances	3.6	5.0	7.8	12.8	13.9	15.7	15.9	17.9	18.2	17.5	12.9

Source: own elaboration based on NBP balance of payments data.

During the period under analysis, a marked increase in compensation of employees and expenditures of seasonal and cross-border workers is observed, particularly during so-called migration shocks, characterised by a sudden rise in the number of migrants in Poland. At the same time, the data indicate the growing importance of workers' remittances sent to their countries of origin, although the pace of this growth noticeably slowed in 2023.

This slowdown was associated, among other factors, with the prolonged armed conflict in Ukraine, as a result of which some Ukrainian citizens residing in Poland for more than one year became residents of Poland for balance of payments purposes. An additional factor reducing the growth rate was the declining share of migrants sending money abroad between 2022 and 2024. In 2024, only 55% of pre-war migrants and 30% of war refugees reported making remittance transfers (Dudek *et al.*, 2024a, p. 28).

Analysis of balance of payments data also indicates a systematic increase in inflows from taxes and social security contributions up to 2023. In 2024, the flow of fiscal revenues decreased, which may be related to the transition of migration from temporary forms toward more permanent settlement. In 2024, 48% of pre-war migrants and 21% of war refugees expressed the intention to settle permanently (Dudek *et al.*, 2024a, p. 33).

The changes observed in balance of payments data highlight the validity and necessity of conducting regular migration surveys, which enable proper interpretation and reliable estimation of the individual components of the balance of payments.

Conclusions

Migration surveys conducted by the National Bank of Poland are empirical in nature and provide essential data for economic analyses, particularly for compiling the balance of payments, including estimates of workers' remittances and compensation of employees. Conducted cyclically across all voivodeships, they are among the largest surveys of this type in the country and allow for systematic observation of migration trends over time and across regions. Beyond the economic dimension, the surveys also cover socio-demographic aspects, such as residence plans, social integration, and age and gender structure. A key strength of these surveys is their methodological flexibility and the ability to rapidly adapt research tools to changing economic and geopolitical conditions, including the opening of EU labour markets, conflicts in Ukraine, the COVID-19 pandemic, and the escalation of the war in 2022.

Combining survey data with administrative registers and official statistics allows for a more comprehensive understanding of migration processes. At the same time, effective estimation of the balance of payments requires close institutional cooperation, as official data sources remain incomplete and poorly synchronized, particularly with regard to the foreign labour market. Despite their high cognitive value, migration surveys face limitations such as difficulties in ensuring sample representativeness, reaching hard-to-access groups, respondent errors, rising costs, and organizational complexity.

Future development of migration research should therefore go hand in hand with improved access to up-to-date public data and the integration of administrative registers based on PESEL register and Border Guard records. The changing migration landscape also requires further evolution of sampling methods, expansion of the survey scope beyond dominant migrant groups, and the development of panel approaches. Survey research may be complemented by alternative data sources, including payment card transaction data. In this evolving migration context, the continued enhancement of NBP migration surveys remains crucial for maintaining their high analytical and practical utility.

Translated by Author

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SEGMENTED REPORTING AND ITS CHANGES AS A RESULT OF THE COVID-19 PANDEMIC IN THE CONSTRUCTION AND REAL ESTATE INDUSTRY

Joanna Dynowska

Institute of Management and Quality Sciences
Faculty of Economic Sciences
University of Warmia and Mazury in Olsztyn
ORCID: <https://orcid.org/0000-0003-4338-2961>
e-mail: joannan@uwm.edu.pl

Katarzyna Krysztofiak

Faculty of Economic Sciences
University of Warmia and Mazury in Olsztyn
e-mail: katarzyna.krysztofiak@student.uwm.edu.pl

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Key words: operating segments, COVID-19 pandemic, IFRS 8, real estate sector, construction sector.

Abstract

This paper analyses the impact of the COVID-19 pandemic on segment reporting in the construction and real estate sector in Poland. The study includes an analysis of the financial statements of companies listed on the Warsaw Stock Exchange in 2019 and 2023. The study results indicate that the COVID-19 pandemic did not cause fundamental changes in the structure of the reported operating segments of the surveyed companies (segmentation by business line still dominates), but it reduced the scope of disclosed financial results. In some cases, a reduction in the number of reported segments was observed, which could be a response to changing market conditions. The study results highlight the flexibility of segment reporting and its ability to adapt to global crises. Although the pandemic did not lead to significant changes in accounting regulations, it forced the adaptation of management strategies to new economic realities.

SPRAWOZDAWCZOŚĆ W UKŁADZIE SEGMENTOWYM I JEJ ZMIANY NA SKUTEK PANDEMII COVID-19 W BRANŻY BUDOWNICTWA I NIERUCHOMOŚCI

Joanna Dynowska

Institut Zarządzania i Jakości
Wydział Nauk Ekonomicznych
Uniwersytet Warmińsko-Mazurski w Olsztynie

Katarzyna Krysztofiak

Wydział Nauk Ekonomicznych
Uniwersytet Warmińsko-Mazurski w Olsztynie

Kody JEL: G00, M41.

Słowa kluczowe: segmenty operacyjne, pandemia COVID-19, MSSF 8, sektor nieruchomości, sektor budownictwa.

Abstrakt

Niniejsza praca analizuje wpływ pandemii COVID-19 na sprawozdawczość segmentową w sektorze budownictwa i nieruchomości w Polsce. Badanie obejmuje analizę sprawozdań finansowych przedsiębiorstw notowanych na Giełdzie Papierów Wartościowych w Warszawie w latach 2019 oraz 2023. Wyniki badania wskazują, że pandemia COVID-19 nie spowodowała fundamentalnych zmian w strukturze wykazywanych segmentów operacyjnych badanych przedsiębiorstw (nadal dominuje segmentacja po linii biznesu), jednak wpłynęła na zmniejszenie zakresu ujawnianych wyników finansowych. W niektórych przypadkach zaobserwowano redukcję liczby raportowanych segmentów, co mogło stanowić reakcję na zmieniające się warunki rynkowe. Wyniki badań podkreślają elastyczność raportowania segmentowego oraz jego zdolność do dostosowania się do globalnych kryzysów. Choć pandemia nie doprowadziła do istotnych zmian w regulacjach rachunkowości, wymusiła adaptację strategii zarządzania do nowych realiów gospodarczych.

Introduction

Accounting is most often considered taking into account its two aspects: financial and management accounting. Today, however, these two areas are intertwining, which affects the area of information processing in the accounting process. Segmented reporting is an example of changes in reporting caused by the increasing complexity of modern organizations and information enforced by managers and external stakeholders across facilities (e.g., distribution channels, departments) (Nita, 2015, p. 288).

The COVID-19 pandemic has had a significant impact on the global economy, including the construction and real estate sectors. One of the areas that has changed significantly is financial reporting, in particular in the context of segment reporting. Segment reporting is a key element of financial

transparency, enabling stakeholders to better understand the operational structure and financial performance of companies.

The purpose of this paper is to analyze changes in segment reporting in the construction and real estate sector in Poland, with a particular emphasis on the impact of the COVID-19 pandemic on these changes. The audit includes an analysis of the financial statements of companies listed on the Warsaw Stock Exchange in 2019 and 2023.

International Financial Reporting Standards in the context of operating segments (IFRS 8)

For investors, one of the most important aspects in financial reporting is segment information. This is justified given the complexity and heterogeneity of listed companies. Thus, segment information provides an understanding of corporate business models and economic dynamics (Veron, 2007, p. 4). The purpose of IFRS 8 is to isolate the financial information held, the effects of which are checked by the entity's CODM (the Chief Operating Decision Maker), which evaluates the company's performance and resource allocation (Alanezi *et al.*, 2016, p. 137).

IFRS 8 focuses on the principle that an entity discloses such information that will be used to assist users of its financial statements in assessing the type and financial effects of the entity's business activities (Official Journal of the European Union, IFRS 8, 2008).

The presentation of financial data by segment is also influenced by the degree of diversification of sales markets or the variety of products offered. Moreover, even when segments are identified, companies do not always fulfill their reporting obligations under IFRS 8, as indicated by the authors of the article, who compare such enterprises as GK Tarczyński S.A. and GK Makarony Polskie S.A. (Daniłowicz & Gierusz, 2023, p. 180).

IFRS 8 has changed the perception of segmental reporting from a risk-based and return-based approach to a management approach. This requires information to be presented from the perspective of management, which is highly controversial in the international and EU context (Aboud *et al.*, 2019, p. 101). Concerns about importing IFRS 8 into EU law; indicated the impact of moving away from a system that clearly shows the definition and reporting of segments by listed EU companies (Aleksanyan & Danbolt, 2015, p. 47).

The principles that characterize IFRS 8 are, among others, indicating the CODM, the main entity making operational decisions (Tsai *et al.*, 2020, p. 3). Disclosing segment information in accordance with the internal reporting structure means that IFRS 8 uses a management approach (Rufino, 2022, p. 1006).

Impact of the COVID-19 pandemic on the financial reporting of entities

The COVID-19 pandemic has undoubtedly had a widespread and multidimensional impact on the operation of individuals. It is a crisis that has threatened the continuity of operations. This makes it all the more difficult for the management boards of companies to correctly present the entity's condition in the financial report in such a way that is understandable to stakeholders. The pandemic period was characterized by uncertainty and volatility of the economic environment, which posed a challenge not only for the previously mentioned management board, but also for statutory auditors verifying the entity's reports (Chrostowska, 2023, p. 12).

The Accounting Standards Committee responded to the needs of the companies by formulating recommendations intended to assist in the preparation of financial statements during the pandemic. Their purpose was to support the recognition of the effects of the pandemic in accounting records and financial statements based on seven key areas: the going concern assumption, prudent measurement of assets and liabilities, valuation of products under unused production capacity, recognition of support received under the anticrisis shield, inventory-taking, the management report, and the recognition of additional operating costs caused by the pandemic (Appendix to Resolution No. 13/2020 of 10 December 2020).

Depending on the industry or country in which the entity operates, the consequences of the impact of COVID-19 on financial reporting vary. The pandemic has led to the phenomenon of "freezing" economic activities due to disorientation and uncertainty in an unusual situation, an international crisis. This also resulted in disorganization in the area of reporting the entity's activities: a broken document circulation cycle, a change in the working time of accountants or difficult supervision and provision of data on economic events. In the first stages of the pandemic (2019), financial statements were delayed due to a backlog of accounting and arrears in the preparation of balance sheets (Bartoszewicz *et al.*, 2021, p. 74). Paradoxically, one of the biggest crises, which was the COVID-19 pandemic, which reached its peak in 2020, did not increase the intensity of work on the unification of international accounting and the introduction of new regulations. In recent years, only a few new IFRS standards have been created, some of which have a narrow area of impact (industry standards). The difficult situation of entities reporting their activities and their results has halted the development of reporting. It was stated that accounting regulations are already demanding and extensive, so the introduction of new ones will hinder the operation of enterprises. Moreover, the new financial reporting requirements, with companies fighting to maintain sales profitability and financial liquidity, will only result in the allocation of additional resources

to observe and implement these standards, which in turn will not help entities in the already difficult operating conditions (Gierusz, 2023, p. 33).

Research conducted in 2025, comparing the presentation of operating segments in the consolidated financial statements of companies listed in sWIG80 in 2019 and 2023, indicated a decrease in the number of entities disclosing this information in the year following the COVID-19 pandemic. Nevertheless, greater interest was observed in the disclosure of intersegment revenues and revenues from external customers. As the authors of the article suggest, this may result from pressure exerted by investors or from the need for internal control (Dynowska & Wrona, 2025, p. 60, 61).

Research methods

The research is based on the analysis of data from financial statements of listed companies operating in the construction and real estate sector. The main research method was content analysis, which allowed systematic processing of the information contained in financial reports.

The study was carried out on the basis of the data contained in the financial statements for 2019 and 2023. The adopted time range of the research allowed the identification of changes in segmented reporting before and after the outbreak of the COVID-19 pandemic.

The research sample covered all companies in the construction and real estate sector listed on the Warsaw Stock Exchange in 2019 and 2023. Therefore, the study included 71 enterprises meeting the above criteria.

The study took into account variables such as the number of operating segments, the identification of key customers, as well as the division of revenues and profits by segments. This analysis allowed us to assess how the COVID-19 pandemic has affected the way information is reported and disclosed in this sector.

Characteristics of the research objects

The analysis includes companies diversified in size and financial results. The table below shows a comparison of the companies key financial data of the surveyed in two different periods: 2019 and 2023. Data analysis allows for the evaluation of changes in the financial structure of the surveyed entities.

The structure of the companies analyzed companies in terms of the presented variables remained relatively stable in the compared years. However, there is a slight upward trend in the number of companies in the ranges with higher revenues and assets. This may indicate an increase in the scale of operations of some companies.

Table 1

Characteristics of the analyzed companies in 2019 and 2023

Category	2019		2023	
	Number of companies	% of companies	Number of companies	% of companies
Value of revenues (PLN thousand)				
up to 500	7	10	5	7
500 – 1,000	0	0	2	3
above 1,000	64	90	64	90
Value of assets (PLN thousand)				
up to 500	4	6	0	0
500 – 1,000	0	0	0	0
above 1,000	67	94	71	100
Earnings per share (PLN)				
below 0	8	11	21	30
0 – 5	53	75	40	56
5 – 10	7	10	4	6
over 10	3	4	6	8
Net profit (PLN)				
below 0	8	11	19	27
0 – 50	4	6	0	0
50 – 100	0	0	0	0
over 100	59	83	52	73

Source: own elaboration based on the companies' financial statements for 2019 and 2023.

The companies presented are mostly profitable, and the average value of earnings per share remains at a similar level, indicating that profitability remained at a similar level before and after the COVID pandemic. Furthermore, the table above indicates the dominance of companies with higher revenue and asset values.

On the basis of the data presented in the table, it should be stated that the surveyed companies indicate relative financial stability and the dominant group are big companies.

Research results

In 2019, 10 of the 71 analyzed companies (10%) did not apply operating segment reporting. In 2023, this percentage increased by only 1 percentage point.

The most commonly used model for reporting operating segments remains segmentation by business line. In 2023, 72% of companies (51 out of 71) applied it, representing an increase of 6 percentage points compared to 2019. The dominance of this approach indicates that enterprises focus on their core areas of activity, which improves reporting transparency and allows for better alignment of operational strategies with the specific characteristics of the markets in which they operate.

Geographical segmentation was applied by 5 companies (7%) in both 2019 and 2023, indicating the stability of this model.

The mixed model, combining segmentation by business line and geographical criteria, was applied by 4 companies in 2023, representing a decrease compared to 2019. This solution enables a more detailed presentation of results taking into account both product and the geographical diversification of business activities simultaneously.

Table 2

Segment reporting in the analysed companies

Year	Segmentation model	Number of companies	Share % of companies
2019	Line of business	47	66
2023	Line of business	51	72
2019	Geographic	5	7
2023	Geographic	5	7
2019	Mixed	9	13
2023	Mixed	4	6

Source: own elaboration based on the companies' financial statements for 2019 and 2023.

An analysis of changes in the number of operating segments disclosed by selected companies in 2019 and 2023 provides interesting conclusions about management strategies and adaptation to changing market conditions. In particular, attention was paid to changes in the number of segments, revenues, non-current assets, earnings per share (EPS), and net financial result.

Changes in the structure of the companies operating segments of the analysed in the period 2019–2023 revealed several important trends. In 19.72% of cases (14 of 71 companies), a decrease in the number of operating segments in 2023 compared to 2019. In this group, the number of segments presented ranged from 0 to 5, while the scale of reduction amounted to between 1 and 3 segments.

Among the 14 analyzed companies, 6 increased their revenues in 2023 compared to 2019. In turn, eight companies recorded an increase in the value of assets in 2023, and five of these cases concern the same entities that reported revenue growth. Similarly, in terms of net financial result, 6 companies achieved a higher result in 2023 than in 2019. Among them, five simultaneously recorded an increase in the value of assets or revenues.

The conducted analysis indicates that, among the entities that reduced the number of presented operating segments, approximately half did not experience negative financial consequences from this change.

In turn, an increase in the number of reported operating segments was observed in 19.72% of the analysed companies (14 out of 71 entities). The number of segments in the period 2019–2023 ranged from 0 to 8, while the increase in 2023 compared to 2019 was between 1 and 3 new segments.

Among the 14 analysed companies, 11 recorded revenue growth and 10 reported a higher value of assets in 2023 compared to the prepandemic period. Despite the predominance of entities characterised by improvement in the indicated categories, only six companies achieved a higher net financial result in 2023.

Meanwhile, in most of the analyzed companies (60.56%, that is, 43 out of 71 entities), the number of reported operating segments remained unchanged. The lack of changes in the segment structure may indicate relative operational stability and the absence of significant strategic transformations in these enterprises during the analysed period. The Table 3 presents changes in the number of operating segments.

Table 3

Number of operating segments of the analyzed companies in 2019 and 2023

Number of segments	2019		2023		Dynamics 2023/2019
	Number	%	Number	%	
No segments	3	5%	3	5%	0%
1 segment	16	23%	22	31%	+37.5%
2 segments	27	38%	18	25%	−33.3%
3 segments	12	17%	13	18%	+8.3%
4 segments	6	8%	8	12%	+33.3%
more than 5 segments	7	9%	7	9%	0%

Source: own elaboration based on the companies' financial statements for 2019 and 2023.

The data presented in Table 3 indicate the relative stability of the overall structure of the number of segments in the companies. Most companies operate in 1 to 3 segments. Moreover, it should be noted that there have been isolated cases of companies that have a large number of segments, which indicates a very

complex organizational structure. However, it is important that a significant number of companies maintain a constant level of the number of segments, proving that the diversification strategy is maintained. The structure of the companies surveyed in terms of operating segments is subject to minor changes but primarily focuses on striving to optimize their operations to adapt to changing market conditions.

Changes in the structure of operating segments and key financial ratios in 2019–2023 reflect various management strategies and adaptation of companies to changing market conditions. Analyzing changes in the number of segments and their impact on financial results, it can be seen that increasing and decreasing the number of segments can lead to an improvement in financial results, depending on the adopted management strategy and adaptation to market conditions. These results underscore the importance of strategic decisions regarding segment structure in the company's context of the management and its financial results.

The analysis of the dynamics of changes in segment reporting indicates that the number of companies reporting one or four segments has increased, while the number of companies reporting two segments has decreased. The categories “no segments” and “>5 segments” have remained unchanged. This may indicate a simultaneous tendency to simplify reporting in some companies and expand it in others, in response to changing market conditions.

The conducted analysis showed that in all companies analysed where a CODM (Chief Operating Decision Maker) was identified, this function was performed by the management board. Therefore, the number of CODMs depended on the size of the management board and was most frequently (30%) made up of three members (see Tab. 4).

Table 4

Number of the company's Management Board of the analyzed companies

Number of board members	Number of companies	Share % of companies
0	15	21%
1	13	18%
2	14	20%
3	21	30%
4	5	7%
5–7	3	4%

Source: own elaboration based on based on the companies' financial statements for 2019 and 2023.

Most often, companies surveyed have a three-person board, which also acts as CODM. This indicates the optimal size of the board, which allows for effective decision making. Moreover, a significant number of companies with boards of one or two members can also be observed. The study of the size of the management

board allows for a depiction and better understanding of the management structure in the audited companies. The results show flexibility in selecting the appropriate size of the management board, which was adapted to the individual needs of a given company.

Conclusions

The purpose of the study was to analyze changes in segment reporting in the construction and real estate sector in Poland, with particular emphasis on the impact of the COVID-19 pandemic on these changes. The audit included an analysis of the financial statements of companies listed on the Warsaw Stock Exchange in 2019 and 2023. The research conducted showed that the COVID-19 pandemic had a differentiated impact on segment reporting in the construction and real estate sectors. In most cases, the structure of the segments remained stable, which may indicate the operational stability of the companies. However, significant changes have been observed in the disclosure of financial results, which may be the result of companies adapting to changing market conditions.

Furthermore, the following conclusions can be drawn regarding the changes in segment reporting as a result of the Covid-19 pandemic:

1. Changes in operating segment reporting observed in 28 companies were twofold in nature. An increase in the number of segments (e.g., from 1 to 5 or from 2 to 3) may indicate a tendency toward business diversification and more detailed reporting. In contrast, a reduction in the number of segments (e.g., from 3 to 2 or complete abandonment of their presentation) may suggest business consolidation and simplification of the management structure.

2. Regardless of the direction of changes in the reporting structure, the companies majority of the analysed recorded improvements in financial indicators, including growth in revenues and the value of fixed assets. The positive trend may indicate that managerial efficiency and operational development are important determinants of financial performance, regardless of the degree of business segmentation.

3. Both maintaining a stable segment structure and expanding it showed a positive correlation with increases in net profit and revenues. This implies that the key factor influencing the improvement of financial results is the effective implementation of the strategy and operational efficiency of the enterprises, rather than merely the number of reported operating segments.

The results of the survey highlight the importance of flexibility in financial reporting in the face of global crises and the need to adapt management strategies to dynamically changing market conditions.

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THE ESSENCE OF SUSTAINABLE DEVELOPMENT AND ITS IMPORTANCE FOR FUTURE GENERATIONS

Apolonia Jaskólska

Faculty of Economic Sciences
University of Warmia and Mazury in Olsztyn
ORCID: <https://orcid.org/0000-0001-6476-2520>
e-mail: apolonia.jaskolska@uwm.edu.pl

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Abstract

Since the second half of the 20th century, the issue of sustainable development has been the subject of intense research and debate within the scientific community. Despite a precise definition, publications on sustainable development have presented divergent interpretations. This phenomenon results from the widespread adoption of sustainable development in scientific and social discourse, leading to numerous misinterpretations by its proponents and opponents. Sustainable development is composed of distinct terms, and their combined meaning is more than the sum of the meanings of the individual components. The subject of this work is sustainable development, and the goal is to analyze and assess sustainable development in the context of its importance for future generations. The main research question is: How can sustainable development impact future generations?

The article employs a literature review of both domestic and international literature and legal acts. Based on the collected material, it was concluded that sustainable development is crucial for the creation of future generations, as it allows access to natural resources and protects against environmental degradation and social and economic crises, ensuring the possibility of continued life and growth. The role of sustainable development is to strike a balance between economic, social, and environmental needs to ensure that the needs of the present generation are met without compromising the ability of future generations to meet their own needs.

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Apolonia Jaskólska

Wydział Nauk Ekonomicznych
Uniwersytet Warmińsko-Mazurski w Olsztynie

Kody JEL: Q01, Q56, M14.

Słowa kluczowe: zrównoważony rozwój, zrównoważona przyszłość, koncepcja zrównoważonego rozwoju, społeczna odpowiedzialność biznesu.

Abstrakt

Problematyka zrównoważonego rozwoju od drugiej połowy XX wieku stanowi przedmiot intensywnych badań i debat w środowisku naukowym. Pomimo jasnej definicji, w publikacjach poświęconych tematowi zrównoważonego rozwoju pojawiały się rozbieżne interpretacje. Zjawisko to stanowi rezultat upowszechnienia koncepcji zrównoważonego rozwoju w dyskursie naukowym i społecznym, która doprowadziła do licznych błędnych interpretacji zarówno ze strony jego zwolenników, jak i przeciwników. Zrównoważony rozwój składa się z odrębnych terminów, a ich łączne znaczenie jest czymś więcej niż sumą znaczeń poszczególnych elementów. Przedmiotem pracy jest zrównoważony rozwój, a celem jest analiza i ocena zrównoważonego rozwoju w kontekście znaczenia dla przyszłych pokoleń. Głównym problemem badawczym jest pytanie: W jaki sposób zrównoważony rozwój może wpływać na przyszłe pokolenia?

W artykule zastosowano metodę przeglądu literatury zarówno krajowej jak i zagranicznej, a także aktów prawnych. W oparciu o zebrany materiał uznano, że znaczenie zrównoważonego rozwoju jest kluczowe dla zapewnienia rozwoju przyszłym pokoleniom, gdyż pozwala on na dostęp nie tylko do zasobów naturalnych, lecz również chroni przed degradacją środowiska oraz kryzysów o charakterze społecznym i gospodarczym, zapewniając możliwość dalszego życia i rozwoju. Rola zrównoważonego rozwoju polega na znalezieniu równowagi między potrzebami gospodarczymi, społecznymi i środowiskowymi, aby zapewnić zaspokojenie potrzeb obecnego pokolenia bez umniejszania możliwości przyszłych pokoleń do zaspokojenia własnych potrzeb.

Introduction

The concept of sustainable development is a response to the modern world's problems. It is seen as a compromise between "having" and "being," thus creating a modern definition of quality of life. The history of this concept and the diverse ways in which it is understood and interpreted complicate its contemporary acceptance. Sustainable development is often defined as development that meets the needs of present and future generations. One of the main goals of sustainable development is improving the quality of life, which is interpreted in various ways and is often treated as a set of factors defining both objective living conditions and the subjective perception of well-being. At the same time, it is essential to establish a hierarchy of needs that determines the quality of life of an individual or group in a specific place (region) and time. Therefore, interpreting the concepts of quality

of life and sustainable development and understanding their interdependence has become a key research topic (Tuziak, 2022).

Sustainability is defined in the Gro Harlem report, "Our Common Future," as development that meets the needs of present generations without compromising the ability of future generations to meet their own needs. Its goal is to ensure economic growth while maintaining socio-cultural and environmental sustainability. This concept assumes that desired progress will encompass three economic, social, and ecological areas. Mohan Munasinghe first proposed this concept at the Earth Summit in Rio de Janeiro in 1992. Each perspective corresponds to a different domain (system) with its goals and means. The economic domain focuses on improving human well-being, primarily through increased consumption of goods and services. The environmental domain focuses on protecting the integrity and resilience of ecosystems. The social domain emphasizes enriching interpersonal relationships, fulfilling individual and collective aspirations, and strengthening values (Kalinowski, 2018).

The development of the idea of sustainable development – a historical and scientific perspective

The concept of sustainable development emerged and developed at a specific time. Its origins can be traced to the 1960s, when public awareness of environmental protection increased, coinciding with the development of the media. Media coverage of environmental disasters heightened awareness of global responsibility for local ecological changes. This increased awareness within the international community led to cooperation in environmental protection. The concept of sustainable development arose as a response to growing concerns about the nature of the relationship between humans and the environment and its consequences at the time (Kenig-Witkowska, 2011).

U'Thant, among others, addressed the issue of the environmental impact of current resource management standards and the threat of resource deficits for future generations. As Secretary-General of the United Nations, he announced the report prepared by the UN Economic and Social Commission entitled "Man and the Environment." This document was released on May 26, 1969, during the UN General Assembly. The document under review highlighted several important issues concerning the environmental consequences of development. Attention was drawn to the growing pressure on the environment, which manifests itself, among other things, in the intensification of land development at the expense of green spaces. Furthermore, the issue of environmental quality was discussed in the context of the quality of agricultural production space, as well as the effects of uncontrolled urban growth and the transformation of their hinterlands.

This publication is considered a turning point in the perception of environmental problems (Namieśnik, 1999).

In his speeches, however, U'Thant did not limit himself to highlighting the problem of human misuse of resources. He also emphasized the need to change the approach to environmental protection and foster a sense of global responsibility. Within the UN, he established structures that still function today for ecological research and implementing projects to support environmental protection. These include the United Nations Development Programme (UNDP) and the United Nations Environmental Programme (UNEP). Their responsibilities include monitoring the implementation of sustainable development objectives on a global scale. In 1968, the Club of Rome, known as a "global think tank," was established in response to the desire of scientists, businesspeople, and politicians to engage in discussions on global responsibility. The report "The Limits to Growth," prepared by the Club of Rome (Meadows, 1973), presented downright catastrophic visions of the planet's future, linked to resource constraints. It highlighted the threats generated by accelerating industrialization and the demographic explosion, connecting them to the problems of hunger and poverty and negative environmental changes, such as a decline in quality and the rapid depletion of resources. The report was consistent with Malthus's concept, which, in the 19th century, predicted the occurrence of a tipping point. According to his theory, the Earth's resources are limited, leading to a growth limit and a reduction in production capacity. This state of affairs could result in a decline in the global population. To prevent this situation, the report's authors proposed the so-called zero growth postulate, i.e., freezing economic growth at the achieved level as a strategy for human survival. This postulate sparked considerable controversy (Ciążela, 2007). It was interpreted primarily as an argument for maintaining the differences in socioeconomic development worldwide in a given period. Regardless of one's assessment of the zero growth concept, it cannot be denied that the Club of Rome report played a key role in initiating international discussion on development issues (Forrester, 1971, 1995).

Following the publication of the famous Club of Rome report, a series of studies was initiated to assess how human activities have led to a critical juncture, characterized by the maximum level of human pressure on Earth's ecological systems exceeding their tolerance limits. These studies demonstrated that humanity has already exceeded growth limits, i.e., the permissible, safe level of economic activity and Earth's population (Michnowski, 2008).

The term "sustainable development" began to be used in literature as early as the mid-1970s. Barbara Ward is credited with pioneering this concept, eventually becoming a central element of the entire concept (Satterthwaite, 2006). In her work, she frequently addressed resource constraints, including those affecting developing countries. She divided them into two groups of limiting factors. The first category consisted of internal factors, stemming from human needs and aspirations to achieve a certain standard of living. The second category,

the external limit, was linked to the physical limitations of the planet's resources. She saw the rationalization of resource management as humanity's only chance for survival (Ward & Dubos, 1972).

She often emphasized that proper management of Earth's resources is closely linked to Christian values. Her work inspired numerous discussions at the Stockholm conference. The reports mentioned earlier drew the international community's attention to the dangers associated with the current environmental approach, which focused primarily on exploiting raw materials (Murphy, 2012).

In the early 1970s, a need arose beyond merely signalling the need for change and attempting to develop a proposed recovery program. From June 5 to 16, 1972, a conference devoted to environmental problems, "We Have Only One Earth," was held in Stockholm under the auspices of the United Nations. This was the first meeting of this magnitude. The primary outcome of the deliberations was the declaration adopted on June 14. It contained 26 principles that addressed, among other things, the need to implement environmental policy, with the clear understanding that it should not be perceived as an impediment to development (Kozłowski, 2007). It also emphasized the need for scientific research and suggested planning as an essential tool that could protect the environment from the effects of human activity. Although the Stockholm Declaration was not legally binding, its provisions were repeatedly referenced in developing international agreements. This declaration marked the first time that a portion of the international community (77 countries voted in favour) committed to prioritizing environmental issues. In 1983, the UN Commission on Environment and Development began operating within the United Nations. The primary outcome of its work was the report "Our Common Future." Besides considering contemporary challenges, such as maintaining an appropriate level of global food production and limiting the amount of resources used in industry, its significance stemmed primarily from its first definition of sustainable development (Kozłowski, 2007).

The UN Commission's report was published in 1987. Its content was not limited to a recounting of humanity's failures. Instead, it was a balance sheet that also took into account the successes achieved to date (Pawłowski, 2007):

- decline in infant mortality,
- extension of the average lifespan,
- increase in the enrollment rate,
- a decrease in illiteracy among young people,
- faster growth in food production relative to the rate of population growth.

On the other hand, the problem of the widening gap between the North and South regarding the aforementioned achievements was highlighted. Following the commitments made in Stockholm, another major conference on environmental issues was organized 20 years later. From June 3 to June 14, 1992, the Earth Summit (UN Conference on Environment and Development) in Rio de Janeiro was attended by approximately 30,000 people. This event is considered the largest

gathering of its kind in history. Its importance was evidenced by the attendance of 183 government delegations, led by heads of government and heads of state (Kozłowski, 2007). It is important to remember that environmental problems were given special attention at the time, as they were significant for the poorest countries. The most important outcome of the Earth Summit was the documents and conventions adopted at the summit (Kozłowski, 2007):

- The Declaration on Environment and Development (the Rio Declaration or the Rio Protocol) contains 27 general principles, rights and obligations intended to constitute the basis for building new relations (a new order) between states, nations and social groups.

- Agenda 21 – a set of recommendations and actions for environmental protection necessary to be undertaken at the threshold of the 21st century.

- Convention on Climate Change – spoke about the need to reduce greenhouse gas emissions to prevent the anthropogenic intensification of the greenhouse effect.

- Convention on the Conservation of Biological Diversity – stating the need to ensure equal protection of fauna and flora.

- Declaration of principles of cooperation for the development, protection and use of all forests.

The Rio Earth Summit delivered concrete provisions for the concept of sustainable development. The year 2000 and the world's entry into the new millennium provided a good pretext for further major meetings of international community representatives, aimed at summarising achievements to date in implementing sustainable development and addressing new challenges. The next stage in shaping sustainable development was the United Nations Millennium Summit in 2000, which adopted the Millennium Development Goals for 2015. Among the most important are (Śtepiak-Kucharska & Kapela, 2022):

- eliminating extreme poverty and hunger,
- halving the number of people whose income does not exceed \$1 a day,
- ensuring universal primary education,
- ensuring that everyone has the opportunity to complete a full cycle of basic education,

- promoting gender equality and women's social advancement,
- eliminating gender inequality in access to all levels of education,
- reducing child mortality and reducing the mortality rate of children under 5 years of age by 2/3,

- improving maternal health care and reducing the maternal mortality rate by three-quarters,

- limiting the spread of HIV/AIDS, malaria and other diseases and stopping the spread of HIV/AIDS, including reducing the number of new infections,

- using sustainable methods of managing natural resources,
- taking into account the principle of sustainable development in national strategies,

- the use of methods that inhibit the depletion of natural resources,
- halving the number of people without access to clean drinking water,
- improving the living conditions of 100 million slum dwellers by 2020.

At subsequent UN assemblies, in Johannesburg in 2002 and Rio de Janeiro in 2012, a global partnership for development was established. The following issues were discussed within this framework (Morzół, 2006):

- opportunities to solve problems with access to water,
- opportunities to reduce greenhouse gas emissions,
- increasing the involvement of civil society in the implementation of sustainable development,
- protection of overexploited marine fisheries,
- creating an initiative aimed at achieving absolute gender equality and guaranteeing women equal development opportunities.

Table 1

Characteristics of actions undertaken to implement the idea of sustainable development within the 5P areas

The area of sustainable development	Characteristics of the actions needed
People	It assumes that no social group should be left out, that excluded groups should be reached, and that conditions and opportunities for everyone to enjoy universal human rights and economic achievements should be created. Furthermore, the document promises equal access to economic resources, basic services, land, natural resources, technology, and finance.
Planet	The document addresses the creation of a solid foundation for sustainable development by integrating social, economic, and environmental aspects. It also calls for building a development model that fosters economic growth and greater social inclusion, rationalizing natural resources, achieving a better quality of life and addressing poverty.
Prosperity	This section of the document calls for transforming economies to foster job creation and inclusive development, as well as shifting to sustainable consumption and production models, leveraging new technologies and business potential, ensuring access to quality education, healthcare, clean water, electricity, transport, and telecommunications, and facilitating business start-ups, investments, and trade. It is also essential to intensify sustainable urban development.
Peace	The development of sustainable development principles at this point is based on building peace and effective, fair, open and accountable institutions that guarantee the strengthening of the role of law, social inclusion and co-decision-making, strengthening the role and responsibility of institutions that should support the rule of law, property rights, freedom of speech and media, political freedom, access to justice, and non-discrimination.
Partnership	It is based on solidarity, cooperation, responsibility and transparency of actions undertaken, including partnerships between governments, local and regional administrations, scientific communities, businesses and all interested parties and groups.

Source: own study based on: Raczkowska *et al.*, 2021.

In keeping with the principle of holding Earth Summits every two decades, another global conference attended by states and representatives of institutional structures was held in Rio de Janeiro from June 20 to 22, 2012. Besides summarising the international community's achievements in implementing the concept of sustainable development, the main goal of this event was to reiterate and further disseminate previous assumptions. Topics discussed during the conference focused on "green economies" as a means of combating hunger and poverty, protecting oceans in the face of intensive exploitation, the problems of rural areas, and institutional frameworks for sustainable development (Stępnia-Kucharska & Kapela, 2022).

An essential document in sustainable development was the 2030 Agenda, "Transforming our world." The set of 17 goals and detailed tasks supporting their implementation, included in the document, covers developed and developing countries, oriented towards lasting transformation in key areas for humanity and the planet. It is a unified, global program striving to achieve sustainable development in its three dimensions – social, economic and environmental at the regional, national and global levels (Cenkier, 2024).

It included goals supporting sustainable development in five key areas, defined as 5P – People, Planet, Prosperity, Peace, and Partnership (Raczkowska *et al.*, 2021). The characteristics of the activities undertaken within the identified areas are presented in Table 1.

The development of the concept of sustainable development: historical conditions and contemporary importance

Sustainable development is a multidimensional research subject from many disciplines: economics, political science, law, etc. (Ciesielska *et al.*, 2024). It primarily refers to macro-level systems – states, economies, and international communities – but its practical implementation requires implementation in the management process at the enterprise level. Sustainable development is a political-economic doctrine that assumes a quality of life consistent with current civilizational development (Rutkowska & Pakulska, 2011). The concept of sustainable development appears in numerous legal acts and various strategic documents of a regional and international nature. It is also the subject of consideration and research by many scientists. The evolution of the concept of sustainable development is presented in the table below.

Sustainable development has also entered Polish legislation (Act of April 27, 2001, Environmental Protection Law, Journal of Laws No. 62, item 627, as amended; Art. 3, item 50). Sustainable development is defined here as socioeconomic development that integrates political, economic, and social activities while

Table 2

Selected definitions of the concept of sustainable development

Year of publication	Definition of sustainable development	Source
1	2	3
1985	A set of all activities that improve human living conditions on Earth without causing degradation of the natural environment.	Kozłowski, S.
1986	Conduct any economic activity in harmony with nature, so as not to cause any irreversible changes in living nature.	Zaufał, T.
1989	A method of socioeconomic development of a given area, the assumptions of which are related to natural conditions, without disturbing the ecological balance and ensuring the survival of current and future generations.	Kozłowski, S.
1991	Such socioeconomic development, which implies respect for natural resources and is based on socioeconomic calculation, is applied in every economic and living activity of man, triggering actions for the energy- and material-intensive and transport savings of the national economy, without limiting economic opportunities for future generations.	Niedka, A.
1993	A form of socioeconomic development that would lead and bring the world system or part of it closer to a state of eco-development.	Michnowski, L.
1995	The issue of future generations is at the heart of sustainable development, stating that it occurs when we leave our entire heritage (including environmental assets) intact for a specific period. We must pass the same „capital to future generations,” containing the conditions for potential prosperity (the same as we enjoy today).	Winpenny, J.T.
1998	Sustainable development as an „idea” and „eco-development,” stating that it is a way of conducting business, shaping and using the potential of the environment and such an organization of social life that will ensure the dynamic qualitative development of new production processes, management systems, the sustainable use of natural resources and the improvement and subsequent maintenance of a high quality of life.	Poskrobko, B.
2001	Socioeconomic development, which integrates political, economic, and social activities while maintaining natural balance and the sustainability of fundamental natural processes, aims to ensure that the basic needs of individual communities or citizens, both current and future generations, are met.	Act of April 27, 2001, Environmental Protection Law, Journal of Laws No. 62, item 627, as amended; art. 3, item 50.
2005	Sustainable development can be understood as a process of long-term changes in socio-economic systems that leads to an improvement in the quality of human life while maintaining the ability of ecosystems to sustain life processes and provide resources for future generations.	Hopwood, B. <i>et al.</i>

cont. Table 2

1	2	3
2015	Sustainable development involves the simultaneous pursuit of economic prosperity, social inclusion, and environmental protection. These three dimensions should be interconnected in public policies and institutions so that progress in one area does not lead to deterioration in another.	Sachs, J.D.
2019	Sustainable development focuses on intergenerational and intragenerational equity and is based on three interrelated pillars: the environment, the economy, and society. It requires decision-makers to consider the relationships, complementarities, and potential conflicts between these pillars in order to support human development.	Mensah, J.
2020	It is extremely important, in an integrated view of the sustainable development paradigm, to define the principles of its practical application. This concept cannot be limited solely to the level of general declarations or theoretical assumptions. Effective implementation of sustainable development requires the establishment of principles and instruments that enable the integration of economic, social, and environmental objectives in management processes and public decision-making.	Bugdol, M. <i>et al.</i>
2024	Sustainable development is a process that ensures the needs of contemporary societies are met while preserving the ability of future generations to meet their own need.	Baron, J. <i>et al.</i>
2026	Sustainable development offers an integrated vision to reconcile economic, ecological, and social dimensions of growth by recognizing their interdependencies. Achieving it requires systemic changes in governance, economic systems, and societal behavior so that development pathways operate within planetary limits while supporting human well-being.	Obura, D. <i>et al.</i>

Source: own study.

maintaining natural balance and the sustainability of fundamental natural processes. Its goal is to ensure the ability to meet the basic needs of individual communities or citizens, both current and future generations.

The concept of sustainable development has been defined in Polish legislation. It is understood as socio-economic development in which political, economic, and social activities are integrated. The literature emphasizes that the effective implementation of sustainable development is based on the principles of rational management of natural resources, long-term thinking in decision-making processes, and consideration of the interests of both present and future generations. It is also important to integrate activities in the economic, social, and environmental spheres, which helps to limit the negative effects of development and supports stable and lasting socio-economic progress. This definition highlights the need to integrate human development in the economic dimension while taking into account the well-being of the natural environment (Bugdol *et al.*, 2020).

The cited definitions indicate two fundamental features of sustainable development. First, they point to the necessity of shaping and maintaining outcomes that are as effective as possible from the perspective of the quality of management. Second, they emphasize the implementation of economic and social goals that take into account the high quality of the natural environment and the availability of its resources in a spatio-temporal dimension (Obura *et al.*, 2026). Among the paradigms of the concept of sustainable development, it is emphasized that it is an intergenerational concept, a process that integrates all human activities and an approach that may lead to maximizing the possibilities of satisfying the needs of all inhabitants of the Earth (Teufer *et al.*, 2024). The issue of sustainable development was also addressed by Pope John Paul II. He believed that initiatives related to sustainable development should be based on a vision of the world that places the human being at its center and respects the importance of historical and environmental conditions, which makes it possible to achieve lasting development. Above all, it is necessary to follow a long-term vision of the use of natural resources, but in such a way as to avoid their depletion through unreasonable and excessive exploitation (Kalinowski, 2018).

In conclusion, based on the definitions of sustainable development presented in this paper, it can be observed that each of them focuses on the intergenerational dimension of sustainable development. The presented definitions also indicate the need to integrate activities undertaken in the social, economic, and environmental spheres in such a way that the needs determining the possibility of the existence of different communities can be satisfied effectively and efficiently while maintaining appropriate relations between them (Misztal, 2023).

However, actions aimed at integrating these areas must also take into account the necessity of maintaining ecological balance, particularly through activities that allow the use of the Earth's resources in a way that does not threaten its environmental integrity. Another common element of the mentioned definitions is the transfer of responsibility for maintaining ecological balance to humans, who constitute both a factor that may enable the implementation of the principles of sustainable development and, at the same time, the entity that contributes most significantly to the degradation of the environment in which they operate (in each of the mentioned areas). The cited definitions of sustainable development and the directions of its evolution indicate that it is an interdisciplinary concept applied in various contexts and areas of human activity. This concept is often associated with such terms as eco-development, durable development, sustainable development, and self-sustaining development (Adamczyk, 2017).

In an integral view of the sustainable development paradigm, it is essential to establish the principles of its practical application, which can be understood as (Ogryzek, 2023):

- protection of natural capital, essential for sustainable development, economic production and intergenerational capital,

- in terms of ecology, the population and the total demand for specific goods must be limited in scale, and the integrity of ecosystems and species diversity must be preserved,
- the use of sustainable development practices that must address social inequalities and environmental damage while maintaining a reasonable economic base,
- social justice, meeting basic health and education needs, and participatory democracy as elements linked to environmental sustainability.

Sustainable development requires an integrated approach to this issue and synchronizing individual approaches. The literature also suggests that this issue should be considered in the context of activities within separate scientific disciplines, with the findings in each discipline not being binding within a global understanding of the paradigm, but instead supporting the overarching idea of sustainable development (Stępnia-Kucharska & Kapela, 2022).

Sustainable development should be implemented in a purposeful, territorial, and temporal dimension (Adamowicz & Smarzewska, 2009). Sustainable development integrates social, economic, and natural capital into a single entity. In a territorial context, global commitment to implementing solutions at the local level is crucial, considering development goals and the means to achieve them for all of humanity, including present and future generations. Sustainable development theory emphasizes equal access to limited resources and environmental assets for societies, social groups, and individuals while addressing the general and local communities' needs (Kozłowski, 2007).

Conclusions

The role of sustainable development is to strike a balance between economic, social, and environmental needs to ensure that the needs of the present generation are met without compromising the ability of future generations to meet their own needs. This includes striving for sustainable economic growth, social cohesion, and protecting the natural environment and resources. Preventing the degradation of ecosystems, reducing pollution, and responsibly managing natural resources. Creating conditions for economic development based on innovation and efficiency, and considering long-term impacts on society and the environment. Working to improve the quality of life, reduce social inequalities and poverty, and ensure equal opportunities for all. Ensuring that current activities do not destroy or abuse available resources and opportunities for future generations. The role of sustainable development is to strike a balance between economic, social, and environmental needs to ensure that the needs of the present generation are met without compromising the ability of future generations to meet their own

needs. This includes striving for sustainable economic growth, social cohesion, and protecting the natural environment and resources.

The goal of the study, which was to analyze and assess sustainability in the context of its importance for future generations, was achieved. The research question addressed the recognition that sustainable development ensures future generations' access to limited natural resources, protects the environment from degradation and climate change, and promotes social justice, equal opportunities, a better quality of life, and the preservation of cultural heritage. Actions promoting practices such as using renewable energy, responsible consumption, and nature conservation are crucial to creating long-term ecological balance and human well-being.

Translated by Author

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THE IMPACT OF SALARY AND NON-SALARY MOTIVATION ON THE WORK EFFICIENCY OF GENERATION Z

Weronika Barańska

Faculty of Economic Sciences
University of Warmia and Mazury in Olsztyn
ORCID: <https://orcid.org/0009-0005-4687-2458>
e-mail: weronika.barańska@student.uwm.edu.pl

JEL Classification: J28, M12, J24.

Key words: motivation, financial incentives, non-financial incentives, Generation Z.

Abstract

The aim of the study was to analyse the significance of monetary and non-monetary forms of motivation for the engagement and work performance of the study group comprising members of Generation Z, as well as to identify the motivators considered by the respondents to be the most effective. The study was conducted using a diagnostic survey method involving a questionnaire. The results indicate that, within the study group, significant importance is attached primarily to flexible working hours and job security. Among financial motivators, discretionary bonuses and profit-sharing were highly rated, which respondents associated with a sense of appreciation and influence on the organisation's operations. The results of the study may serve as a guide for employers in designing incentive schemes better suited to the expectations of Generation Z employees; however, due to the deliberate and non-random selection of the sample, they apply exclusively to the group of respondents surveyed.

WPLYW MOTYWACJI PŁACOWEJ I POZAPŁACOWEJ NA EFEKTYWNOŚĆ PRACY POKOLENIA Z

Weronika Barańska

Wydział Nauk Ekonomicznych
Uniwersytet Warmińsko-Mazurski w Olsztynie

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Słowa kluczowe: motywacja, zachęty płacowe, zachęty pozapłacowe, pokolenie Z.

Abstrakt

Celem badań była analiza znaczenia płacowych i pozapłacowych form motywowania dla zaangażowani i efektywności pracy badanej grupy przedstawicieli pokolenia Z oraz identyfikacja motywatorów uznawanych przez respondentów za najskuteczniejsze. Badanie przeprowadzono metodą sondażu diagnostycznego z wykorzystaniem kwestionariusza ankiety. Uzyskane wyniki wskazują, że w badanej grupie istotne znaczenie przypisywane jest przede wszystkim elastyczności czasu pracy oraz stabilności zatrudnienia. Wśród motywatorów płacowych wysoko oceniono premie uznaniowe oraz udział w zyskach, które respondenci wiązali z poczuciem docenienia oraz wpływu na funkcjonowanie organizacji. Wyniki badania mogą stanowić wskazówkę dla pracodawców w zakresie kształtowania systemów motywacyjnych lepiej dostosowanych do oczekiwań pracowników pokolenia Z, jednak ze względu na celowy i nielosowy dobór próby odnoszą się wyłącznie do badanej grupy respondentów.

Introduction

The modern labour market is undergoing rapid changes driven by technological progress as well as social and economic shifts. In this context, the methods used to effectively motivate employees are of paramount importance, as carefully selected motivational methods and tools influence not only the level of engagement but also work efficiency. From an organisational perspective, this means that incentive schemes must be designed to take account of employees' diverse needs whilst also supporting the achievement of the organisation's overall objectives (Knap-Stefaniuk *et al.*, 2018, pp. 186-187).

One group that has been gaining increasing prominence in the labour market in recent years is Generation Z, comprising those born after 1995. Members of Generation Z, having grown up in an era of widespread digitalisation and rapid access to information, may view the importance of job security, flexible working hours and opportunities for development differently (Wojtoszek, 2023, pp. 174-175). Employers face the difficult challenge of creating an effective incentive scheme that will not only attract young employees but also boost their productivity and commitment to their work.

In organisational practice, both financial incentives – which are directly linked to pay and additional financial benefits – and non-financial incentives – which include opportunities for development, flexible working hours and job security – are utilised (Beck-Krala, 2013, p. 66). However, the effectiveness of individual tools is not the same for all employee groups, which is why it is important to investigate which of them are considered to have the greatest impact on Generation Z employees.

The originality of the topic lies in the combination of a human resource management perspective and a sociological analysis of the expectations of the younger generation of employees. From a human resource management

perspective, this topic has practical significance, as it enables incentive schemes to be better tailored to the needs of those starting or advancing their careers. From a sociological perspective, however, the study enables a better understanding of Generation Z's attitudes, values and expectations regarding work. The research gap concerns the need for further investigation into how young employees assess the importance of monetary and non-monetary forms of motivation, and which of these factors they consider to have the greatest impact on their professional performance.

The aim of the study was to analyse the significance of financial and non-financial incentives for the work performance of the study group comprising members of Generation Z, and to identify the motivators they consider to be the most effective. The research findings can be utilised in organisational practice, particularly by employers, managers and HR departments, to support the design of incentive schemes better suited to the expectations of young employees. The research was conducted using a diagnostic survey method involving a questionnaire. The article is empirical in nature, and the results presented should be treated as preliminary and applicable solely to the group of respondents studied.

The remainder of the article presents the basic theoretical issues concerning monetary and non-monetary motivation, characterises the specific characteristics of Generation Z in the labour market, discusses the methodology of the research conducted, and then presents and interprets the results of the authors' own research. The article concludes with conclusions regarding the significance of selected motivators for the work performance of Generation Z employees and recommendations relating to human resource management practice.

Literature review

Employee motivation and productivity are key factors in improving an organisation's efficiency (Chi *et al.*, 2023, p. 1). Thanks to motivation, people are able to achieve more with greater commitment. Motivation is regarded as a force that drives and sustains an individual's actions, enabling them to achieve their goals (Piotrowska & Puchała, 2012, p. 8).

In organisations, the most commonly used motivational tools include both financial and non-financial incentives. The most common financial incentives are: basic pay, company shares, pay rises, company bonds, bonuses, coverage of training costs, awards, company cars, company cars, position-related allowances, paid leave, supplementary pension schemes, and allowances for overtime or work on Sundays and public holidays (Oleksyn, 2017, pp. 241-242). Financial incentives are not the only way to reward employees. The most commonly used non-financial motivators include: promotion, authority, access to information,

a high degree of autonomy, flexible working hours, work organisation, praise, recognition, communication, self-fulfilment, and job security or occupational safety (Krzysztofek & Kumańska, 2011, p. 48). The effective implementation of both financial and non-financial incentives requires a careful and precise understanding of employees' expectations, taking into account factors such as length of service, level of professional development and individual preferences. It should be emphasised that a significant proportion of Generation Z employees focus primarily on salary levels, followed by additional benefits such as bonuses or rewards, which influence their motivation and commitment to their duties (Kozłowski & Czaplicka-Kozłowska, 2016, p. 371). The literature highlights the importance of demographic variables, such as age, stage of life and marital status, which may influence the effectiveness of the motivational tools employed. An appropriate incentive scheme provides for separate incentives available to every employee, as well as those intended for selected individuals with exceptional performance (Adamik & Nowicki, 2012, p. 385).

Employee motivation changes over time; therefore, implementing carefully selected measures can effectively influence its level, which in turn leads to increased productivity (Conradty & Bogner, 2022, p. 1). A properly designed system increases staff engagement, improves productivity and supports professional development, taking into account the intensity and regularity of its implementation (Ścibiorek, 2010, pp. 133-135). The motivation process is a multi-stage one. It begins when an employee feels that something important is missing; they then recognise an opportunity to satisfy their needs and take action to achieve their goals. The next stage is the implementation of the plan, following which it is evaluated. The employee then receives a reward or punishment that affects their needs. They analyse the result obtained, which may lead to the emergence of new needs or changes to existing ones (Zajac, 2014, p. 117). It should be emphasised that an employee's level of commitment and determination in striving to achieve the desired results increases when they feel more motivated (Walkowiak *et al.*, 2013, p. 114).

We distinguish between three main categories based on the method of influence, namely coercion, incentives and persuasion (Tab. 1).

Coercive tools include negative incentives such as criminal sanctions or threats. Persuasive tools, on the other hand, focus on effective communication by involving the employee in the change process. Incentive tools are based on positive stimuli, such as rewards, bonuses or recognition. At the same time, motivational tools can be divided into financial and non-financial, as well as monetary and non-monetary (Czerwińska-Lubszczyk & Jankowiak, 2024, p. 13).

It is essential to adapt incentive schemes to generational differences, as these influence professional expectations and attitudes. In the literature, Generation Z is defined as the group of people born between 1995 and 2010 (Solif & Critikian, 2023, p. 388). A generation also known as the 'social generation', which frequently features in popular culture and is analysed from a sociological perspective (Roy

Table 1

Employee motivation tools

Coercion	Persuasion	Incentives		
		economic		non-economic
		financial	non-financial	
– orders – prohibitions – instructions – guidelines – work standards – regulations – work instructions	– consultation – negotiation – joint goal-setting – participation in management – leadership styles – promotional tools	– types of remuneration – pay scales – components of remuneration – remuneration structure	– non-cash rewards – social benefits – shares and bonds	– flexible working hours – flexible working arrangements – promotions – opportunities for professional development – autonomy in carrying out tasks and making decisions – a positive working environment

Source: Czerwińska-Lubszczyk & Jankowiak (2024, p. 13).

et al., 2022, p. 435). Generation Z strives to change the world, having experienced many difficult global events. Their priority is to prepare themselves as well as possible for life and to make full use of the capital they possess (López-Santacruz & Guízar-Mendoza, 2022, p. 23).

The values and principles held by Generation Z have a significant influence on their professional attitudes and expectations of employers. The table below (Tab. 2) illustrates generational differences in terms of preferred values and principles.

Table 2

Generational differences based on personal values

Description	Generation Z
Career goals	Dynamism
Key trait	A desire to fast-track one's career
Work-life balance	Rejection of a step-by-step approach
Job security	Work-life balance is the top priority
Professional development	Lack of interest in a permanent job; A tendency towards dynamic change; Stability solely in the form of an employment contract

Source: Wasiluk & Bańkowska (2021, p. 143).

The shifts in mindset across generations are reflected not only in attitudes towards work, but also in the way duties are carried out. The relationship between the employee and the organisation is also undergoing a transformation, leading to a redefinition of roles and expectations of staff. Contemporary enterprises increasingly treat staff as a key factor for success, on a par with suppliers, customers and end-users (Springer & Basińska-Zych, 2018, p. 54).

Research methodology

The study was conducted using a diagnostic survey method based on a questionnaire. The study involved 142 respondents belonging to Generation Z – i.e., people born between 1995 and 2010. The survey involved participants from various sectors. The selection of respondents was purposeful and non-random; therefore, the results are indicative and apply solely to the group surveyed. A total of 142 people took part in the survey, including 78 women and 64 men from Generation Z. The survey was conducted online, which made it possible to gather a wide range of data in a relatively short time. The research question focused on the impact of financial and non-financial incentives on the work performance of Generation Z employees. The aim of the study was to determine which motivational strategies respondents perceive as most effective in increasing their commitment and work performance.

The questionnaire used in the study contained 20 questions, of which 14 required a single choice from the options provided, whilst 6 allowed respondents to select more than one answer.

Results of our own research

The gender breakdown of the sample shows a slight predominance of women, who accounted for 54.9% of all respondents. Among the women, 25.35% were in the 20–25 age group, whilst 29.58% were in the 25–30 age group. The proportion of men in the sample was 45.1%; in this group, 19.01% of respondents were aged 20–25, and 26.06% were in the 25–30 age group.

The respondents participating in the survey represented a wide range of professional roles, which enabled a multi-dimensional perspective to be gained regarding the assessment of financial and non-financial motivation (Fig. 1). The largest group consisted of directors and owners, who accounted for 24.65% of the total. The next categories were specialists (21.13%) and supervisors and managers (20.42%) – i.e., individuals performing tasks requiring specialist knowledge, as well as those responsible for managing teams and organisational processes. Administrative staff accounted for 19.72% of the sample, whilst manual

workers accounted for 11.27%. The smallest share was recorded in the 'other' category, covering positions not covered by the adopted classification, which accounted for 2.82% of respondents.

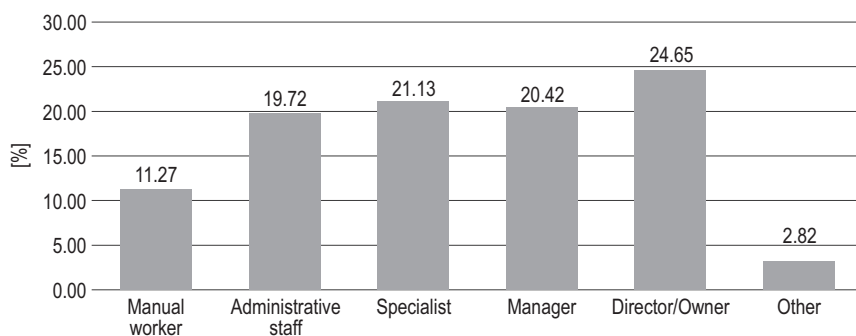


Fig. 1. Workstation

Source: own compilation based on research.

Respondents reported varying levels of gross monthly pay, as shown in Figure 2. A comparison of pay levels with length of service reveals a clear correlation between the length of one's working life and the amount of income earned. Those with shorter lengths of service were more likely to report salaries in the lower pay brackets, whereas as professional experience increased, so did the proportion of respondents earning higher salaries. This is particularly evident in the group of people with over 15 years' work experience, where a higher proportion of respondents reported a gross monthly salary exceeding PLN 15,000.

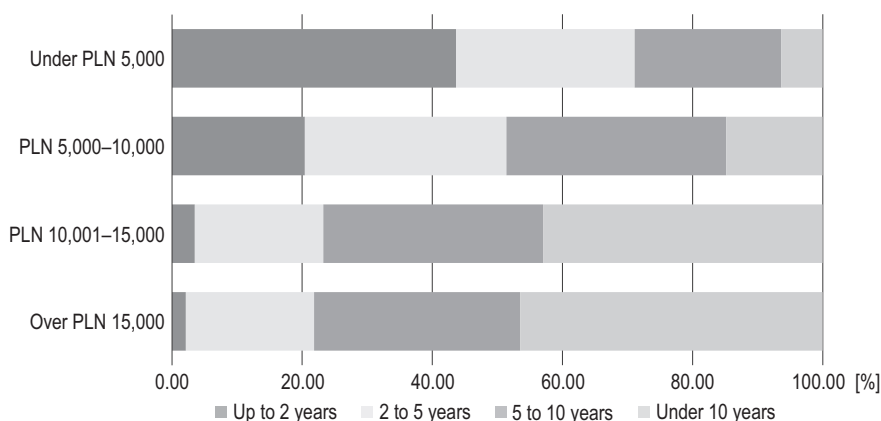


Fig. 2. Gross monthly salary by length of service

Source: own compilation based on research.

Figure 3 shows the breakdown of respondents by working model, covering on-site, remote and hybrid working. The largest proportion of respondents reported working on-site, accounting for 56.34% of responses. Remote working accounted for 23.94% of respondents, whilst 19.72% of respondents indicated a hybrid model. The results indicate that, despite the development and increasing prevalence of flexible forms of work organisation, on-site work remains the dominant employment model in the sample.

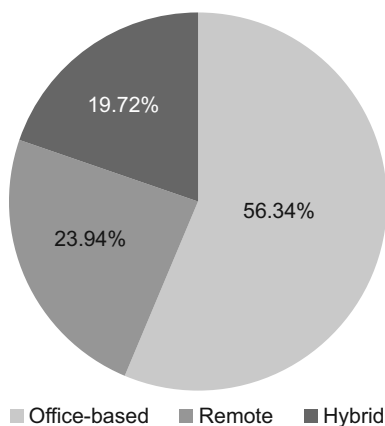


Fig. 3. Working model

Source: own compilation based on research.

Respondents rated their own level of work motivation on a five-point scale, where 1 indicated a very low level of motivation and 5 a very high level. The lowest rating was given by 10.56% of respondents, which may indicate a relatively small proportion of people declaring a very low level of professional commitment. The most frequently selected answers were ratings 3 and 5, each receiving 26.06% of responses. This means that within the sample, it is possible to identify both a group of people with a moderate level of motivation and respondents declaring a very high level of motivation at work. The variation in responses may stem from differing employment conditions, the remuneration systems in place, the organisational atmosphere, and individual factors influencing the level of employee engagement.

The results obtained indicate a mixed assessment of the current incentive scheme among the group of respondents surveyed (Fig. 5). The largest proportion of respondents, amounting to 28.87%, rated the scheme at the lowest level, which may indicate the presence of significant shortcomings in the tools used to motivate staff. At the same time, 19.01% of respondents gave the highest rating, indicating that for some of the respondents, the current incentive arrangements are satisfactory. The distribution of responses confirms the mixed reception of the

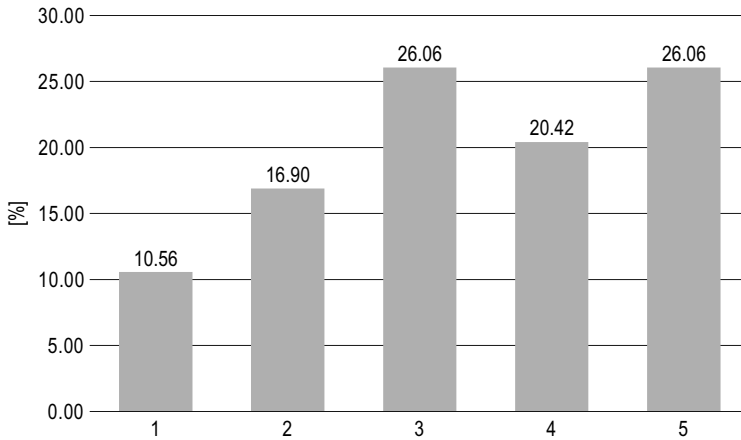


Fig. 4. Respondents' assessment of their level of motivation at work

Source: own compilation based on research.

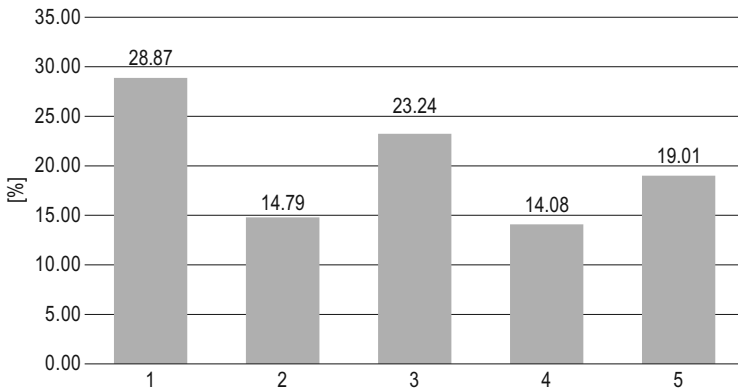


Fig. 5. An assessment of the organisation's existing incentive scheme

Source: own compilation based on research.

incentive scheme and may indicate a need for further analysis and improvement, particularly in areas that do not meet the expectations of a significant proportion of employees.

Based on the results obtained, it can be concluded that financial factors play a significant role in shaping respondents' motivation to work (Fig. 6). The greatest influence was attributed to high pay, which was cited by 36.62% of respondents. Share in company profits and incentive bonuses were also significant, indicated by 33.80% and 28.87% of respondents respectively. These results confirm that the remuneration system and additional financial incentives are among the key tools for motivating employees.

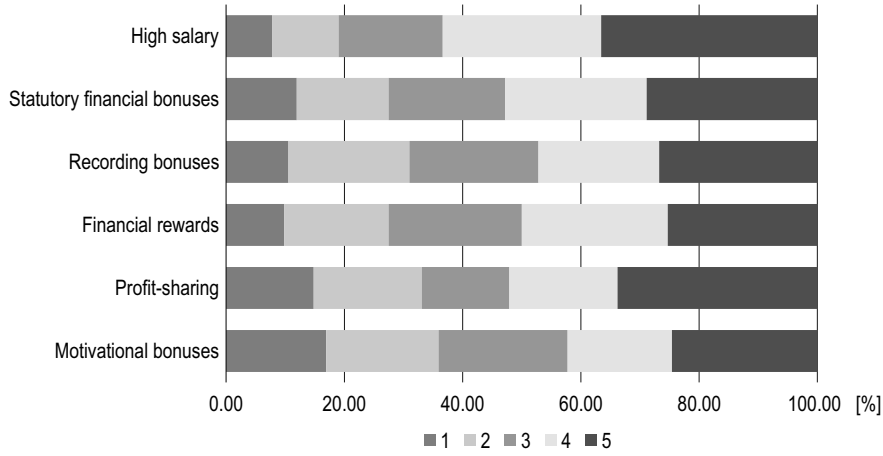


Fig. 6. The impact of pay incentives on work motivation
Source: own compilation based on research.

Figure 7 shows the forms of non-financial motivation preferred by respondents. The most frequently cited category was the prospect of promotion, chosen by 21.18% of respondents, which demonstrates the significant importance of career development prospects in shaping employee engagement. Job security and access to training also played an important role, highlighting the need for job security and skills development. Flexible working hours and the possibility of remote working were also recognised as motivating factors, though their importance was relatively lower. The results suggest that effective incentive schemes should take into account the diverse needs of employees, combining opportunities for development, a sense of stability and flexible forms of work organisation.

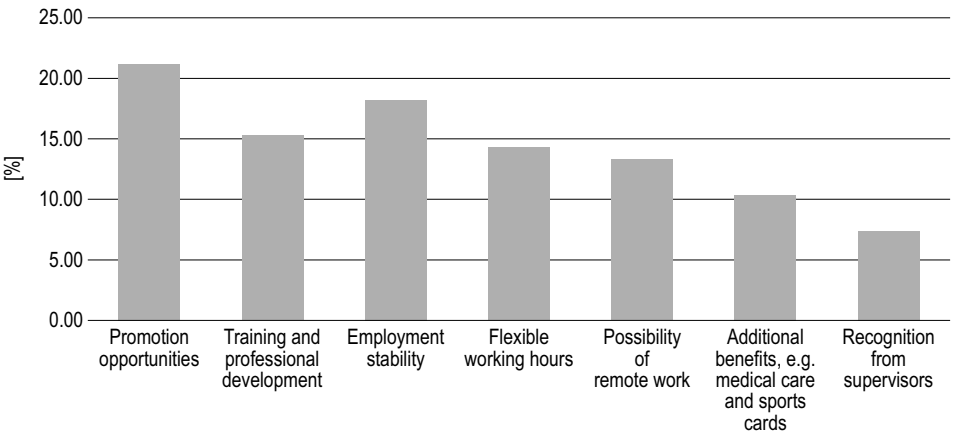


Fig. 7. The most important non-financial forms of motivation
Source: own compilation based on research.

The survey results shown in Figure 8 indicate that job security and flexible working hours are among the most important factors motivating employees. Job security received the highest percentage of responses, with 42.25% of respondents identifying it as a significant motivational factor. Flexible working hours were also highly rated, cited by 38.03% of respondents. The results confirm that, in addition to financial aspects, a sense of job security and the ability to better adapt work arrangements to individual needs are of significant importance for employee motivation.

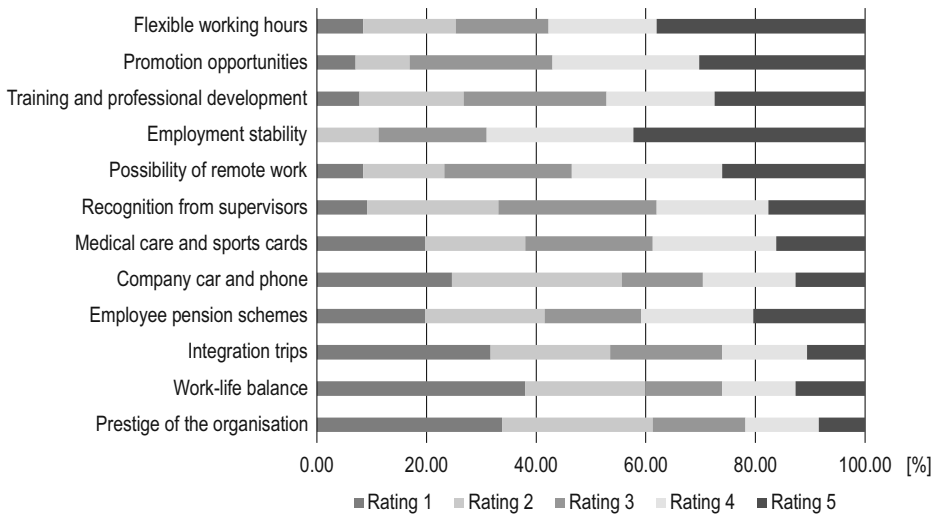


Fig. 8. The impact of non-financial incentives on work motivation

Source: own compilation based on research.

The ability to tailor working hours to individual needs and a sense of job security are factors that significantly influence staff engagement and productivity. Considerable importance was also attached to opportunities for promotion, as well as training and professional development, which points to the growing role of career prospects in the workplace. Factors such as the organisation's prestige and recognition from superiors, cited by 8.45% and 7.39% of respondents respectively, were of relatively lesser importance. This may suggest that respondents focus more on the direct benefits of employment than on the organisation's image or interpersonal aspects. The findings indicate that an effective incentive scheme should prioritise job security, opportunities for professional development and flexible working arrangements, enabling duties to be better tailored to employees' individual needs.

Conclusions

The aim of the study was to analyse the impact of financial and non-financial forms of motivation on the level of engagement among young Generation Z employees, and to identify the motivators they consider most effective. The research indicates that Generation Z's expectations regarding work differ from the traditional perception of employee motivation, which is based mainly on pay. Although financial factors continue to play a significant role, non-financial elements related to flexibility, job security and opportunities for professional development are also becoming increasingly important.

An analysis of the results suggests that flexible working hours and job security were of particular importance to the group surveyed. This points to the need for employers to combine organisational arrangements that provide a sense of security with the ability to adapt work to employees' individual needs. In terms of financial motivation, high pay was considered most important, though discretionary bonuses and profit-sharing also played a significant role. This may indicate that young employees expect not only an appropriate level of pay, but also a sense of appreciation and a genuine link between their own commitment and the organisation's performance.

The findings can be applied in human resources management, particularly when designing incentive schemes aimed at young employees. Organisations should take into account not only attractive remuneration, but also transparent bonus schemes, opportunities for promotion, access to training, flexible working arrangements and measures to enhance the sense of job security. Implementing such solutions can contribute to increased engagement, improved work efficiency and greater employee loyalty to the organisation.

The added value of this research lies in identifying which motivational factors are particularly important to members of Generation Z. The findings can serve as a basis for further improving companies' HR policies, particularly with regard to developing incentive schemes tailored to the expectations of the younger generation of employees. Generation Z expects employers to demonstrate transparency, adopt a modern approach to work organisation, and provide solutions that align with their needs and lifestyle. Companies that are able to adapt their motivational strategies accordingly can gain an advantage in the process of attracting and retaining young employees.

It should be emphasised, however, that the study has certain limitations. The results apply solely to the sample group of respondents and should not be generalised to the entire Generation Z. Another limitation is the self-reported nature of the survey, as respondents' answers reflect their subjective opinions and feelings. In future, it would be worthwhile to expand the research to a larger and more diverse sample, including representatives from various industries, job roles and regions. It would also be worthwhile to compare the expectations

of Generation Z with those of older generations of employees, which would allow for a more comprehensive assessment of differences in attitudes towards financial and non-financial incentives.

Translated by Author

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ASSESSMENT OF INFORMATION TRANSMISSION IN THE PROCESS OF IMPLEMENTING THE DEPOSIT-REFUND SYSTEM AS A TOOL FOR SUSTAINABLE DEVELOPMENT

Natalia Kubica

Faculty of Humanities

University of Warmia and Mazury in Olsztyn

ORCID: <https://orcid.org/0009-0005-8708-5397>

e-mail: natalia.kubica@student.uwm.edu.pl

JEL Classification: Q18, C83.

Key words: Deposit-Refund System, Reverse Vending Machines, informative communication, consumer behavior, purchasing decisions.

Abstract

The main objective of the article was the assessment of the reliability, comprehensibility, and effectiveness of information provision during the implementation of the Deposit-Refund System (DRS), and its influence on usage of Reverse Vending Machines (RVMs), with special consideration of assessment of DRS functioning. The study was conducted using an online survey questionnaire distributed through social media using random sampling techniques, which allowed for nationwide coverage. 111 people participated in the study. Quantitative and qualitative analysis methods were used to analyze the results. The analysis examined the extent to which these messages support consumers in making economic and environmental decisions and how they affect the effectiveness of sustainable development goals. The considerations allowed for the identification of key information factors determining the efficient functioning of the Deposit-Refund System and its importance in shaping pro-environmental attitudes and reducing waste. The study results clearly indicated that the information provision was ineffective for the study group, and the low rating of information quality translates into low use of the DRS. Another reason respondents stated for not using RVMs was the underdeveloped infrastructure. The combination of negative aspects of the system's operation, coupled with the need for respondents to change their daily routines and develop new habits, contributed to the low rating of the DRS functioning.

OCENA PRZEKAZYWANIA INFORMACJI W PROCESIE WDRAŻANIA SYSTEMU KAUCYJNEGO JAKO NARZĘDZIA ZRÓWNOWAŻONEGO ROZWOJU

Natalia Kubica

Wydział Nauk Humanistycznych
Uniwersytet Warmińsko-Mazurski w Olsztynie

Kody JEL: Q18, C83.

Słowa kluczowe: system kaucyjny, butelkomaty, komunikacja informacyjna, zachowania konsumentów, decyzje zakupowe.

Abstrakt

Głównym celem artykułu była ocena rzetelności, zrozumiałości oraz skuteczności informacji przekazywanych podczas wdrażania systemu kaucyjnego oraz ich wpływ na korzystanie z butelkomatów, z uwzględnieniem oceny funkcjonowania systemu kaucyjnego. Badanie zostało przeprowadzone przy pomocy kwestionariusza ankietowego rozpowszechnionego za pomocą Internetu przez media społecznościowe przy użyciu techniki doboru losowego, co umożliwiło ogólnopolski zasięg. W badaniu wzięło udział 111 osób. Przy opracowywaniu wyników wykorzystano metody analizy ilościowej oraz jakościowej. Analizie poddano, w jakim stopniu komunikaty wspierają konsumentów w podejmowaniu decyzji ekonomicznych i środowiskowych oraz jak wpływają na efektywność realizacji założeń zrównoważonego rozwoju. Przeprowadzone rozważania pozwoliły na identyfikację kluczowych uwarunkowań informacyjnych determinujących sprawne funkcjonowanie systemu kaucyjnego oraz jego znaczenie w kształtowaniu postaw proekologicznych i ograniczaniu ilości odpadów. Wyniki badań jednoznacznie wskazały, że dla grupy badanej przekaz informacji był nieefektywny, a niska ocena jakości informacji przekłada się na niewielkie korzystanie z systemu kaucyjnego. Kolejną przyczyną niekorzystania z butelkomatów była dla respondentów słabo rozwinięta infrastruktura. Zestawienie negatywnych aspektów działania systemu w połączeniu z koniecznością zmiany codziennego funkcjonowania respondentów i wyrobienia nowych nawyków, przyczyniło się do niskiej oceny funkcjonowania systemu kaucyjnego.

Introduction

According to the Environmental Protection Law (2001, Article 3(39)), the environment is defined as “all natural elements, including those transformed as a result of human activity, in particular the earth’s surface, minerals, water, air, landscape, climate, and other elements of biological diversity, as well as the interactions between these elements.” Human impact on the natural environment causes the systematic degradation of our planet, which translates into the fact that ecology is the subject of many discussions in the economic, political, and social. Although the constitution mainly places the responsibility for environmental protection on the state, according to Article 86, every citizen is responsible for the deterioration of the natural environment and is obliged to take steps to protect the environment (Jaworowicz-Rudolf, 2014, p. 171). The environmental protection

referred to above is defined as “activities undertaken to preserve the natural character of the environment as far as possible, guaranteeing the continuity of the most important processes taking place in the biosphere and maintaining the environment in a state that ensures optimal conditions for human life.” Protective measures may include the preventing and counteracting harmful processes that may lead to degradation, pollution, or damage to natural elements (Ekologia, 2026). Such activities include recycling, which involves processing substances and materials found in waste in order to obtain substances and materials with their original or other intended use (Wengierek, 2014, p. 478). With environmental protection in mind, a Deposit-Refund System and “Reverse Vending Machines,” i.e., automatic packaging return points, have been introduced. This system is based on assigning a deposit value to bottles and cans, which is added to the purchase price and which the user recovers after returning the packaging to a designated location. As a result, packaging is returned to circulation or recycled, and the funds from deposits and producer fees circulate among the participants in the system (Rudewicz, 2020, pp. 51-52). The success of this solution depends directly on the involvement of consumers themselves. Therefore, this study aims to assess the reliability, comprehensibility, and effectiveness of information provision during the implementation of the DRS and its impact on the use of RVMs, including an assessment of the operation of the DRS. To effectively and comprehensively achieve the intended research objective, the following research questions were posed:

1. Was the information provided effectively?
2. How does the information provision influence the use of the Deposit-Refund System?
3. How do citizens evaluate the functioning of the Deposit-Refund System?

Literature review

The Deposit-Refund System is an important and current issue in the field of ecological policy and environmental protection, relating to waste management and reducing the amount of waste released into the environment. The aim of waste management measures is to increase the level of reuse and recycling of raw materials from packaging. This system is an integral part of the European Union’s sustainable development policy, which, through the Single-Use Plastics Directive (SUP), has imposed an obligation on Member States to ensure the separate collection of waste for recycling (Adamczyk *et al.*, 2024, pp. 6-7; Dyrektywa Parlamentu Europejskiego i Rady (UE), 2019). This solution has been successfully implemented in many European countries, while in Poland the legal framework for the Deposit-Refund System was established as early

as in 2023, and its actual operation began on October 1, 2025 (Siedlecki, 2025, pp. 66-67; Ministerstwo Klimatu i Środowiska, 2026).

The Deposit-Refund System is one of the ways of implementing the principles of Extended Producer Responsibility, according to which producers are responsible for the entire life cycle of packaging placed on the market (Görgün *et al.*, 2021, p. 200). These mechanisms affect both businesses and consumers, encouraging them to return used packaging to designated collection points. This solution is in line with the circular economy approach, which aims to maximize resource use and minimize waste, while enabling high recycling rates and generating mutual environmental and economic benefits (Zhou *et al.*, 2020, pp. 1-2). The introduction of a Deposit-Refund System also connects to significant effects of social and educational natures. The functioning of this solution promotes increased consumer involvement in the packaging return process and contributes to the formation of pro-ecological attitudes and raising the level of environmental awareness among the public (Malindzakova *et al.*, 2022, pp. 4-6). Although DRS effectively increase recycling rates, their key result should be, above all, a reduction in the amount of waste generated in the economy. This is due to the possibility of reusing packaging that is already in circulation, which reduces the need to introduce new glass and plastic packaging into the market. Giving packaging a financial value in the form of a deposit significantly reduces the risk of it being discarded in the environment, as consumers are more likely to return it in order to recover the money they have paid (Agnusdei *et al.*, 2022, pp. 1-10; Ławińska, 2026, pp. 671-672). Consumption in a circular economy includes all activities undertaken by individuals to satisfy their needs – from purchasing products, through their use, to responsible disposal in a manner that allows for the reuse of resources (Geiger *et al.*, 2018, pp. 18-33). In the circular model, particular emphasis is placed on maximizing the life cycle of products and materials, which is achieved through practices such as reuse, repair, recycling, sharing, and renting. In this model, consumers are not merely recipients of goods, but actively participate in the circulation of materials by supplying secondary raw materials and engaging in activities such as repair, renovation, and upcycling (Rabiu & Jaeger-Erben, 2022, pp. 1-4). The Deposit-Refund System is an important tool for achieving these goals, as it simultaneously extends the life cycle of packaging and reduces the amount of waste generated in the economy. However, it should be emphasized that different countries have different models of DRS, which makes direct comparisons and the transfer of solutions between countries difficult. This diversity results from different stakeholder arrangements and the influence of social, cultural, economic, and legal factors that determine the effectiveness of the systems implemented (Picuno *et al.*, 2025, pp. 2-10; Krzywda, 2022, p. 237). However, the ultimate effectiveness of a DRS depends on the proper balancing of key elements of its functioning, in particular the availability of return points, the amount of the deposit, and the level of public awareness and motivation, which directly affect packaging return rates (Picuno *et al.*, 2025, pp. 2-9).

The Deposit-Refund System in Poland was designed as a tool to support selective collection, recycling, and reuse of beverage containers. Beverages covered by this mechanism are marked with a uniform deposit symbol along with information about the deposit amount, which allows consumers to easily identify returnable containers. The deposit amount for each type of packaging is specified in the Regulation of the Minister of Climate and Environment of July 8, 2024, on the deposit amount for each type of packaging covered by the Deposit-Refund System, issued pursuant to Article 40m(2) of the Act of June 13, 2013, on packaging and packaging waste management (Rozporządzenie Ministra Klimatu i Środowiska..., 2024; Ministerstwo Klimatu i Środowiska, 2026). The scope of the system covers three main groups of packaging. The first group consists of disposable plastic bottles with a capacity of up to 3 liters, for which a deposit of PLN 0.50 is provided. The second category consists of metal cans up to 1 liter, also subject to a deposit of PLN 0.50. The third group consists of reusable glass bottles with a capacity of up to 1.5 liters, for which the deposit is PLN 1.00. This fee is added to the price of the product at the time of purchase and is refunded after the empty packaging marked with the system symbol is returned (Rozporządzenie Ministra Klimatu i Środowiska..., 2024). When purchasing a beverage in packaging marked with the system logo, the deposit is collected automatically and added to the price at the checkout. The deposit is refunded when the empty packaging is returned, and importantly, there is no obligation to present a receipt. The system also provides for the possibility of creating collection points outside commercial units, which increases the availability of return locations for consumers (Ministerstwo Klimatu i Środowiska, 2025, pp. 5-7). Packaging can be returned in an extensive network of collection points. The following are required to accept them (Ministerstwo Klimatu i Środowiska, 2025, pp. 9-10):

- all stores larger than 200 m² that offer beverages in packaging covered by the Deposit-Refund System,
- stores smaller than 200 m² that sell beverages in reusable glass bottles (currently, this mainly applies to beer beverages on the market),
- other stores that have joined the system,
- Reverse Vending Machines also available outside retail outlets,
- other collection points.

Research methodology

The research was conducted over a month (January 14 – February 14, 2026) using a diagnostic survey method. It involves collecting facts and information about phenomena of interest to the researcher, as well as their dynamics. It allows for both the verification of the phenomenon's existence and the determination

of its intensity. It also provides the opportunity for a statistical description of the collected data. The research tool was a survey questionnaire. It consisted of 11 substantive questions and a personal data form. The questionnaire used a variety of response formats, including single and multiple choice closed questions, semi-open questions, and matrix questions based on a five-point Likert scale. The survey was conducted online using random sampling techniques, ensuring nationwide coverage. Access to the anonymous survey questionnaire was disseminated via social media. Ultimately, 111 respondents from all over Poland took part in the survey. Even though the group collected is non-representative, the data obtained allowed for a multi-faceted analysis of the phenomenon under study. Women predominated among the respondents, accounting for 76% of the total, while men accounted for 23% (1% of respondents preferred not to disclose their gender). The most numerous age groups were 18-25 (43%) and 36-45 (23%). In terms of place of residence, the sample was diverse, with a predominance of residents of towns with up to 50,000 inhabitants (34%) and towns with 50,000 to 200,000 inhabitants (also 34%), which allows for assessment of infrastructure accessibility in general outline. Most of the respondents had higher education (41% – with a bachelor's, engineer's, or master's degree) and secondary education (37%). In terms of professional status, the largest groups were employed (51%) and students (45%). Quantitative and qualitative analysis methods were used to compile the results. Data from the questionnaires was counted and compared, and then presented in the form of graphs and tables. The supplementary statements of the respondents were grouped by topic, which allowed for a more accurate description and understanding of the respondents' opinions. The full reliability of the study was limited by the low number of respondents, including the low number of men compared to women. Furthermore, most of the sample had at least a secondary education and were either employed or studying. This element limits the overall picture of public opinion due to the very small percentage of unemployed and lower-educated individuals.

Results of author's own research

The research showed a lack of clear social consensus on the legitimacy of the Deposit-Refund System. The largest group of respondents (38%) approve of this solution, which can be interpreted as a sign of growing environmental awareness and willingness to use the Deposit-Refund System. On the other hand, the percentage of opponents of the solution (34%) indicates significant social resistance, which is likely due to concerns about logistical barriers or additional transaction costs for consumers. Although the respondents support the Deposit-Refund System, in practice very few of them have had any previous experience with it. Only 13% of respondents had used this solution before its official implementation. This shows that for the majority of the respondents the system

was only a positive idea, not an everyday habit. This situation suggests that the process of implementing the new rules may be more difficult, as it requires citizens to change their existing shopping habits.

However, the situation changed after the statutory introduction of the Deposit-Refund System. The percentage of people using Reverse Vending Machines has almost tripled from an initial 13% to 41%. Such a significant jump in the surveyed group shows that the mandatory deposit can become an effective economic incentive to act. However, the fact that the majority of respondents (59%) still do not use the Deposit-Refund System confirms the difficulty in changing everyday habits. Although the economic incentive is strong, the process of completely abandoning existing purchasing habits in favor of new ones requires time and further social adaptation.

An analysis of the ratings of individual elements of the Deposit-Refund System (Tab. 1) helps to understand why the majority of respondents (59%) still do not use Reverse Vending Machines. The lowest-rated aspect was the overall level of preparation for the implementation of the system as many as 45% of respondents gave it a failing grade. This suggests that initial organizational shortcomings made it difficult to develop new habits. The availability of Reverse Vending Machines (33% of the lowest ratings) and information campaigns in the public media (39% of the lowest ratings) were rated equally critically. This indicates a clear knowledge deficit and logistical barriers that effectively discourage respondents from changing their habits. The low clarity of the message and the lack of adaptation of communication to different age groups (a total of 75% negative ratings) suggest that despite the existence of an economic incentive, the rules of the system remain unclear. This may raise the barrier to entry for the average user and builds distrust of the deposit mechanism. Even the

Table 1
Evaluation of individual elements of the Deposit-Refund System in Poland

Feature	Quantity of ratings (%)					
	1	2	3	4	5	Total (%)
How the Deposit-Refund System works in Poland	34	32	25	7	1	100
Accessibility of Reverse Vending Machines	33	36	19	6	5	100
Ease of use of Reverse Vending Machines	22	26	26	14	12	100
Availability of information about the Deposit-Refund System before its introduction	39	30	15	11	5	100
Clarity of information before system implementation	36	31	21	10	3	100
Level of preparedness for the implementation of a Deposit-Refund System in Poland	45	33	18	4	0	100
Deposit refund policy	30	27	27	11	5	100
Information tailored to people of different ages	39	33	20	5	3	100
Information campaigns conducted in public media	39	33	21	5	3	100

Source: own elaboration based on survey.

highest-rated feature ease of use of the devices (12% very good ratings) – received a majority of critical votes (a total of 69% of ratings of 1 and 2). This proves that for the subjects the current infrastructure does not provide the comfort necessary for pro-environmental choices to become an everyday standard rather than a burdensome obligation.

The low rating of Reverse Vending Machines availability mentioned above is fully justified when compared with the place of residence of the respondents (Fig. 1). The study shows that difficulties in accessing infrastructure increase as the size of the locality decreases. The most critical situation is in rural areas, where almost half of the respondents living in these areas (46%) gave the availability of Reverse Vending Machines the lowest rating, and no one rated it as very good. Importantly, the problem does not only affect smaller towns even in large cities (over 200,000 inhabitants), more than half of the respondents (54%) rated access to the machines negatively (scores of 1 and 2). This may be due to the specific nature of the neighborhoods where the respondents live (e.g., their distance from collection points, shopping centers, or large stores). This suggests a conclusion that the current network of machines is not keeping up with the needs of citizens, which is the main obstacle to using the Deposit-Refund System and building new, environmentally friendly habits.

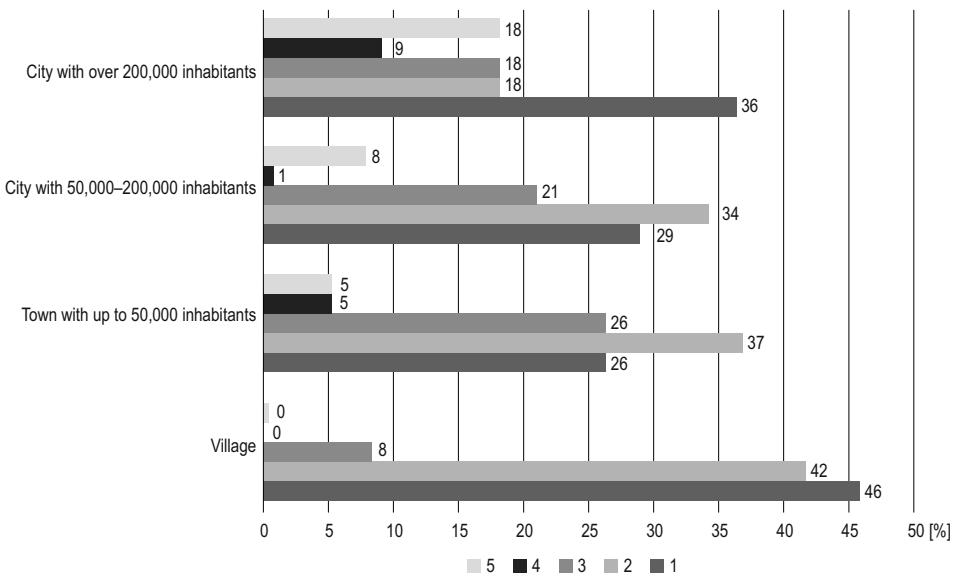


Fig. 1. Assessment of access to Reverse Vending Machines, taking into account the place of residence of respondents

Source: own elaboration based on survey.

While infrastructure and communication scored the lowest, the economic incentive itself is rated most highly (Fig. 2). The majority of respondents (54%) consider the deposit amount to be appropriate, confirming that it is acceptable and cost-effective. At the same time, one in four respondents (24%) consider the deposit to be too high (the sum of “definitely” and “rather” too high responses). This result suggests that for some of the population, the current rate is not perceived as a refundable deposit, but as a real burden on their wallet when shopping. This may increase the resistance of people who were already concerned about additional transaction costs. In turn, the group that considers the deposit too low (22%) needs an even stronger financial impulse that could additionally motivate them to become active in the deposit system.

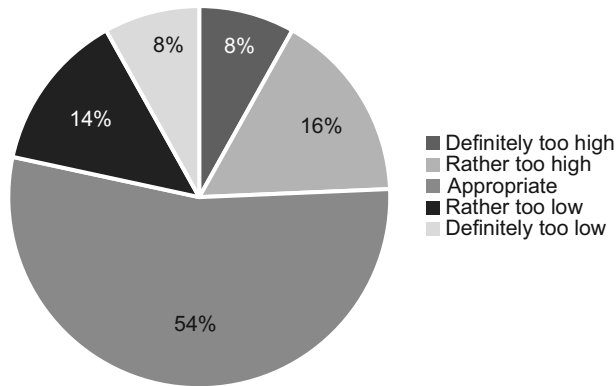


Fig. 2. Respondents' assessment of the deposit amount

Source: own elaboration based on survey.

Despite the deposit being considered as cost-effective, real logistical barriers block the spread of new habits (Fig. 3). The main obstacle is the lack of space in homes to store bottles (50%) and the habit of throwing them into the yellow bin (47%). For 35% of respondents, returning individual containers is time-consuming, which, combined with cumbersome infrastructure, means that even an attractive economic incentive loses out to a lack of convenience. These barriers are complemented by open-ended responses, which reveal that for individuals the reliability of the system is further undermined by technical errors. Respondents point to the unreliability of machines, which are often overfilled or frozen. In addition, some people declare that they do not need to use the system because they have water filters or choose products that are not covered by the deposit, which, combined with the low efficiency of Reverse Vending Machines, makes the system perceived as not very functional.

Apart from technical and logistical difficulties, the main factor determining inactivity in the Deposit-Refund System turned out to be unclear communication.

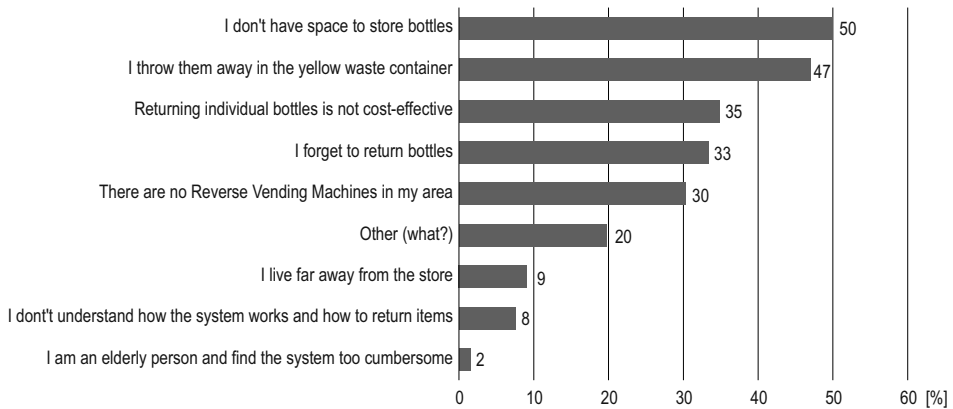


Fig. 3. Reasons why respondents do not use the Deposit-Refund System

Source: own elaboration based on survey.

When comparing data on people who do not use Reverse Vending Machines, we notice that the quality of information provision before the introduction of the Deposit-Refund System is rated very low by them as many as 44% of this group gave the lowest rating (Fig. 4). This suggests that for these people, communication is unclear or poorly formulated, which effectively discourages them from trying to use the machine. With a total of 73% negative ratings (grades 1 and 2) among inactive people, it is clear that the knowledge deficit is becoming an significant barrier. This correlation is confirmed by the results of active users, who were three times more likely to rate the quality of information as good (18% compared to 5% in the non-user group). This result suggests that understanding the rules is an important element in overcoming resistance and implementing new habits. Therefore, reliable communication is a key complement to the economic incentive, without which the deposit – despite being considered profitable – is insufficient to encourage habit breaking.

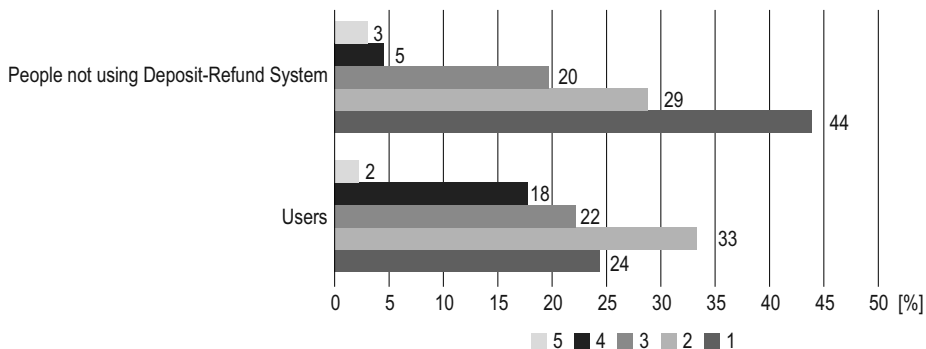


Fig. 4. Assessment of the quality of information communication before the introduction of the Deposit-Refund System, broken down into groups users and non-users of the system

Source: own elaboration based on survey.

An analysis of sources of knowledge about the Deposit-Refund System shows that respondents obtain information mainly from the Internet (54%) and social media and private relationships (44% each), while official government campaigns reach only 9% of respondents (Fig. 5). Supplementary data from open-ended responses indicate that education is often based on random observations, such as instructions on Reverse Vending Machines or the sight of infrastructure under construction, which suggests the informal and scattered nature of the communication. This arrangement of sources, dominated by unofficial channels, may directly affect the level of understanding and trust in the messages received.

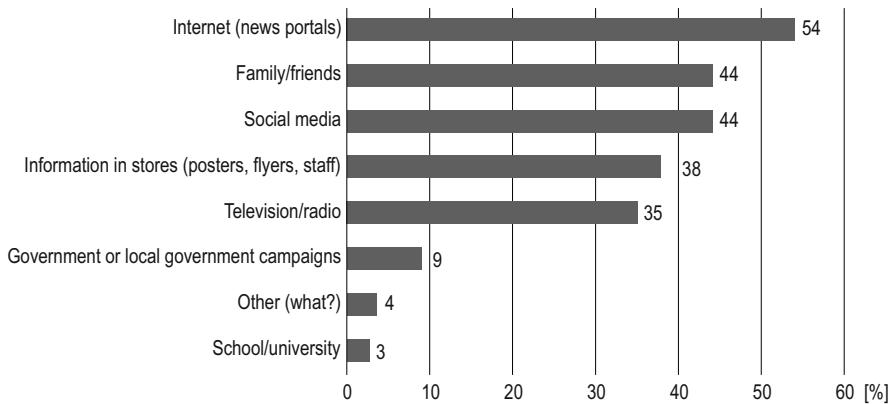


Fig. 5. Sources from which respondents obtain information about the Deposit-Refund System
Source: own elaboration based on survey.

It is important to note that the most frequently chosen informal channels are not considered the most reliable, which shows a dissonance between the reach and credibility of the message (Fig. 6). Although the Internet and

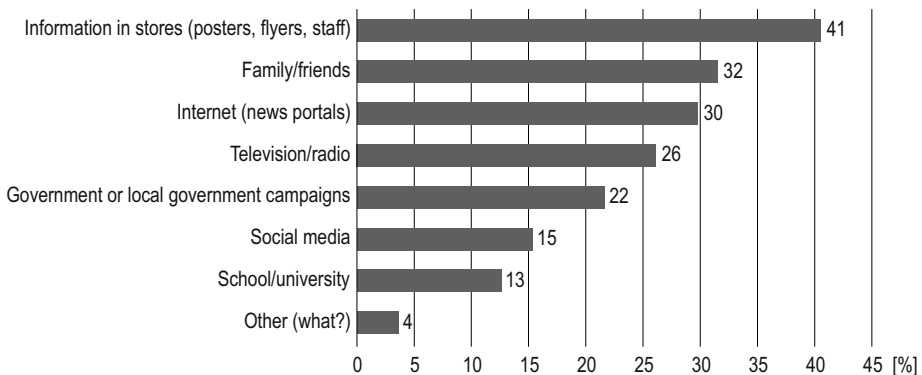


Fig. 6. Sources of information about the Deposit-Refund System that respondents consider most reliable
Source: own elaboration based on survey.

social media dominate everyday use, they are trusted by only 30% and 15% of people, respectively, while communication directly at points of sale is most highly valued (41%). Family and friends, despite their popularity as a source of knowledge, are considered reliable by 32% of respondents. This hierarchy explains the low ratings for clarity of communication, as consumers use channels that are easily accessible but not very reliable, which may increase information chaos and weakens the impact of economic incentives.

The low rating of information quality is not the only problem requiring improvement in the DRS mechanism. Consumers indicate that, in addition to improving communication, it is also necessary to address the issue of insufficient number and availability of Reverse Vending Machines, as declared by 47% of respondents (Fig. 7). Other important expectations concern improving the organization and functioning of the entire system (29%) and conducting more reliable educational campaigns (21%). An analysis of the supplementary responses also shows that subjects are hoping for the introduction of a statutory obligation to pay deposits exclusively in cash, in order to avoid being forced to spend the money in the form of vouchers in a specific store. All these factors – from knowledge deficits to infrastructure deficiencies – combine to make it difficult to implement the assumptions of the DRS.

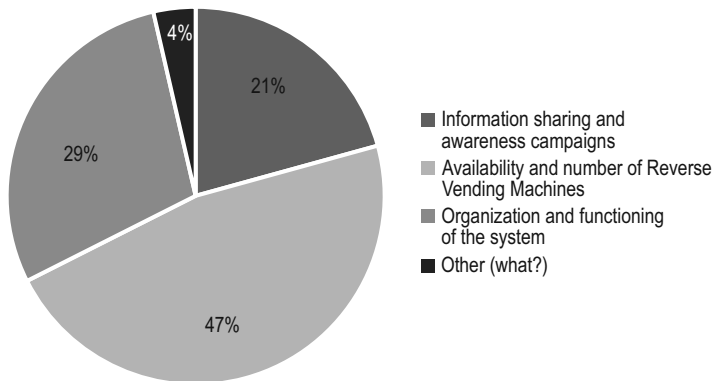


Fig. 7. Elements of the system that, according to respondents, require the most improvement
Source: own elaboration based on survey.

Respondents were asked to indicate the factors that most effectively encourage or would encourage them to use a Deposit-Refund System (Fig. 8). The most important factor is the availability of infrastructure – 61% of respondents considered that a greater number of Reverse Vending Machines is crucial. The transparency of the process is also important: 36% of respondents expect simpler rules and 29% expect clearer instructions. Financial issues (higher deposit 24%) and education (22%) are less important, and the least important

factor is the time it takes to get a refund (6%). These data are supplemented by suggestions from the users themselves. They propose linking the system to discounts on waste disposal fees and extending it to all types of bottles (including those that are currently non-deposit). The reliability of the machines and clear labeling on the products are also key for them.

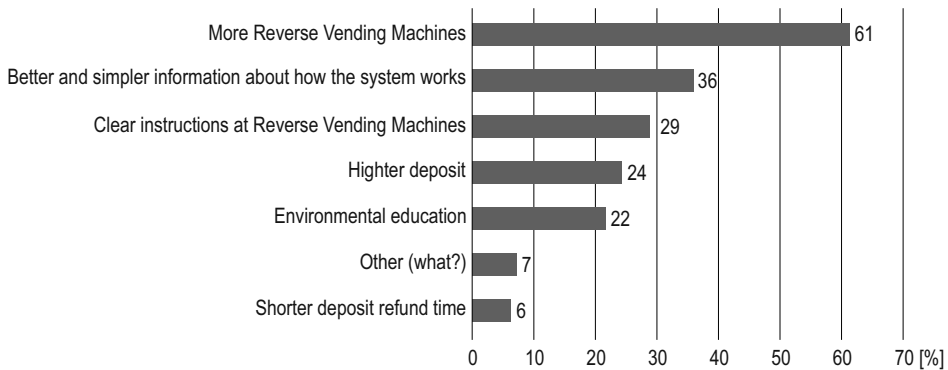


Fig. 8. Measures that encourage or would encourage respondents to use the Deposit-Refund System
Source: own elaboration based on survey.

According to the respondents, the most effective way to increase support for the Deposit-Refund System is to expand the infrastructure as many as 64% of respondents pointed to the need to increase the number of Reverse Vending Machines (Fig. 9).

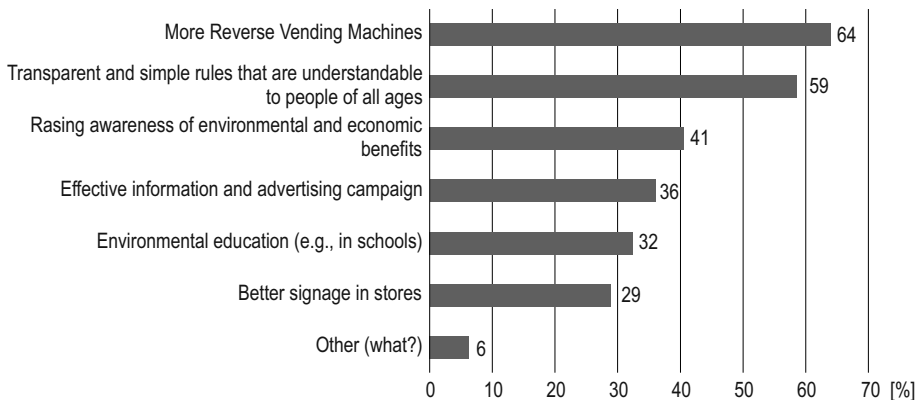


Fig. 9. Elements that could increase the number of supporters of the Deposit-Refund System according to respondents

Source: own elaboration based on survey.

It is equally important to simplify the rules so that they are understandable to people of all ages, as declared by 59% of respondents. In their supplementary opinions, consumers propose specific incentives, such as increasing the deposit to PLN 1, introducing discounts on waste disposal fees, or the possibility of returning all types of bottles at any machine. The technical efficiency of the machines (e.g., resistance to freezing) and clearer labeling on products are also key.

Conclusions

The pilot study proved that despite the declared public acceptance of the Deposit-Refund System, its practical implementation faces a number of barriers that limit the effectiveness of implementing sustainable development goals. Although the introduction of a statutory deposit obligation has become a significant economic incentive for some of the public, for most respondents it has not proved to be a sufficient incentive to bring about a lasting change in purchasing habits. The main reason for this is the strong habit of using existing waste segregation methods and physical limitations in households, which make it difficult to store deposit-bearing packaging.

Analysis of the research material indicates the key importance of the quality of information communication in the process of adapting new pro-environmental solutions. The low rating of the clarity of messages and the failure to tailor information campaigns to different target groups constitute a significant barrier to entry for potential users. The study showed a direct correlation between the assessment of the quality of information communication prior to the introduction of the Deposit-Refund System and actual activity in the use of Reverse Vending Machines; people who negatively assess the reliability and clarity of messages prior to the introduction of the system are much less likely to return packaging to return machines. This proves that a knowledge deficit at the preparatory stage directly translates into subsequent social resistance. In addition, the scattered nature of information sources, based largely on informal channels and social media, can exacerbate information chaos and undermine confidence in the deposit mechanism, especially in view of the marginal reach of official educational campaigns. The collected data indicate that the information provision was ineffective, particularly for those not using the DRS. Due to the small sample size, the results cannot be generalized to the general population.

Another key factor determining the effectiveness of the system is the availability and reliability of the technical infrastructure. Difficulties in accessing Reverse Vending Machines, particularly acute in smaller towns and rural areas, combined with the unreliability of the machines, effectively discourage respondents from making the effort to recover packaging. Even the positively assessed economic incentive in the form of a deposit loses its significance when faced with a cumbersome process and lack of user comfort. It can therefore be

concluded that the success of the Deposit-Refund System in Poland depends on combining and refinement of three pillars: the development of a dense network of collection points, the simplification of return procedures, and the implementation of a professional, multi-channel communication strategy that will transform ideological support into a lasting standard of conduct.

Respondents rated the functioning of the DRS in Poland as very poor. According to respondents, this was primarily due to the level of availability of RVMs and, to a lesser extent, the organization of the system, which were most frequently stated as areas for improvement. This aligns with the literature, which indicates that the ultimate effectiveness of the DRS depends on the proper balance of key elements, particularly the availability of return points, the deposit amount, and the level of public awareness and motivation, which directly impact return rates.

The study provided up-to-date insight into respondents' opinions regarding information provision and an assessment of the functioning of the recently introduced Deposit-Refund System in Poland. Despite the relatively small sample size, a potential gap in the functioning of the DRS was identified and provided a potential starting point for further, larger-scale research. The study results may be useful in formulating recommendations for decision-makers regarding improving the clarity of messages about the DRS to ensure they are relevant to all social groups, conducting intensive information campaigns, and improving the availability and reliability of infrastructure (Reverse Vending Machines).

Translated by Author

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OUTPUT MULTIPLIERS IN THE ECONOMIES OF GERMANY, POLAND AND SLOVAKIA: A COMPARATIVE INPUT-OUTPUT ANALYSIS

Lyubomyr Sozanskyy

Department of Problems of the Real Sector of the Economy of Regions

Dolishniy Institute of Regional Research of the NAS of Ukraine

ORCID: <https://orcid.org/0000-0001-7854-3310>

e-mail: ls.ird2@ukr.net

JEL Classification: C67, D57, O14.

Key words: output multiplier, input-output analysis, Leontief inverse matrix, decomposition of total requirements, interindustry linkages.

Abstract

The article presents a comparative analysis of output multipliers in the economies of Germany, Poland and Slovakia for 2022. The study is based on national input-output tables published by the OECD and covers fifty economic activities. The results reveal a clear cross-country gradient in average output multipliers: Germany records the lowest value, Poland an intermediate one and Slovakia the highest. This gradient reflects the higher material intensity of production in Poland and Slovakia and is amplified by the use of the total Leontief inverse, which includes both domestic and imported intermediate consumption. The ranking of economic activities is broadly similar across the three countries: manufacturing and energy occupy the upper part of the distribution, whereas education, public administration and real estate activities are located at the lower end. Slovakia combines the highest average multiplier with the widest dispersion, driven especially by motor vehicles, electronic products and electricity supply. The output multiplier is decomposed into a direct requirements component and a residual requirement component, the latter defined as the remaining output requirement after the first round of direct inputs; this residual component accounts for about 70–85 per cent of the total multiplier in all three economies. A central empirical finding is that selected manufacturing activities in Poland and Slovakia, especially motor vehicles, computers and electronics, electrical equipment and, in Slovakia, electricity supply, generate substantially higher multipliers than their German counterparts.

MNOŻNIKI PRODUKCJI GLOBALNEJ W GOSPODARKACH NIEMIEC, POLSKI I SŁOWACJI: PORÓWNAWCZA ANALIZA INPUT-OUTPUT

Lyubomyr Sozanskyi

Katedra Problemów Sektora Realnego Gospodarki Regionów
Dolizsny Instytut Badań Regionalnych Narodowej Akademii Nauk Ukrainy

Kody JEL: C67, D57, O14.

Słowa kluczowe: mnożnik produkcji globalnej, analiza input-output, macierz odwrotna Leontiefa, dekompozycja wymagań całkowitych, powiązania międzybranżowe.

Abstrakt

W artykule przedstawiono porównawczą analizę mnożników produkcji globalnej w gospodarkach Niemiec, Polski i Słowacji w 2022 roku. Badanie oparto na narodowych tablicach input-output OECD i przeprowadzono w przekroju pięćdziesięciu rodzajów działalności gospodarczej. Wyniki wskazują wyraźny międzykrajowy gradient średnich mnożników produkcji globalnej: najniższą wartość odnotowano w Niemczech, pośrednią w Polsce, a najwyższą na Słowacji. Gradient ten odzwierciedla większą materiałochłonność produkcji w Polsce i na Słowacji oraz znaczenie importowanego zużycia pośredniego w mniejszych gospodarkach otwartych. Ranking działalności według wartości mnożnika jest podobny w trzech krajach: najwyższe pozycje zajmują przetwórstwo przemysłowe i energetyka, a najniższe edukacja, administracja publiczna i obsługa nieruchomości. Mnożnik produkcji rozłożono na komponent bezpośredni oraz komponent rezydualny, przy czym ten drugi zdefiniowano jako pozostałe zapotrzebowanie na produkcję po pierwszej rundzie nakładów bezpośrednich; komponent rezydualny stanowi około 70–85 procent mnożnika całkowitego we wszystkich trzech gospodarkach. Wyniki mogą wspierać analizę powiązań międzybranżowych oraz decyzje w zakresie polityki przemysłowej i strukturalnej. Kluczowym wynikiem jest również to, że wybrane działy przemysłu przetwórczego w Polsce i na Słowacji, zwłaszcza pojazdy samochodowe, komputery i elektronika, urządzenia elektryczne oraz na Słowacji sektor energii elektrycznej, osiągają znacznie wyższe mnożniki niż ich odpowiedniki w Niemczech.

Introduction

Input-output analysis is one of the oldest and at the same time most persistently used tools of applied macroeconomics. The model proposed by Leontief (1936, 1941), which describes the structure of interindustry linkages through a system of linear production equations, has become the standard framework for studying how a unit increase in final demand for the output of a given economic activity spreads through the economy via supply chains. The output multiplier is the aggregate indicator of this propagation: it measures the total response of gross output in all economic activities to a unit increase in final demand for the output of one of them. Despite the long history of the method, comparative empirical studies remain valuable, especially when they are based on harmonised cross-country data that minimise the methodological differences which have traditionally complicated such comparisons (Miller & Blair, 2022; Dietzenbacher *et al.*, 2013b).

The objects of comparison in this article are three European Union economies with different sectoral specialisations and different degrees of openness. Germany is a large EU economy with a developed manufacturing sector and a diversified sectoral structure. Poland is a large post-transition economy with a completed transformation, a strong manufacturing and engineering base, and an expanding service sector. Slovakia is a small open economy specialising in automotive production and performing the function of a regional energy hub: a substantial share of nuclear generation, combined with transit capacities, meets domestic needs and also supports electricity exports to neighbouring countries. Comparing these three cases makes it possible to trace how the depth of interindustry linkages varies with the character of sectoral specialisation and the degree of economic openness.

The country selection follows a purposive comparative design. Germany, Poland and Slovakia are linked by their participation in the EU single market and in Central European production networks, especially in manufacturing, automotive, machinery, electronics and energy-related value chains. At the same time, they occupy three different structural positions along a core, post-transition and small-open gradient. The comparison therefore does not treat the three economies as homogeneous; it uses them as an ordered set of contrasting but economically connected cases. Other EU economies, such as Czechia, Hungary and Austria, could be included in a wider design, but the present selection was chosen to keep the paper focused on a core-post-transition-small-open gradient with identical 2022 OECD input-output coverage.

The purpose of the study is to identify and compare the output multiplier effects of economic activities in Germany, Poland and Slovakia and to reveal the common features, specific characteristics and regularities in their formation. It should be emphasised that all multipliers are calculated on the basis of the total Leontief inverse matrix; hence, they include the contribution not only of domestic but also of imported intermediate consumption. This is crucial for the subsequent interpretation, because the role of imports in intermediate consumption differs substantially across the three economies under study.

The article provides an updated empirical description of the structure of output multipliers in three European economies and systematises their sectoral composition and decomposition into a direct requirements component and a residual requirement component. In this way it offers a comparative empirical basis for subsequent structural and sectoral research. The regularities identified – the cross-country gradient of mean values, the broadly similar ranking of economic activities and the predominance of the residual requirement component over the direct one – are analytically relevant both for researchers of interindustry linkages and structural change and for designers of industrial and structural policy who need empirical reference points for assessing expected output responses to changes in final demand in particular economic activities.

The remainder of the article is organised as follows. The literature review outlines the conceptual and methodological background of output multiplier analysis. The data and methodology section describe the OECD input-output tables used in the study and explains the calculation procedure. The results section presents the comparative empirical findings for Germany, Poland and Slovakia. The conclusions summarise the main regularities identified and discuss their analytical and policy relevance.

Literature review

The conceptual foundations of output multiplier analysis were laid by Leontief (1936, 1941), who formalised the structure of interindustry linkages through a system of linear production equations. The central technical object of this framework is the Leontief inverse matrix; the sum of the elements in each of its columns indicates the total volume of gross output in all economic activities that must be produced to satisfy a unit increase in final demand for the output of a given activity. This indicator, traditionally referred to as the simple output multiplier (Type I multiplier), concisely summarises the depth of interindustry linkages associated with each economic activity and remains a basic tool of input-output analysis (Miller & Blair, 2022; ten Raa, 2005).

The research that developed around the original Leontief model evolved in two directions: substantive applications and methodological refinement. In empirical work, Chenery and Watanabe (1958) initiated comparative studies of interindustry structures, demonstrating the stability of basic patterns of intermediate input use across national economies. Rasmussen (1956) proposed indices of dispersion, which, together with Hirschman's (1958) concepts of backward and forward linkages, became a standard instrument for identifying so-called key economic activities and for discussing strategies of unbalanced growth. The methods developed in this period continue to underpin most modern multiplier-based diagnostics.

Input-output analysis also has a broader theoretical background than the operational calculation of multipliers. Kurz and Salvadori (2006) interpret Leontief's work and Sraffa's early analysis as related attempts to describe the economy as a system of mutually dependent industries, in which outputs of some activities reappear as inputs of others. Opocher and Steedman (2015) extend this perspective to the theory of full industry equilibrium, stressing that long-run industrial adjustment has to be analysed at the level of the complete production system rather than as a collection of isolated industries. Empirical contributions such as Paraskevopoulou *et al.* (2016), which revisit Leontief's paradox using input-output evidence, also show that input-output analysis can reveal structural regularities that are not captured by simpler trade or sectoral models. These

works are important for the present article because they support the interpretation of output multipliers as indicators of systemic interindustry dependence, while also reminding the reader that a high multiplier reflects the scale of intermediate requirements rather than welfare, productivity or competitiveness in itself.

At the same time, the standard Leontief multiplier has been subject to important critical reassessments. Dietzenbacher (2002) and Oosterhaven and Stelder (2002) note that the traditional definition tends to overstate the economic importance of activities with exceptionally high intermediate input requirements, because the multiplier mechanically captures the volume of intermediate linkages rather than the value created in the activity concerned. To overcome this limitation, alternative formulations have been proposed, including net multipliers and gross value-added multipliers (Oosterhaven & Stelder, 2002; Dietzenbacher, 2005; Oosterhaven, 2007); a textbook treatment of these issues, together with related decomposition methods, is provided by ten Raa (2005). The methodological debate has therefore enriched the toolkit, while at the same time confirming the relevance of the standard column-sum multiplier as an appropriate indicator for comparative analysis, provided that its results are interpreted carefully.

Consistent with this, output multipliers, value-added multipliers and employment multipliers are best understood as complementary rather than competing indicators that describe different aspects of the same demand impulse: output multipliers describe the gross production requirements and intersectoral propagation of final demand, while value added and employment multipliers describe net income and labour-market effects. Official statistical and central-bank applications therefore routinely calculate output multipliers together with value added, income and employment multipliers. This applied use is reflected in the United Nations Handbook, the U.S. Bureau of Economic Analysis methodology, the Bank of Greece and Central Bank of Malta studies, and the multiplier tables published by the Scottish Government and Statistics Canada (Australian Bureau of Statistics, 2025; Bureau of Economic Analysis, 2009; United Nations, 2018; Backinezos *et al.*, 2020; Cassar, 2015; Scottish Government, 2025; Statistics Canada, 2026).

A further line of methodological development, summarised in the programmatic essay by Dietzenbacher *et al.* (2013a), concerns the construction of multiregional and global input-output databases. The World Input-Output Database (Dietzenbacher *et al.*, 2013b; Timmer *et al.*, 2015) and, later, the OECD Inter-Country Input-Output tables (Yamano & Webb, 2018) made it possible to move multiplier analysis from a closed national context to a global production network and to account for the cross-border transmission of demand impulses, which now shapes modern manufacturing. The unified classifications of economic activities and harmonised accounting principles on which these databases are based have largely removed the harmonisation problems that once made cross-country comparisons of multipliers highly risky.

Empirical applications of multiplier analysis to European economies have a long tradition. For Germany, multipliers have been used in studies of interindustry structure, technological change, environmental impacts and the effects of fiscal stimulus, often in combination with structural decomposition and integrated environmental-economic accounts such as NAMEA (Schäfer & Stahmer, 1989; Moll *et al.*, 2006). The Polish multiplier school, associated primarily with the University of Lodz, has accumulated a substantial body of work on input-output modelling (Tomaszewicz, 1994; Plich, 2002; Boratyński *et al.*, 2010; Boratyński *et al.*, 2015; Świeczewska, 2014). These studies address, among other issues, the effects of European integration, fiscal and tax effects, the environmental consequences of structural change and the short-term effects of energy price changes. For Slovakia, comparative descriptions of interindustry structure developed in parallel with the country's integration into the European automotive supply chain, while more recent research based on harmonised sources has documented the exceptionally high material intensity of Slovak manufacturing (Grodzicki & Skrzypek, 2020).

Despite this substantial body of research, recent comparative descriptions of output multipliers for the Germany-Poland-Slovakia triangle based on the latest available data remain scarce. The present article is intended to fill this descriptive and analytical gap by systematically presenting the structure of output multipliers and their decomposition into a direct requirements component and a residual requirement component using national OECD input-output tables for the three economies.

Data and methodology

The empirical analysis is based on national input-output tables published by the OECD (2025) for the reporting year 2022. This is the most recent year for which the source currently publishes national tables. The data are compiled at basic prices and are available for fifty economic activities according to ISIC Rev. 4, with a detailed breakdown of selected manufacturing activities that is identical across the three countries. Intermediate consumption in the tables is split into domestic and imported components, which makes the data directly suitable for calculating multipliers that include both domestic and import-induced effects (Yamano & Webb, 2018; OECD, 2025). The advantage of this source over national statistical office data lies in the full harmonisation of activity definitions and accounting principles, so the cross-country differences observed in the multipliers can be attributed to structural rather than methodological factors. The output multiplier of economic activity j is calculated as the sum of the elements of the j -th column of the Leontief inverse matrix, as shown in formula (1):

$$m_j = \sum_i L_{ij} \quad (1)$$

where

$$L = (I - A)^{-1}$$

In formula (1), A is the matrix of total, that is, domestic and imported, technical coefficients. Each element $a_{ij} = z_{ij}/x_j$ expresses the share of inputs supplied by economic activity i per unit of gross output of economic activity j . The diagonal element of the Leontief inverse matrix reflects the response of the economic activity itself to a unit increase in final demand, while the off-diagonal elements capture the responses transmitted through other economic activities via interindustry linkages (Miller & Blair, 2022).

The calculated multiplier is decomposed according to a two-component, requirements-based convention into the direct intermediate-requirements component d_j and the residual requirement component r_j . The direct component is calculated as the sum of the elements of the j -th column of the matrix of technical coefficients, as shown in formula (2):

$$d_j = \sum_i a_{ij} = \frac{Z_j}{x_j} \quad (2)$$

In formula (2), Z_j is the total intermediate consumption of economic activity j . The direct component is therefore equal to the ratio of intermediate consumption to gross output and reflects the immediate technical input requirements generated by a unit increase in final demand. The residual requirement component is defined as the difference between the total output multiplier and the direct intermediate-requirements component, as shown in formula (3):

$$r_j = m_j - d_j \quad (3)$$

The residual component r_j is thus the remaining output requirement after the first round of direct inputs. Since $L = I + A + A^2 + A^3 + \dots$, subtracting A from L leaves $I + A^2 + A^3 + \dots$; the residual component therefore comprises the initial unit of output associated with final demand together with the higher-order interindustry requirements, and differs from the strict higher-order indirect effect $L - I - A$, in which the identity matrix is separated as an initial effect. This two-component, requirements-based reading is documented in the literature (Parikh, 1975; Coskun & Coskun, 2021; Office for National Statistics, 2017; Thomas *et al.*, 2024).

The calculations are performed using the total Leontief inverse matrix, which includes inputs of both domestic and imported origin. This methodological choice should be kept in mind when interpreting the cross-country differences, especially for smaller open economies in which imported intermediate consumption is quantitatively significant.

Results

According to the calculations based on national OECD input-output tables (OECD, 2025), output multipliers in the three economies under study form a clear and economically meaningful picture of interindustry linkages. The first notable regularity concerns the average level of multipliers. Calculated as a simple average over forty-nine economic activities (activity T, 'Activities of households as employers', is excluded because it has no intermediate consumption, its multiplier is identically equal to one and it carries no comparative information), the output multiplier is 2.258 in Germany, 2.469 in Poland and 2.618 in Slovakia. This ordering, summarised in the last row of Table 1, is fully consistent with the known structural characteristics of the three economies and admits a twofold interpretation. On the one hand, it shows that production in Poland and Slovakia is on average more material-intensive than in Germany: producing one unit of gross output requires a larger volume of intermediate inputs. By contrast, German production creates more gross value added per unit of output and relies less on assembly-type processes accompanied by high intermediate consumption. On the other hand, the observed gradient also reflects the fact that the multipliers are calculated from the total Leontief inverse matrix and include imported intermediate consumption alongside domestic inputs. In small open economies such as Slovakia and, to a lesser extent, Poland, this imported component is quantitatively important and explains a substantial part of the difference from Germany. Poland's average multiplier lies between the two reference points and reflects the dual nature of a post-transition economy that combines a strong engineering and manufacturing base with a growing service sector.

The aggregate results of the output multiplier calculations and their decomposition into a direct requirements component and a residual requirement component for the three economies are presented in Table 1.

The dispersion of multipliers across economic activities also changes systematically with the country average. In Germany, the range between the highest and the lowest multiplier is 1.83, from 1.27 in coal mining to 3.11 in the manufacture of non-ferrous and precious metals; in Poland, it is 1.95, from 1.23 in coal mining to 3.18 in motor vehicles; and in Slovakia, it reaches 2.31, from 1.57 in education to 3.88 in motor vehicles. The wider dispersion in Slovakia is linked to the concentration of its manufacturing base around a small number of material-intensive activities, above all automotive assembly. The unusually low values for coal mining in Germany and Poland deserve separate attention: they are not caused by a low cost of intermediate inputs in the usual sense, but rather reflect the structural decline of the activity in both countries. The remaining capacities are characterised by an unusually low ratio of intermediate consumption to gross output (around 10–13 per cent), so most of the value structure consists of labour compensation and depreciation, while the scope for backward propagation of a demand impulse is limited.

Table 1
Output multipliers and their decomposition into a direct requirements component and a residual requirement component in Germany, Poland and Slovakia, 2022

Economic activity	Code	Germany				Poland				Slovakia	
		Multiplier	Effect		Multiplier	Effect		Multiplier	Effect		
			Direct	Residual		Direct	Residual		Direct	Residual	
1	2	3	4	5	6	7	8	9	10		
Agriculture, hunting and related service activities	A01	2.175	0.522	1.653	2.691	0.645	2.046	2.813	0.680	2.133	
Forestry and logging	A02	1.999	0.474	1.526	2.367	0.555	1.811	1.846	0.400	1.445	
Fishing and aquaculture	A03	2.064	0.491	1.574	2.148	0.486	1.662	2.162	0.484	1.678	
Mining of coal and lignite	B05	1.274	0.130	1.144	1.226	0.100	1.126	2.490	0.563	1.927	
Extraction of crude petroleum and natural gas	B06	2.335	0.643	1.692	2.529	0.662	1.868	1.769	0.295	1.475	
Mining of metal ores	B07	1.000	—	1.000	2.073	0.469	1.603	2.488	0.556	1.932	
Other mining and quarrying	B08	2.239	0.590	1.649	2.542	0.662	1.880	3.122	0.802	2.320	
Mining support service activities	B09	1.859	0.421	1.439	2.225	0.538	1.687	2.480	0.597	1.883	
Manufacture of food products, beverages and tobacco products	C10T12	2.752	0.787	1.965	3.167	0.827	2.340	3.062	0.771	2.291	
Textiles, wearing apparel, leather and related products	C13T15	2.474	0.677	1.797	2.570	0.640	1.930	2.646	0.639	2.006	
Manufacture of wood and wood products	C16	2.589	0.705	1.885	2.752	0.688	2.064	2.639	0.705	1.934	
Manufacture of paper and paper products; printing	C17_18	2.680	0.739	1.941	2.901	0.735	2.166	3.270	0.805	2.465	
Manufacture of coke and refined petroleum products	C19	3.052	0.895	2.157	2.935	0.786	2.149	2.544	0.789	1.755	
Manufacture of chemicals and chemical products	C20	2.756	0.742	2.014	3.125	0.801	2.324	3.386	0.839	2.546	
Manufacture of basic pharmaceutical products	C21	2.177	0.554	1.623	2.446	0.591	1.855	2.391	0.557	1.833	
Manufacture of rubber and plastic products	C22	2.566	0.681	1.885	2.944	0.729	2.215	3.117	0.745	2.372	

cont. Table 1

1	2	3	4	5	6	7	8	9	10	
Manufacture of other non-metallic mineral products	C23	2.457	0.668	1.789	2.756	0.716	2.040	3.030	0.732	2.299
	C24A	2.959	0.839	2.120	3.069	0.840	2.229	3.269	0.783	2.486
	C24B	3.106	0.867	2.239	3.001	0.817	2.183	3.488	0.834	2.654
	C25	2.573	0.640	1.932	2.804	0.676	2.129	3.058	0.697	2.360
Manufacture of computers, electronic and optical products	C26	2.155	0.538	1.617	3.084	0.792	2.291	3.770	0.892	2.878
	C27	2.509	0.647	1.862	3.046	0.771	2.275	3.408	0.800	2.608
Manufacture of machinery and equipment n.e.c.	C28	2.479	0.634	1.845	2.763	0.678	2.085	3.324	0.792	2.532
	C29	2.615	0.686	1.929	3.175	0.814	2.361	3.882	0.895	2.986
Building of ships and boats	C30I	2.916	0.812	2.104	2.965	0.751	2.214	2.955	0.679	2.276
	C302T309	2.547	0.659	1.888	3.023	0.761	2.262	3.266	0.771	2.495
Manufacture of furniture; repair and installation of machinery and equipment	C31T33	2.307	0.588	1.719	2.575	0.629	1.946	2.774	0.652	2.122
	D	2.470	0.650	1.819	2.453	0.643	1.810	3.855	0.969	2.887
Electricity, gas, steam and air conditioning supply	E	2.261	0.577	1.685	2.298	0.552	1.747	2.400	0.527	1.873
	F	2.327	0.592	1.736	2.842	0.705	2.138	2.578	0.592	1.985
Wholesale and retail trade; repair of motor vehicles	G	1.932	0.460	1.473	1.953	0.422	1.531	2.147	0.456	1.692
	H49	2.203	0.563	1.640	2.466	0.678	1.789	2.324	0.567	1.757
Water transport	H50	2.460	0.615	1.845	2.937	0.748	2.189	1.584	0.251	1.334

cont. Table 1

Air transport	H51	2.815	0.753	2.062	3.055	0.801	2.253	3.148	0.855	2.293
Warehousing and support activities for transportation	H52	2.487	0.682	1.805	2.486	0.641	1.845	2.499	0.618	1.881
Postal and courier activities	H53	2.423	0.633	1.790	2.008	0.469	1.539	2.367	0.578	1.789
Accommodation and food service activities	I	2.146	0.557	1.589	2.301	0.509	1.792	2.109	0.421	1.688
Publishing, audiovisual and broadcasting activities	J58T60	2.189	0.581	1.608	2.196	0.538	1.658	2.378	0.559	1.819
Telecommunications	J61	2.370	0.670	1.700	2.058	0.497	1.561	2.121	0.444	1.677
Computer programming and information services	J62_63	1.900	0.466	1.434	1.852	0.429	1.423	2.069	0.463	1.606
Financial and insurance activities	K	2.141	0.568	1.573	1.633	0.328	1.305	2.139	0.511	1.629
Real estate activities	L	1.561	0.279	1.283	2.139	0.492	1.647	1.645	0.260	1.385
Professional, scientific and technical activities	M	1.962	0.487	1.475	2.030	0.476	1.554	2.184	0.500	1.684
Administrative and support service activities	N	1.903	0.454	1.448	2.077	0.487	1.590	2.394	0.569	1.825
Public administration and defence; compulsory social security	O	1.749	0.373	1.376	1.623	0.276	1.347	1.803	0.328	1.475
Education	P	1.464	0.241	1.224	1.472	0.211	1.260	1.571	0.223	1.348
Human health and social work activities	Q	1.649	0.337	1.312	1.951	0.426	1.526	1.838	0.356	1.481
Arts, sports, entertainment and recreation	R	1.935	0.479	1.456	2.252	0.561	1.692	2.705	0.664	2.041
Other service activities	S	1.698	0.358	1.341	1.988	0.437	1.551	1.994	0.392	1.601
Activities of households as employers	T	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000
Average (excluding activity T)	—	2.258	0.583	1.687	2.469	0.602	1.867	2.618	0.609	2.009

Source: author's calculations based on OECD input-output tables (OECD, 2025) for 2022.

Note: mining of metal ores (B07) in Germany in 2022 has zero recorded output and is conventionally reported with a multiplier of 1.000; the direct effect for this activity is not defined. The average in the last row is calculated for forty-nine economic activities, excluding activity T.

The list of activities with the highest multipliers is broadly similar across the three economies. The upper part of the distribution is formed by activities that use intermediate inputs from other manufacturing activities intensively: motor vehicles, coke and refined petroleum products, metallurgy, chemicals, other non-metallic mineral products, rubber and plastics, and food manufacturing. In Poland and Slovakia, the manufacture of computers, electronic and optical products and electrical equipment also occupies a prominent position. The highest individual multiplier in the sample is observed in Slovakia, in the manufacture of motor vehicles (3.88), followed by electricity supply (3.86) and computer products (3.77). In Poland, motor vehicles (3.18) and the food industry (3.17) occupy the leading positions, while computer products and electrical equipment are close to the top. In Germany, the highest values are found in coke and refined petroleum products (3.05) and metallurgy (around 3.0), reflecting the deep integration of the country into heavy-industrial value chains.

Two regularities within the upper part of the distribution deserve particular attention. The first is that a number of manufacturing activities in Poland and Slovakia show much higher multipliers than in Germany. The most striking case is the manufacture of computers, electronic and optical products: the Slovak multiplier (3.77) exceeds the German value (2.16) by more than 1.6 points, while the Polish value (3.08) is almost one point higher than the German one. A similar difference is visible in motor vehicles, where the Slovak multiplier (3.88) is more than one point higher than the German value (2.62), as well as in electrical equipment. This regularity is not a random deviation; it is an empirical manifestation of the assembly-based character of the Slovak manufacturing base and, to a lesser extent, of the Polish one. A large share of gross output value is formed through intermediate linkages rather than created locally, which mechanically inflates the column sums of the Leontief inverse matrix. The second notable feature is the exceptionally high multiplier in electricity, gas and steam supply in Slovakia (3.86), compared with 2.47 in Germany and 2.45 in Poland. This value reflects Slovakia's role as a regional energy hub: the large share of nuclear generation in the energy balance, together with gas and electricity transit capacities, creates a dense chain of intra-sectoral intermediate linkages and, consequently, a high multiplier value.

The lower part of the multiplier distribution mirrors the regularities observed at the top and is also similar across the three countries. The lowest positions are systematically occupied by service activities with a high direct content of gross value added: education, public administration, real estate activities, human health and social work, and other personal services. If the special case of coal mining in Germany and Poland is set aside, education is the activity with the lowest multiplier among substantive activities in all three countries: 1.46 in Germany, 1.47 in Poland and 1.57 in Slovakia. The very high share of labour compensation in this activity and its limited use of intermediate inputs make this result entirely expected from a technological perspective.

The cross-country similarity of activity rankings can be summarised quantitatively using Spearman rank correlations between multiplier values. The pairwise coefficients are 0.85 between Germany and Poland, 0.78 between Poland and Slovakia and 0.73 between Germany and Slovakia. This ordering of coefficients is itself informative: the relatively higher coefficient between Germany and Poland and the lower coefficient between Germany and Slovakia are consistent with the narrow and distinctive industrial profile of the Slovak economy, which generates both higher peaks and a less typical sectoral ordering than in the other two countries.

The percentage decomposition of the output multiplier into a direct requirements component and a residual requirement component for the three economies is presented in Table 2.

Table 2
Shares of the direct and residual requirement components in the output multiplier in Germany, Poland and Slovakia, 2022 (%)

Economic activity	Code	Germany		Poland		Slovakia	
		Direct	Residual	Direct	Residual	Direct	Residual
1	2	3	4	5	6	7	8
Agriculture, hunting and related services	A01	24.0	76.0	24.0	76.0	24.2	75.8
Forestry and logging	A02	23.7	76.3	23.4	76.6	21.7	78.3
Fishing and aquaculture	A03	23.8	76.2	22.6	77.4	22.4	77.6
Mining of coal and lignite	B05	10.2	89.8	8.2	91.8	22.6	77.4
Extraction of crude petroleum and natural gas	B06	27.5	72.5	26.2	73.8	16.7	83.3
Mining of metal ores	B07	—	100.0	22.6	77.4	22.3	77.7
Other mining and quarrying	B08	26.4	73.6	26.0	74.0	25.7	74.3
Mining support service activities	B09	22.6	77.4	24.2	75.8	24.1	75.9
Food products, beverages and tobacco	C10T12	28.6	71.4	26.1	73.9	25.2	74.8
Textiles, apparel, leather and related products	C13T15	27.4	72.6	24.9	75.1	24.1	75.9
Manufacture of wood and wood products	C16	27.2	72.8	25.0	75.0	26.7	73.3
Manufacture of paper and paper products; printing	C17_18	27.6	72.4	25.3	74.7	24.6	75.4
Manufacture of coke and refined petroleum products	C19	29.3	70.7	26.8	73.2	31.0	69.0
Manufacture of chemicals and chemical products	C20	26.9	73.1	25.6	74.4	24.8	75.2
Pharmaceutical products	C21	25.4	74.6	24.2	75.8	23.3	76.7
Rubber and plastic products	C22	26.5	73.5	24.8	75.2	23.9	76.1
Other non-metallic mineral products	C23	27.2	72.8	26.0	74.0	24.2	75.8

cont. Table 2

1	2	3	4	5	6	7	8
Basic iron and steel	C24A	28.4	71.6	27.4	72.6	24.0	76.0
Non-ferrous and precious metals	C24B	27.9	72.1	27.2	72.8	23.9	76.1
Fabricated metal products	C25	24.9	75.1	24.1	75.9	22.8	77.2
Computer, electronic and optical products	C26	25.0	75.0	25.7	74.3	23.7	76.3
Electrical equipment	C27	25.8	74.2	25.3	74.7	23.5	76.5
Machinery and equipment n.e.c.	C28	25.6	74.4	24.5	75.5	23.8	76.2
Motor vehicles, trailers and semi-trailers	C29	26.2	73.8	25.6	74.4	23.1	76.9
Building of ships and boats	C301	27.8	72.2	25.3	74.7	23.0	77.0
Manufacture of other transport equipment	C302T309	25.9	74.1	25.2	74.8	23.6	76.4
Furniture; repair and installation of machinery	C31T33	25.5	74.5	24.4	75.6	23.5	76.5
Electricity, gas, steam and air conditioning	D	26.3	73.7	26.2	73.8	25.1	74.9
Water supply; sewerage; waste management	E	25.5	74.5	24.0	76.0	22.0	78.0
Construction	F	25.4	74.6	24.8	75.2	23.0	77.0
Wholesale and retail trade; motor vehicle repair	G	23.8	76.2	21.6	78.4	21.2	78.8
Land and pipeline transport	H49	25.6	74.4	27.5	72.5	24.4	75.6
Water transport	H50	25.0	75.0	25.5	74.5	15.8	84.2
Air transport	H51	26.7	73.3	26.2	73.8	27.2	72.8
Warehousing and support for transportation	H52	27.4	72.6	25.8	74.2	24.7	75.3
Postal and courier activities	H53	26.1	73.9	23.4	76.6	24.4	75.6
Accommodation and food service activities	I	26.0	74.0	22.1	77.9	20.0	80.0
Publishing, audiovisual and broadcasting activities	J58T60	26.5	73.5	24.5	75.5	23.5	76.5
Telecommunications	J61	28.3	71.7	24.1	75.9	20.9	79.1
Computer programming and information services	J62_63	24.5	75.5	23.2	76.8	22.4	77.6
Financial and insurance activities	K	26.5	73.5	20.1	79.9	23.9	76.1
Real estate activities	L	17.9	82.1	23.0	77.0	15.8	84.2
Professional, scientific and technical activities	M	24.8	75.2	23.4	76.6	22.9	77.1
Administrative and support service activities	N	23.9	76.1	23.4	76.6	23.8	76.2
Public administration and defence	O	21.3	78.7	17.0	83.0	18.2	81.8
Education	P	16.5	83.5	14.3	85.7	14.2	85.8

cont. Table 2

1	2	3	4	5	6	7	8
Health and social work activities	Q	20.4	79.6	21.8	78.2	19.4	80.6
Arts, entertainment and recreation	R	24.8	75.2	24.9	75.1	24.5	75.5
Other service activities	S	21.1	78.9	22.0	78.0	19.7	80.3
Households as employers	T	0.0	100.0	0.0	100.0	0.0	100.0

Source: author's calculations based on OECD input-output tables (OECD, 2025) for 2022. For mining of metal ores (B07) in Germany, the decomposition is not reported; see the note to Table 1.

In addition to the level and ordering of the multiplier, its two-component decomposition provides further comparative information. Two important regularities emerge. First, in virtually every economic activity and in all three countries, the residual requirement component substantially exceeds the direct intermediate-requirements component: its share usually ranges from 70 to 85 per cent of the total multiplier. Empirically, this shows that most of the total gross-output requirement is not exhausted by the one-round direct input coefficients but is associated with the residual requirement component.

Second, the share of the direct component varies systematically with the technological character of the economic activity. The highest values of this share, from 25 to 31 per cent, are observed in coke and refined petroleum products, food products, metallurgy, paper products, chemicals and motor vehicles, that is, in activities that intensively use intermediate inputs from a relatively narrow circle of suppliers. The lowest shares, from 14 to 22 per cent, are recorded in education, public administration, real estate activities and other personal services, where intermediate inputs play a minor role and most of the value structure consists of labour compensation. This regularity is informative for applied analysis because it shows what part of the total multiplier effect is realised directly in the activity being stimulated and what part is transmitted through its supply chain.

Two sectoral features in the decomposition of shares deserve particular attention. In coal mining in Germany and Poland, the share of the direct component falls to 10–13 per cent, while the share of the residual component rises to almost 90 per cent. As noted above, this profile results from a structurally low ratio of intermediate consumption to gross output in the remaining capacities of the activity. In Slovakia, the corresponding activity has a much more conventional decomposition, with a direct share of 23 per cent, reflecting a different value structure of the local mining base. The second notable case is water transport in Slovakia, where the share of the direct component is unusually low (16 per cent) and the multiplier itself is the lowest among non-trivial activities in the country (1.58). The explanation lies in Slovakia's geography as a landlocked country: water transport is limited to inland waterways and requires very little intermediate input.

Conclusions

The comparative analysis carried out in this article has identified several stable regularities in the structure of output multipliers in Germany, Poland and Slovakia. The most visible regularity is the cross-country gradient of average multipliers: the lowest value is observed in Germany, an intermediate value in Poland and the highest value in Slovakia. This gradient allows two complementary interpretations, which do not exclude one another. The first is that production in Poland and, especially, Slovakia is more material-intensive than German production: one unit of gross output requires a larger volume of intermediate inputs. The second is that the multipliers are calculated on the basis of the total Leontief inverse matrix and therefore include not only domestic but also imported intermediate consumption. The greater openness of the Slovak and Polish economies and the important role of imports in their assembly-type activities explain a substantial part of the observed difference from Germany. The gradient identified should not be interpreted as evidence that one economy is more productive or competitive than another; it only indicates that its production structure relies more heavily on intermediate consumption of both domestic and imported origin.

Another stable feature of the results is the similarity of sectoral rankings across the three countries. Despite substantial differences in absolute multiplier levels, the ordering of activities by multiplier size is broadly stable: manufacturing and energy systematically occupy the upper part of the distribution, whereas service activities are concentrated at the lower end. Spearman rank correlation coefficients ranging from 0.73 to 0.85 quantitatively confirm this regularity. The stability of the ranking shows that the basic technological structure of interindustry linkages creates a common profile across the three economies, while specific deviations from it – such as the peak in motor vehicles and electronic products in Slovakia or the peak in petroleum refining in Germany – can be linked to identifiable structural specialisations rather than idiosyncratic measurement effects. A separate and theoretically interesting case is the exceptionally high multiplier in electricity supply in Slovakia, which reflects the country's function as a regional energy hub: nuclear generation, together with transit capacities, forms a dense chain of intra-sectoral intermediate linkages.

The most important sector-specific result is the stronger multiplier response of several Polish and Slovak manufacturing activities relative to Germany. This is particularly visible in computers, electronic and optical products (2.16 in Germany, 3.08 in Poland and 3.77 in Slovakia), motor vehicles (2.62, 3.18 and 3.88 respectively) and electrical equipment (2.51, 3.05 and 3.41 respectively). In Slovakia, electricity, gas, steam and air conditioning supply also stands out, with a multiplier of 3.86 compared with about 2.45–2.47 in Germany and Poland. These differences confirm that Poland and especially Slovakia contain activities in which a unit increase in final demand generates a larger gross-output

response than in Germany, mainly because of higher material intensity, stronger assembly-type linkages and the larger role of intermediate inputs.

A separate comment should be made on a warning long emphasised in the literature (Dietzenbacher, 2002; Oosterhaven & Stelder, 2002; Oosterhaven, 2007). High output multipliers do not necessarily indicate high economic importance in terms of value added or income; they only indicate a high requirement for intermediate inputs. The exceptional multiplier of 3.88 in motor vehicles in Slovakia is therefore a telling illustration: it reflects the assembly character of the activity rather than a large domestic contribution to value. For applied purposes, output multipliers should therefore be used together with complementary indicators, such as value added or employment multipliers, to avoid overstating the economic weight of material-intensive activities.

The two-component, requirements-based decomposition of output multipliers provides an additional layer of comparative information. The residual requirement component substantially exceeds the direct intermediate-requirements component in all three economies, accounting on average for 70–85 per cent of the total multiplier, while the direct component increases systematically with the material and technological intensity of the activity. This confirms that a large part of the total gross-output requirement lies beyond the one-round direct input coefficients, and that the relative weight of the two components can be measured in a way suitable for cross-country comparison.

The regularities identified in the article are analytically valuable for researchers of interindustry linkages and structural change, and may also serve as empirical reference points for industrial and structural policy makers who need a balanced tool for assessing expected output responses to changes in final demand in particular economic activities. Further research can naturally develop in two directions. The first is the analysis of the time path of multipliers, which would make it possible to trace empirically the speed and character of structural changes in the Polish and Slovak economies. The second is a systematic comparison of output multipliers with value added, income and employment multipliers, which would enrich the applied interpretation of the gross-output results presented here. Both directions can build directly on the harmonised information infrastructure provided by the OECD, while the descriptive basis established in this article offers a convenient starting point for them.

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