Quarterly
p-ISSN 1898-2255
e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Volume 24 Issue 3
2025

EKONOMIA I PRAWO
ECONOMICS AND LAW

NICOLAUS COPERNICUS
UNIVERSITY
IN TORUŃ

Editorial office
Katedra Ekonomii/Department of Economics
Wydział Nauk Ekonomicznych/Faculty of Economic Sciences and Management
Uniwersytet Mikołaja Kopernika/Nicolaus Copernicus University
ul. Gagarina 13A, 87–100 Toruń, Poland
Piotr Wiśniewski (contact person)
✉ e-mail: psw@umk.pl, https://apcz.umk.pl/EiP

Publisher
Nicolaus Copernicus University, ul. Gagarina 11, 87–100 Toruń, Poland

Contents

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 02.01.2025; accepted 31.08.2025; published 30.09.2025
doi: 10.12775/EiP.2025.11

Synergy or competition? Case heterogeneity and court performance in Polish first-instance civil and commercial courts

JAROSŁAW BEŁDOWSKI
Department of International Comparative Studies, Warsaw School of Economics,
Al. Niepodległości 162, 02-554 Warsaw, Poland
jbeldo@sgh.waw.pl
ORCID:

ŁUKASZ DĄBROŚ
The SGH Doctoral School, Collegium of Economic Analysis,
Warsaw School of Economics, Al. Niepodległości 162
ld50376@doktorant.sgh.waw.pl
ORCID:

WIKTOR WOJCIECHOWSKI
corresponding author
Department of International Comparative Studies, Warsaw School of Economics,
Al. Niepodległości 162, 02-554 Warsaw, Poland
wiktor.wojciechowski@sgh.waw.pl
ORCID: https://orcid.org/0000-0002-4235-2739

Abstract

Motivation: The study uses data on Polish civil and commercial courts of first instance to examine the determinants of the court output measured by the number of cases they adjudicate.

Aim: Besides taking into account a caseload, number of serving judges and auxiliary court staff members, the novelty of the research is that it pays particular attention to the problem of the heterogeneity of cases on the docket which both types of courts are dealing with. Using a set of fixed effects panel data models and addressing potential endogeneity, we test whether this variation promotes court performance or, on the contrary, reduces it.
Results: The results confirm that judges play a significant role in resolving cases albeit it considerably varies between distinguished type of adjudications. The auxiliary court staff members also turned out to affect court output in a different way, depending mainly on the type of cases under examination. The results indicate that there can be both synergy and competition in resolving certain types of cases. This synergy can be explained by either judicial backlash or an increase in experience in judges and support staff that makes the judicial process more time-efficient. The competition between certain types of cases may be indicative of opportunistic behaviour in some courts.

Keywords*:* judicial efficiency, court performance, panel models, case heterogeneity
JEL: C23, K41, K15

1. Introduction

The judge has been always the centre of attention. The judge is blamed by parties who are unsatisfied with a judgment and are often subject to criticism by media and politicians. Having no purse or sword the judge is a vulnerable species. However, judges are not left alone in their 'ivory towers'. They are supported by a variety of staff and technology. The former has evolved into general or specialized clerks who seek to support judges in resolving cases. The role of technology in judicial processes can be associated with the procedures, software and hardware. Together they form a factory of justice. In other words, the court.

It is no surprise that various studies point to the fact that the court system has a positive impact on many aspects of society, including economic activity. For instance, they show a strong link between a well-performing judiciary and economic and social variables such as GDP growth (Kapopoulos & Rizos, 2024; Melcarne & Ramello, 2016), credit availability (Jappelli et al., 2005; Mora-Sanguinetti et al., 2017), entrepreneurship (Chemin, 2009b; García-Posada & Mora-Sanguinetti, 2015b), average firm size (García-Posada & Mora-Sanguinetti, 2015a; Giacomelli & Menon, 2017), their investments (Mora-Sanguinetti, 2021), market performance (Chakraborty, 2016) as well as market efficiency and economic development in general (Chemin, 2009a). Numerous studies point to factors that affect the performance of the courts – including their staffing, organization, management, the characteristics of the cases as well as other external factors including even some weather which we will shortly deliver in the next section. However, it shall be noted that performance is only one of many aspects of the assessment of the judicial

system. As Staats (2005) notes, the overall assessment may also include issues such as accessibility and independence – the topics which are not covered in this paper.

The main goal of our study is to investigate determinants of the court performance measured by the number of resolved cases in Poland. To this end, we employ unique database provided by the Ministry of Justice in Poland on several types of cases brought before commercial and civil district courts in Poland in years 2013-2020. The dataset allows us to carry out a detailed analysis on what factors determine the number of resolved cases including number of judges, number of new and pending cases of the considered type, a caseload of other cases that are being adjudicated in a court and number of auxiliary staff members. Although our research is limited to Poland, the results contribute to a discussion in the literature, indicating that judges do indeed contribute to the increase in the number of cases decided, and that the diversity of cases decided by the courts affects the outcome in different ways depending on the type of case. The results are robust to potential endogeneity, addressed by applying panel two-way fixed effects regression as well as instrumental variables.

Our results obtained with panel models and GMMs show the differential nature of the relationship between caseload structure in civil and commercial courts. In civil courts, we show that while a higher number of simplified writ-of-payment cases on the docket is negatively related to the number of full-trial cases, the relationship in the other direction is the opposite, i.e., more full-trial cases on the docket causes courts to hear more writ-of-payment cases. This may suggest opportunistic behaviour on the part of judges who, under pressure from the number of cases, focus on dealing with simpler cases to signal their productivity (in the meaning of enhancing cases which are easier to be closed). The competition for court resources manifested by the fact that the presence of writ-of-payment and other cases reduces the number of full-trial judgements is also borne out for the commercial courts. In their case, however, we did not observe a stimulating effect of writ-of-payment disputes on full-trial rulings, which may reflect the different working styles and complexity of cases in the two types of courts.

Our research makes multiple contributions to the existing literature on the determinants of court output. Firstly, we provide a comprehensive study of the civil and commercial courts in Poland which complements the scarce number of similar analyses conducted for the European transition economies. Secondly, we investigate the role played by judges and judicial staffing in resolving civil and commercial cases in Poland. On top of that, we analyse whether a caseload of other cases that are being adjudicated in a court affect its performance. To the best of our knowledge, the latter factors have been so far highly under-researched in the empirical literature. Lastly, the analysis was conducted separately for various types of civil and commercial cases that dif-

fer substantially in terms of the adjudication procedures and consequently in terms of the necessary involvement of judges and other court staff members.

The paper is organized as follows. Section 2 provides a brief overview of literature devoted to factors affecting court output. In Section 3 we present in detail the institutional setup and data. Section 4 covers estimation strategy we have applied to verify determinants of court output. Section 5 discusses the empirical results and section 6 concludes.

2. Literature review

The factors affecting court performance have attracted substantial attention in the literature. On the one hand, adjudication can be perceived as a dual-nature good by having characteristics of both private and public goods (Landes & Posner, 1979). On the one hand, it provides benefits to the parties of a legal dispute, but it does the same for the general public, as it reduces legal uncertainty and improves the regulatory environment for human action.

As pointed out by Marciano et al. (2019), studies on court performance tend to obscure the differences between effectiveness and efficacy. The first concept determines how well the court performs in using its resources (staff, cases on the docket) to maximise the product (number of cases disposed of). The second one defines how well the court system responds to the 'demand for justice' coming from citizens. In order to avoid the limitations of both concepts we focus on the court output which measures how well the courts perform in adjudication by treating the data on as external and using instrumental variables if necessary. Having explained the differences between various concepts their determinants can be analysed from the literature to deliver its main observations.

The determinants of court performance can be divided into two major categories: internal and external ones (Pappalardo & Tortorici, 2023).

In the first category, as proposed by Christensen and Szmer (2012), it is possible to enumerate three sub-categories: judges, courts and cases. It is not surprising that much of the literature focuses on the role of the judge, who is undoubtedly a key figure in the functioning of the courts. Unexpectedly, studies conducted for developed countries such as Israel (Beenstock & Haitovsky, 2004) and advanced transition countries like Slovenia (Dimitrova-Grajzl, Grajzl, Sustersic, et al., 2012) show that the number of judges is not significantly linked to the number of cases resolved. In more detail these studies point out that judges adjust their efforts to the number of cases they face in a given period of time (judicial slack). In contrast, the existence of a positive link between the number of judges and court output has been confirmed for some developing countries – e.g., Brazil (Sousa & Guimaraes, 2018), Nepal (Grajzl & Silwal, 2020), Bulgaria (Dimitrova-Grajzl et al., 2016) or Poland (Bełdowski et al., 2020). This disparity appears to be important for

judicial reform plans as the positive relationship might mean that increasing the number of judges will solve the problem of case delays.

The studies also examined how the number of cases decided is influenced by the individual characteristics of the judges. For instance, research points to the role of factors such as judges' salaries (Deyneli, 2012) as higher salaries are associated with more efficient courts in Europe. As shown by Schneider (2005), the educational level of the judges is also important as judges holding PhD degrees are shown to be more productive in Germany. Moreover, Dimitrova-Grajzl, Grajzl, Zajc, et al. . (2012) show that the performance of Slovenian judges is positively associated with promotion prospects (judges seek to demonstrate a track record to increase chances of promotion) and the dependence of productivity on age is U-shaped (youngest and oldest judges being more productive). Moreover, judges' performance may be affected by their colleagues as Martín-Román et al. (2023) showed a productivity decrease in Spanish labour courts where non-career/lay judges are employed.

The literature also examines other internal elements of the court that may affect its performance. For example, a positive relationship has been shown for the provision of IT tools to the court (Castelliano et al., 2023; Sousa & Guimaraes, 2018) as well as the presence of auxiliary staff (Deyneli & Mascini, 2020; Mishra, 2022) which relieves judges of administrative duties and allows them to concentrate on work. Particular attention is given to digital caseload management tools. Their implementation makes it possible to monitor the progress of proceedings and their deadlines, and to identify more quickly cases that require more work for judges and court staff. The use of such screening tools is associated with increased productivity of judges and shorter case processing times (Palumbo et al., 2013a, 2013b).

The third group of internal factors affecting court performance can be attributed to the cases themselves constituting the material from which judges and support staff 'manufacture' justice. Surprisingly, the scope of research concentrated on this area is scarce which opens up an interesting research gap. So far, the case heterogeneity was only addressed e.g., in the study of Polish commercial courts by Bełdowski et al. (2020) and Brazilian labour courts by Castelliano, Grajzl, Guimaraes, et al. (2021) In the latter study, the authors examined the relationship between the different types of cases and the court's performance in resolving them.

External factors also affect the operation of the courts, resulting from political decisions or even random events. For instance the political external factors are being analysed through the effects of previous reforms concerning the geographic distribution of courts (Achenchabe and Akaaboune (2021) for Morocco; Agrell et al. (2020) for Sweden) and make calls for changes that should be implemented (Falavigna and Ippoliti (2021) for Italy). In other words, such studies take into account how the courts are established via political decisions and whether such decisions may affect their performance. In

contrast, an important random event that also affected the functioning of the judiciary was the COVID-19 pandemic, which led to operational difficulties and sudden implementation of new technological tools. Castelliano, Grajzl, and Watanabe (2021) indicate that it had a negative impact on the number of judgements in Brazilian labour courts but did not affect the enforcement of these judgements. In turn, Baumet al. (2023) showed that the pandemic and a subsequent switch to e-procedure in Poland did not affect the performance of the country's commercial courts. It is also worth pointing out the less obvious factors influencing jurisprudence – e.g., weather. As shown by Heyes and Saberian (2019) an increase in temperature is associated with an increase in the severity of judges.

The current study focuses primarily on the internal determinants of court performance. Like Castelliano, Grajzl, Guimaraes et al. (2021), we examine whether and how the composition of the caseload (different types of cases) affects the number of judgements. However, our study is distinguished by its detail, as it includes both civil and commercial courts, and by the set of control variables we accounted for (i.e., demographic and economic data on the areas where the courts studied have jurisdiction).

3. Institutional setup and data

The Polish justice system has been affected by several 'reforms' in recent years, but they have not changed its fundamental distinction between civil and commercial disputes. The former ones are adjudicated in every district court (sąd rejonowy) whereas the latter ones are conducted in the commercial divisions of common courts established by the Minister of Justice who is competent to draw their geographical borders. The district court is the entry point for significant number of disputes as it is the lowest level of a common court system in Poland, and it comprises of the civil court by default and the commercial one if it has been established. These courts, or in fact departments of common courts, resolve cases of a value not exceeding PLN 75.000 (for civil cases, approx. EUR 17.000) or PLN 100.000 (for commercial cases, approx. EUR 22.700). If the threshold is exceeded the case must be lodged at the regional court (sąd okręgowy). The main distinction between commercial and civil courts concerns the parties involved in such cases. Commercial courts deal exclusively with ones involving entrepreneurs and disputes among them. On the contrary, cases involving other persons, e.g., consumers as well as disputes in which at least one of the parties is not an entrepreneur, are dealt with in the civil courts.

In the same vein, a selection process to appoint a judge is the same for civil and commercial district courts, although the candidate for a commercial vacancy is required to have some economic knowledge. However, this condition is obscure and leaves a lot of ambiguity in the selection process.

The role of auxiliary staff in the court depends on its features. The court clerk (urzędnik sądowy) may be allocated with general or specialised tasks whereas the judges assistants' (asystent sędziego) focus is on preparing written justifications of court judgments and lastly legal clerks (referendarz) are allowed to perform some judicial activities, in particular within non-contentious disputes (see in more detail Bełdowski et al., 2020).

It is also important to mention how the cases may be lodged to the civil and commercial courts. In general, they may be lodged before the court in whose district the defendant resides (civil courts) and in case of an action against a legal person or other entity that is not a natural person it shall be brough in accordance with the place of their registered office. The parties may agree on the selection of a different court, but it is not common practice to do so and the allocation of cases to different courts by the decision of a superior court are seldom and they were omitted from this study. However, some specialization may be observed in the multi-departmental courts or specialized courts established by the Ministry of Justice. But taking into account the latest developments the latter have not sped up Polish justice and the former is only observed in few big cities and hence both have negligible impact on our study if any. In the same vein, the case management system is not developed throughout the country and particular approach which tackle the problem cannot be observed either.

A dataset employed in this study was provided by the Ministry of Justice of Poland concerning civil and commercial courts of first instance. It contains annual data on the number of all types of cases received and handled by the commercial and civil courts in Poland in years 2013–2020 as well as data on their staffing (judges and three types of supporting staff, namely court clerks, judges' assistants and legal clerks. The dataset covers 55 commercial courts in the years 2013-2014 and 54 commercial courts in the years 2015–2020. For civil courts dataset includes data on 242 courts in the years 2013–2014, 315 courts in 2015 and 318 courts in the years 2016–2020. The changes in the number of courts result from judiciary reforms implemented in the considered period: a merger of two commercial courts into one larger one and the restoration of so-called small civil courts in smaller towns. In order to ensure that our results are not distorted by organizational changes resulting from the reforms introduced, all estimates have been carried out using data for courts whose jurisdictions have not changed throughout the period under study. Nevertheless, it should be noted that although we are able to distinguish between certain categories of cases, the dataset we use includes only aggregated annual data on court activity. As a result, we are unable to track individual cases or assess their resolution times.

The dataset allows us to distinguish the following types of civil cases (Figure 1):

– Full-trial cases: Cases requiring a full trial between the disputing parties in which the judge (supported by the auxiliary staff) must resolve a contentious dispute.

- Writ-of-payment cases: Cases primarily involving arrears or payment arrears dealt with in a non-contentious procedure on the basis of bear application (writ of payment) e.g., copies of invoices not paid on time, or original documents (order for payment) submitted by the parties e.g. bill of exchange. As the dataset do not differentiate between both types of non-contentious procedure it is under a general headline of writ-of-payment cases.
- Non-full-trial cases: Cases where there is no dispute between the parties, but where there must be, for example, a determination of some fact by the court (e.g., successions or guardianships).
- 'Other' cases: Cases that cannot be classified in the previously enumerated groups.

For commercial courts, we use data for only three categories, i.e., full-trial, writ-of-payment and others (Figure 2). Commercial non-full-trial cases have been excluded from the database due to their marginal share of adjudication. Being aware that certain regions of Poland may bring different types of cases, in particular within 'other' cases, we were unable to break it into details due to the data collection constraints.

Descriptive statistics of all variables for civil and commercial cases used in the study are presented in Table A1 and A2, respectively.

4. Estimation strategy

The primary goal of the research is to establish factors determining court output measured by the number of resolved cases brought before district, first-instance courts in Poland. The empirical verification includes the estimation of a set of panel fixed-effects models separately for all the distinguished types of civil and commercial cases. Specifically, 4 types of civil cases (i.e., full trial, writ-of-payment, non-litigation, other) and 3 types of commercial cases (i.e., full trial, writ-of-payment, other) were examined. We employ a rich set of explanatory variables. Firstly, all specifications include the number of judges serving, new cases coming to a court during each year and the number of pending cases (i.e., cases that were received in previous years but have not yet been heard). Secondly, they incorporate number of other types of cases that are filed into a court. These variables are of crucial importance for the study as its primary goal is to examine how other cases affect court output. They allow us to verify whether there is a synergy or competition between cases adjudicated within a court. Specifically, we investigate whether a larger number of certain type of cases boost or hamper court output. In turn, we directly investigate an impact of caseload heterogeneity on court performance. If the estimated coefficients are positive, the presence of cases of a different type than the one examined makes the court better at adjudicating them. In such circumstances, synergies between resolved cases can be

postulated. On the other hand, negative coefficients indicate there is a competition between cases since the considered types of cases decrease court output. The model regressions control for number of auxiliary staff members (i.e., court servants, judges' assistants and court clerks) as well as a set of regional variables characterizing court jurisdiction. In particular, they include income per capita, the share of private enterprises, the number of companies per 10,000 residents and the population size to control for differences in economic development and the size of the regions under the jurisdiction of the first instance courts. The model specifications also include court fixed effects to control for unobserved court characteristics that potentially might affect their output, like e.g., a diversified complexity of cases filed into courts stemming from regional economic structure not captured by the included control variables or different quality of court management. Time fixed effects are included to account for unobserved country-wide features that have impact on court performance, e.g., business cycle or judicial reforms. To determine whether a fixed effects (FE) or random effects (RE) specification is more appropriate, we performed the Hausman test. The test compares the consistency of the RE estimator with the efficiency of the FE estimator under the null hypothesis that the preferred model is random effects. Rejection of the null indicates that the RE estimator is inconsistent, and that fixed effects should be used.[1]

The model specification is of the following form:

$$resplved_{nit} = \beta_0 + \boldsymbol{\beta_1 caseload_{nit}} + \beta_2 judge_{nit} + B_3 \boldsymbol{control_{nit}} + \mu_{it} + u_{ni} + \varepsilon_{nit} \quad (1)$$

where resolved denotes the number of resolved cases of the considered type, caseload is a vector of the number of new and pending cases of the considered type and judge represents the number of serving judges. The subscript n denotes a court, i – a case type and t – a year. A vector control includes a set of discussed control variables potentially affecting court output. All variables are transformed into natural logarithms and hence the estimated coefficients can be interpreted as respective elasticities. The exceptions are regional characteristics (income per capita, number of companies and a share of privately owned companies) that were standardized within each year to limit their heterogeneity across regions. Lastly, μ indicates time fixed effects, u court fixed effects and ε denotes random residuals. The model coefficients are estimated by ordinary least squares. Standard errors are clustered at the court level.

As pointed out in the literature (e.g. Bełdowski et al., 2020; Dimitrova-Grajzl et al., 2016; Dimitrova-Grajzl, Grajzl, Sustersic, et al., 2012), the em-

[1] The Hausman test results for both civil and commercial cases showed that fixed effects specification is preferred over random effects. Detailed results are available upon request.

pirical verification of determinants of court output should address an issue of potential endogeneity of independent variables. It can arise from two sources: firstly, the appointing body may decide to increase number of judges or auxiliary staff to courts facing difficulty in handling a caseload. Secondly, parties considering resolving a dispute may select courts where proceedings are particularly fast – they may refer their cases to other courts (in Poland, this is legal if the parties stipulate it in a contract) or resort to other methods of conflict resolution (e.g., mediation or arbitration). We address the potential issue of endogeneity and reverse causality by augmenting the model specification by a first lag of the dependent variable and then by employing Arellano-Bover (1995) GMM-system estimator. It uses moment conditions in which lagged differences are used as instruments for the level equation in addition to the moment conditions of lagged levels as instruments for the difference equation. This estimator is designed for datasets with many panels and few periods which is the case in our data. The GMM-system method requires that there is no autocorrelation in the idiosyncratic errors. We verified whether this condition is met by applying Arellano-Bond (1991) test for autocorrelation of order one and two in the first-differenced residuals. Under the null hypothesis, the test assumes no autocorrelation at the specified order. While first-order autocorrelation is expected due to the differencing process, the absence of second-order autocorrelation is necessary for the validity of the GMM estimator. Additionally, we also perform the Hansen test for overidentifying restrictions, which evaluates the overall validity of the instruments and is robust to heteroscedasticity. Its null hypothesis assumes the instruments are exogenous. Failure to reject the null supports the validity of the instrument set, whereas rejection suggests that the instruments may be invalid and should be reconsidered.

5. Results

5.1. Civil courts

The results for the full trial civil cases show that a number of resolved cases of this type is primarily driven by a case inflow as well as a number of pending cases that were not resolved in previous years (Table 1). Judges also play a significant role in court output, however the estimated coefficients for the number of judges are unstable.

Across all GMM specifications, the Arellano-Bond tests for serial correlation and the Hansen test for overidentifying restrictions consistently confirm that the instruments used are valid and exogenous. This reinforces the robustness of the GMM estimates and supports their prioritization in interpreting the results.

In the GMM model (col. 4), the coefficient is less than half the size of those estimated in the fixed effects specifications (col. 1-3). The coefficients reflecting caseload of other civil cases resolved within a court provide mixed results. The fixed-effects models suggest (col. 1-3) that non-full trial civil cases significantly constrain courts' capacity to resolve full trial cases, a result confirmed by the GMM estimates. The GMM model also indicates a negative impact of writ-of payment civil cases on the number of resolved full trial cases, though this effect is not statistically significant in the fixed-effect models. Consistent with the GMM results, other civil cases increase the number of adjudicated cases with a full trial, but again these results were not significant in the fixed effect models.

Given that IV-GMM estimates account for potential endogeneity and reverse causality, they should be prioritized in interpretation. These findings point to a competition for court resources between full-trial cases and both adjudication and non-trial cases. At the same time, they suggest potential synergies with other types of civil cases.

Regarding court staff, the number of clerks is found to significantly increase the number of resolved full trial cases across all model specifications. However, the estimated effect in the GMM model is more than three times smaller than in the FE models. Extending the model specification to include control variables accounting for regional characteristics does not materially alter the main results, although the estimated coefficients for these variables are relatively unstable. The preferred GMM estimates suggest that a higher number of firms per 10,000 inhabitants and higher income per capita are associated with a lower number of resolved full trial civil cases. This finding may reflect greater complexity in cases filed in more economically developed regions, which could lead to longer adjudication times. Additionally, the results indicate that courts in more densely populated areas tend to resolve fewer full trial civil cases, possibly due to greater systematic congestion or higher case complexity.

The results for writ-of-payment cases adjudicated in civil courts show that number of resolved cases is primarily driven by the inflow of new cases (Table 2). In contrast to the findings for full trial cases (Table 1), the judge coefficient in the fixed effects specifications turned out to be statistically insignificant. However, it becomes significant in the GMM model (col. 4), though its magnitude is approximately half that observed for full trial cases. This suggests that while judges are necessary to carry out formal court procedures, their number is less critical to resolving writ-of-payment cases, which are generally less complex.

Interestingly, the caseloads of both full trial and non-full trial cases (the latter only in the GMM model) are positively associated with the number of resolved writ-of-payment cases. This contrasts with earlier findings showing that writ-of-payment caseloads hinder the resolution of full trial cases,

while the reverse does not hold. The study does not provide a definitive explanation for this asymmetry, one possible interpretation is that judges' engagement with more demanding full trail cases may improve their overall efficiency, prompting quicker resolution of simpler writ-of-payment cases. This could reflect a prioritization strategy, where judges focus their efforts on full trial cases and dispose of less complex matters more rapidly. Such behavior may be incentivized if resolution of full trial cases influences career advancement or performance evaluations.

The caseload of the other civil cases is negatively associated with writ-of-payment case resolution, although this effect is only statistically significant in the GMM specification. In addition, the GMM results highlight the positive contribution of both legal and court clerks to court performance, underscoring the importance of support staff in enhancing case throughput. Surprisingly, the GMM estimates also show that court output is higher in more economically developed regions, as reflected by positive associations with income per capita and firm density. In contrast, courts located in more populous areas tend to resolve fewer writ-of-payment cases, possibly due to congestion or higher systemic burdens.

The results for resolved non-trial civil cases show that their number is primarily driven by the inflow of new cases, and to lesser extent, by pending cases and the number of serving judges (Table 3). The estimated coefficients for the caseload variables are mixed and inconclusive, suggesting no consistent pattern across specifications. The estimates from the preferred GMM estimator (col. 4) indicate that the courts' ability to resolve non-trial cases improves with a higher volume of other civil cases filed into a court, but declines with a higher volume of writ-of-payment cases. This supports the notion that there is a competition for court resources, where the burden imposed by certain types of cases reduces the courts' capacity to process others. However, due to the observed instability of the coefficients, these findings should be interpreted with caution. The results also provide evidence that court clerks play a significant role in increasing the number of resolved non-trial cases. However, this effect is statistically significant only in the GMM specification, which again calls for a cautious interpretation of the findings.

Similar to non-full trial civil cases, the resolution of civil cases classified as 'other' is primarily driven by the inflow of new cases, as well as by the number of serving judges (Table 4). The preferred GMM estimates reveal that all previously discussed categories of civil cases, i.e., full trial, non-full trial, and writ-of-payment, significantly reduce the number of adjudicated 'other' civil cases. However, these relationships are not statistically significant in any of the fixed effects specifications.

One consistent finding across all models concerns court clerks, who significantly increase the number of resolved 'other' civil cases regardless of the estimation method used. This underlines the critical role of this category of

auxiliary staff in smooth adjudication of such cases. The GMM results also suggest that other staff members contribute positively to court performance.

With regard to regional control variables, the estimates show that court located in more economically developed areas - reflected by a higher number of firms and a greater share of privately owned enterprises – tend to resolve fewer 'other' civil cases. Similarly, court output is lower in more densely populated regions. These findings might indicate that courts in such areas face more complex caseloads, which in turn hampers their overall output.

5.2. Commercial courts

The estimates for commercial courts indicate that both the number of judges and the size of the caseload are key determinants of the number of resolved full trial cases (Table 5). The results show that the resolution of these cases is significantly dampened by the writ-of payment caseload, reinforcing the notion that different case types compete for limited court resources. In contrast, the caseload of other commercial cases does not have a statistically significant effect on the number of resolved full trial cases. Among auxiliary court staff, only judges' assistants appear to significantly enhance courts' capacity to adjudicate full trial commercial cases.

The analysis of writ-of payment cases in commercial courts yield results broadly consistent with those observed in civil courts (Table 6). The number of resolved writ-of-payment cases is driven almost entirely by their own caseload. The number of serving judges is only weakly significant in the fixed effects specifications as well as in the GMM model. However, the GMM estimates provide some evidence of a negative impact from the full trial caseload on the resolution of writ-of-payment cases, as well as positive contribution from legal clerks.

Finally, the results for 'other' types of commercial cases show that their resolution is significantly reduced by the caseload of full trial and writ-of-payment cases filed within the same court (Table 7). These findings further support the existence of competition for court resources, where a heavier load of more complex or demanding case types adversely affects court output. However, none of the auxiliary staff categories - including legal clerks, court clerks, or judges' assistants - show a statistically significant effect on the resolution of these cases, suggesting that their role may be limited or context-dependent in this particular case category.

6. Conclusion

On the basis of the results, several general conclusions can be drawn regarding adjudication by civil courts of first instance in Poland:

First, the role of judges varies by case type. Judges have a significant impact on the resolution of full-trial and non-full-trial cases, but their effect is either insignificant or considerably lower in writ-of-payment and other civil cases. This likely reflects the nature of cases: while full-trial and non-full-trial cases are more individualized and complex requiring greater judges' involvement whereas writ-of-payment and other ones tend to be more standardized and repetitive.

Second, certain categories of auxiliary court staff contribute to court output, though selectively. Only court clerks are found to consistently increase the number of resolved full-trial and other civil cases. This suggests that clerks may either effectively support judges in complex tasks or even substitute for them in routine judicial operations.

Third, the results indicate some degree of synergy in the resolution of civil cases. For example, the presence of other case types on the docket is positively associated with the number of resolved full-trial and non-full trial cases. Similarly, both full trial and non-full trial caseloads enhance the number of resolved writ-of-payment civil cases. This can be explained by specialization effects within courts – judges and staff becoming more efficient through experience ('learning-by-doing') in handling specific types of cases.

However, competition for court resources is also evident. In most instances, additional caseloads from other case types negatively affect the resolution of civil cases. For example, a high volume of writ-of-payment cases is associated with a decline in the number of resolved full-trial and 'other' civil cases. This pattern may reflect opportunistic behavior in some courts, where judges prioritize simpler writ-of-payment cases to meet their performance targets. In overloaded courts, this strategy may help maximize the number of closed cases but at the expense of more complex, time-consuming ones.

When comparing civil and commercial courts, several common patterns emerge. First, both judges and court clerks play the central role in the adjudication of full-trial cases – a logical outcome given the complexity of these proceedings. Second, in both court types, the resolution of full trial cases is negatively affected by the writ-of payment caseload, again prompting to competition for limited court resources. We also find evidence that a high full-trail caseload can reduce the number of resolved writ-of-payment cases in commercial courts, while judges' assistants appear to have a positive effect in this context. Moreover, 'other' case types also exert downward pressure on court output, reinforcing the view that courts operate under tight capacity constraints.

Finally, courts located in more economically developed regions tend to resolve fewer cases. This likely reflects the greater complexity of cases filed in such areas, which require more judicial effort per case. While this trend is observable for civil courts, it cannot be confirmed for commercial courts due to their more limited geographic coverage.

Based on the findings of this study, a couple recommendations for improving the court performance in Poland can be formulated. First, courts should allocate resources according to case complexity rather than case volume. Complex cases, such as full-trial proceedings, require more time and expertise and should be prioritized in staffing and support. Second, specialization within courts should be more encouraged. When judges and staff focus on specific case types, they become more efficient and consistent through experience (e.g. the specialization may be achieved through introduction of more divisions within the court). Third, simple and high-volume cases like writ-of-payment claims should be processed more efficiently – ideally through institutional internal adjustments (e.g. establishing a subdivision only devoted to such cases) – to prevent them from consuming resources needed for complex cases. Fourth, investing in court clerks can yield clear efficiency gains. Well-trained clerks help reduce the burden on judges and support the resolution of more demanding cases. Lastly, courts in more economically advanced and densely populated regions, where cases tend to be more complex, should receive additional resources to reflect their higher workloads and ensure more balanced access to justice.

References

Achenchabe, Y., & Akaaboune, M. (2021). Determinants of Judicial Efficiency in Morocco. Open Journal of Business and Management, 9(5), Article 5. https://doi.org/10.4236/ojbm.2021.95130.

Agrell, P.J., Mattsson, P., & Månsson, J. (2020). Impacts on efficiency of merging the Swedish district courts. Annals of Operations Research, 288(2), 653–679. https://doi.org/10.1007/s10479-019-03304-0.

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. The Review of Economic Studies, 58(2), 277–297. https://doi.org/10.2307/2297968.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. Journal of Econometrics, 68(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D.

Beenstock, M., & Haitovsky, Y. (2004). Does the appointment of judges increase the output of the judiciary? International Review of Law and Economics, 24(3), 351–369. https://doi.org/10.1016/j.irle.2004.10.006.

Bełdowski, J., Dąbroś, Ł., & Wojciechowski, W. (2020). Judges and court performance: A case study of district commercial courts in Poland. European Journal of Law and Economics, 50(1), 171–201. https://doi.org/10.1007/s10657-020-09656-4.

Castelliano, C., Grajzl, P., Guimaraes, T.A., & Alves, A. (2021). Judicial enforcement and caseload: Theory and evidence from Brazil. European Journal of Law and Economics, 52(1), 137–168. https://doi.org/10.1007/s10657-021-09705-6.

Castelliano, C., Grajzl, P., & Watanabe, E. (2021). How has the Covid19 pandemic impacted the courts of law? Evidence from Brazil. International Review of Law and Economics, 66, 105989. https://doi.org/10.1016/j.irle.2021.105989.

Castelliano, C., Grajzl, P., & Watanabe, E. (2023). Does electronic case-processing enhance court efficacy? New quantitative evidence. Government Information Quarterly, 40(4), 101861. https://doi.org/10.1016/j.giq.2023.101861.

Chakraborty, P. (2016). Judicial quality and regional firm performance: The case of Indian states. Journal of Comparative Economics, 44(4), 902–918. https://doi.org/10.1016/j.jce.2016.07.001.

Chemin, M. (2009a). Do judiciaries matter for development? Evidence from India. Journal of Comparative Economics, 37(2), 230–250. https://doi.org/10.1016/j.jce.2009.02.001.

Chemin, M. (2009b). The impact of the judiciary on entrepreneurship: Evaluation of Pakistan's 'Access to Justice Programme'. Journal of Public Economics, 93(1), 114–125. https://doi.org/10.1016/j.jpubeco.2008.05.005.

Christensen, R.K., & Szmer, J. (2012). Examining the efficiency of the U.S. courts of appeals: Pathologies and prescriptions. International Review of Law and Economics, 32(1), 30–37. https://doi.org/10.1016/j.irle.2011.12.004.

Deyneli, F. (2012). Analysis of relationship between efficiency of justice services and salaries of judges with two-stage DEA method. European Journal of Law and Economics, 34(3), 477–493. https://doi.org/10.1007/s10657-011-9258-3.

Deyneli, F., & Mascini, P. (2020). Utility Maximizing Judges and Judicial Assistants: Testing Rational Choice Theory in 22 EU Countries. International Journal for Court Administration, 11(2), 16. https://doi.org/10.36745/ijca.361.

Dimitrova-Grajzl, V., Grajzl, P., Slavov, A., & Zajc, K. (2016). Courts in a transition economy: Case disposition and the quantity–quality trade-off in Bulgaria. Economic Systems, 40(1), 18–38. https://doi.org/10.1016/j.ecosys.2015.09.002.

Dimitrova-Grajzl, V., Grajzl, P., Sustersic, J., & Zajc, K. (2012). Court output, judicial staffing, and the demand for court services: Evidence from Slovenian courts of first instance. International Review of Law and Economics, 32(1), 19–29. https://doi.org/10.1016/j.irle.2011.12.006.

Dimitrova-Grajzl, V., Grajzl, P., Zajc, K., & Sustersic, J. (2012). Judicial Incentives and Performance at Lower Courts: Evidence from Slove-

nian Judge-Level Data. Review of Law & Economics, 8(1). https://doi.org/10.1515/1555-5879.1610.

Falavigna, G., & Ippoliti, R. (2021). Reform policy to increase the judicial efficiency in Italy: The opportunity offered by EU post-Covid funds. Journal of Policy Modelling, 43(5), 923–943. https://doi.org/10.1016/j.jpolmod.2021.06.001.

García-Posada, M., & Mora-Sanguinetti, J.S. (2015a). Does (average) size matter? Court enforcement, business demography and firm growth. Small Business Economics, 44(3), 639–669. https://doi.org/10.1007/s11187-014-9615-z.

García-Posada, M., & Mora-Sanguinetti, J.S. (2015b). Entrepreneurship and enforcement institutions: Disaggregated evidence for Spain. European Journal of Law and Economics, 40(1), 49–74. https://doi.org/10.1007/s10657-014-9470-z.

Giacomelli, S., & Menon, C. (2017). Does weak contract enforcement affect firm size? Evidence from the neighbour's court. Journal of Economic Geography, 17(6), 1251–1282.

Grajzl, P., & Silwal, S. (2020). The functioning of courts in a developing economy: Evidence from Nepal. European Journal of Law and Economics, 49(1), 101–129. https://doi.org/10.1007/s10657-017-9570-7.

Heyes, A., & Saberian, S. (2019). Temperature and Decisions: Evidence from 207,000 Court Cases. American Economic Journal: Applied Economics, 11(2), 238–265. https://doi.org/10.1257/app.20170223.

Jappelli, T., Pagano, M., & Bianco, M. (2005). Courts and Banks: Effects of Judicial Enforcement on Credit Markets. Journal of Money, Credit and Banking, 37(2), 223–244.

Kapopoulos, P., & Rizos, A. (2024). Judicial efficiency and economic growth: Evidence based on European Union data. Scottish Journal of Political Economy, 71(1), 101–131. https://doi.org/10.1111/sjpe.12357.

Landes, W.M., & Posner, R.A. (1979). Adjudication as a Private Good. The Journal of Legal Studies, 8(2), 235–284.

Marciano, A., Melcarne, A., & Ramello, G. B. (2019). The economic importance of judicial institutions, their performance and the proper way to measure them. Journal of Institutional Economics, 15(1), 81–98. https://doi.org/10.1017/S1744137418000292.

Martín-Román, Á., Moral, A., & Rosales, V. (2023). Judges and Court Productivity: Evidence from Spanish Labour Courts [Preprint]. In Review. https://doi.org/10.21203/rs.3.rs-3682947/v1.

Melcarne, A., & Ramello, G.B. (2016). Justice delayed, growth denied: Evidence from a comparative perspective.

Mishra, S. (2022). 'Cyclic syndrome' of arrears and efficiency of Indian judiciary. SN Business & Economics, 3(1), 6. https://doi.org/10.1007/s43546-022-00377-1.

Mora-Sanguinetti, J.S. (2021). The Impact of the Efficacy of Justice on Business Investment in Spain (Banco de España Article 3/2021). https://papers.ssrn.com/abstract=3878029.

Mora-Sanguinetti, J.S., Martínez-Matute, M., & García-Posada, M. (2017). Credit, crisis and contract enforcement: Evidence from the Spanish loan market. European Journal of Law and Economics, 44(2), 361–383. https://doi.org/10.1007/s10657-017-9557-4.

Palumbo, G., Giupponi, G., Nunziata, L., & Mora-Sanguinetti, J.S. (2013a). Judicial Performance and its Determinants: A Cross-Country Perspective. OECD. https://doi.org/10.1787/5k44x00md5g8-en.

Palumbo, G., Giupponi, G., Nunziata, L., & Mora-Sanguinetti, J. S. (2013b). The Economics of Civil Justice: New Cross-country Data and Empirics. OECD. https://doi.org/10.1787/5k41w04ds6kf-en.

Pappalardo, M.R., & Tortorici, G. (2023). Internal and External Determinants of Court Performance: A Bibliometric Analysis (SSRN Scholarly Paper 4525694). https://doi.org/10.2139/ssrn.4525694.

Schneider, M.R. (2005). Judicial Career Incentives and Court Performance: An Empirical Study of the German Labour Courts of Appeal. European Journal of Law and Economics, 20(2), 127–144. https://doi.org/10.1007/s10657-005-1733-2.

Sousa, M.D.M., & Guimaraes, T.A. (2018). Resources, innovation and performance in labor courts in Brazil. Revista de Administração Pública, 52(3), 486–506. https://doi.org/10.1590/0034-761220170045.

Staats, J.L., Bowler, S., & Hiskey, J.T. (2005). Measuring Judicial Performance in Latin America. Latin American Politics and Society, 47(4), 77–106. https://doi.org/10.1111/j.1548-2456.2005.tb00329.x.

Acknowledgements

Author contributions: authors have given an approval to the final version of the article. Author's total contribution to the manuscript: Jarosław Bełdowski (33.3%); Łukasz Dąbroś (33.3%), Wiktor Wojciechowski (33.3%).

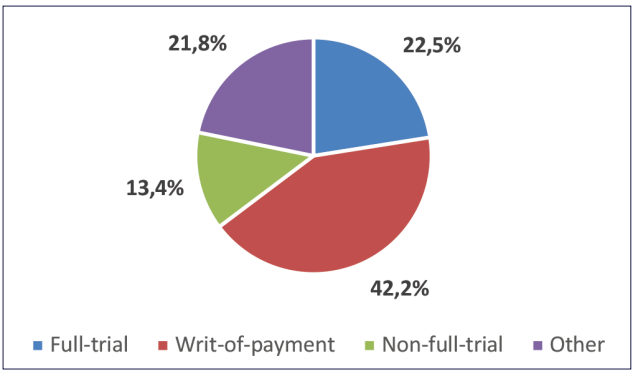
Funding: None.

Supplementary information: None.

Note: Preliminary versions of the study were presented during internal seminar organized in the Warsaw School of Economics.

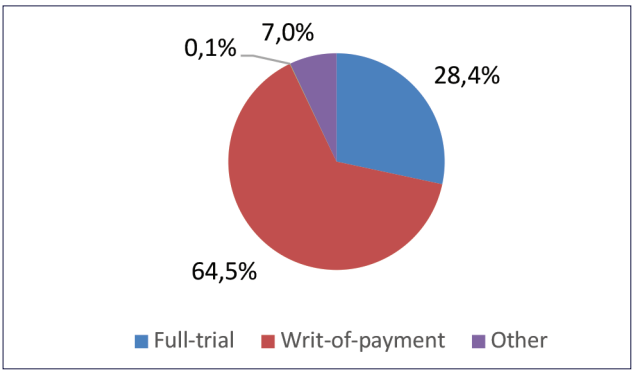
Appendix

Chart 1. Structure of cases adjudicated by civil courts of first instance in Poland in 2013––2020.



Source: Own preparation based on data provided by the Ministry of Justice in Poland.

Chart 2. Structure of cases adjudicated by commercial courts of first instance in Poland in 2013-2020.



Source: Own preparation based on data provided by the Ministry of Justice in Poland.

Table A1. Summary statistics – civil courts

Variable	N	Mean	S.D.	Min	Q1	Median	Q3	Max
New full-trial cases	1936	7.53	0.76	5.17	6.98	7.45	8.06	9.80
Pending full-trial cases	1936	6.84	0.89	4.03	6.21	6.76	7.43	9.85
Adjudicated full-trial cases	1936	7.51	0.75	4.83	6.98	7.43	8.04	9.59
New writ-of-payment cases	1936	8.00	0.88	4.33	7.39	7.89	8.60	11.75
Pending writ-of-payment cases	1936	5.49	1.44	0.00	4.65	5.59	6.49	9.71

Variable	N	Mean	S.D.	Min	Q1	Median	Q3	Max
Adjudicated writ-of-payment cases	1936	8.01	0.88	4.56	7.40	7.91	8.61	11.62
New non-full-trial cases	1936	7.06	0.65	5.42	6.61	7.03	7.49	9.13
Pending non-full-trial cases	1936	5.49	1.44	0.00	4.65	5.59	6.49	9.71
Adjudicated non-full-trial cases	1936	7.04	0.66	5.38	6.59	7.00	7.47	9.12
New 'other' cases	1936	7.44	0.81	4.80	6.91	7.39	8.01	9.56
Pending 'other' cases	1936	6.16	0.89	0.69	5.59	6.20	6.80	8.62
Adjudicated 'other' cases	1936	7.45	0.81	4.57	6.93	7.41	8.03	9.53
Judges	1936	2.03	0.56	0.85	1.61	1.88	2.35	3.89
Legal clerks	1936	0.84	0.64	0.00	0.38	0.70	1.18	3.16
Assistants	1936	1.18	0.57	0.00	0.73	1.09	1.47	3.13
Court clerks	1936	2.52	0.62	1.23	2.06	2.35	2.91	4.40
Full-trial cases in the caseload	1936	7.96	0.77	5.64	7.42	7.87	8.50	10.42
Writ-of-payment cases in the caseload	1936	8.11	0.90	4.60	7.49	7.99	8.73	11.75
Non-full-trial cases in the caseload	1936	7.45	0.61	5.89	7.00	7.38	7.89	9.27
'Other' cases in the caseload	1936	7.71	0.79	5.06	7.17	7.68	8.28	9.75

Note: Variables are expressed in logarithms. They have been incremented by 1 before logarithmization to avoid any issues arising from the non-existence of the logarithm from zero.

Table A2. Summary statistics – commercial courts

Variable	N	Mean	S.D.	Min	Q1	Median	Q3	Max
New full-trial cases	426	7.45	0.81	5.67	6.88	7.37	7.97	10.28
Pending full-trial cases	426	6.85	1.03	4.72	6.17	6.74	7.52	10.33
Adjudicated full-trial cases	426	7.41	0.81	5.7	6.85	7.31	7.92	10.14
New writ-of-payment cases	426	8.19	0.83	6.53	7.53	8.19	8.69	11.09
Pending writ-of-payment cases	426	5.86	1.23	2.48	4.94	5.86	6.64	9.34
Adjudicated writ-of-payment cases	426	8.2	0.84	6.51	7.56	8.16	8.7	11.07
New 'other' cases	426	5.83	1.05	0.69	5.26	5.75	6.46	9.2
Pending 'other' cases	426	4.03	1.1	0.00	3.33	4.01	4.65	7.38
Adjudicated 'other' cases	426	5.83	1.05	0.69	5.27	5.77	6.47	9.17
Judges	426	1.87	0.62	0.62	1.44	1.79	2.27	4.12
Legal clerks	426	0.75	0.61	0.00	0.34	0.64	1.05	3.1
Assistants	426	1.08	0.66	0.00	0.65	0.95	1.43	3.62
Court clerks	426	2.35	0.65	1.23	1.87	2.24	2.73	4.86
Full-trial cases in the caseload	426	7.91	0.87	6.06	7.3	7.81	8.43	10.93
Writ-of-payment cases in the caseload	426	8.3	0.86	6.62	7.64	8.28	8.79	11.23

Variable	N	Mean	S.D.	Min	Q1	Median	Q3	Max
'Other' cases in the caseload	426	5.99	1.05	0.69	5.4	5.92	6.63	9.25

Note: Variables are expressed in logarithms. They have been incremented by 1 before logarithmization to avoid any issues arising from the non-existence of the logarithm from zero.

Table 1. Civil courts: full trial cases

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Resolved full-trial cases (lagged)				0.14***
				(0.01)
Judges	0.21***	0.18***	0.17***	0.081***
	(0.03)	(0.04)	(0.04)	(0.02)
New full-trial cases	0.66***	0.66***	0.66***	0.64***
	(0.02)	(0.02)	(0.02)	(0.01)
Pending full-trial cases	0.37***	0.37***	0.37***	0.33***
	(0.01)	(0.01)	(0.01)	(0.01)
Writ-of-payment cases (caseload)	-0.011	-0.015	-0.017	-0.053***
	(0.01)	(0.01)	(0.01)	(0.01)
Non-full trial cases (caseload)	-0.021	-0.033*	-0.035**	-0.043***
	(0.02)	(0.02)	(0.02)	(0.01)
Other cases (caseload)	0.022	0.010	0.012	0.057***
	(0.02)	(0.02)	(0.02)	(0.01)
Legal clerks		-0.014	-0.018	-0.018***
		(0.01)	(0.01)	(0.01)
Court clerks		0.087***	0.095***	0.028*
		(0.03)	(0.03)	(0.02)
Assistants		-0.0036	-0.0049	0.013
		(0.02)	(0.02)	(0.01)
Income per capita			-0.003	-0.020***
			(0.02)	(0.01)
Share of private enterprises			0.016**	-0.002
			(0.01)	(0.00)
Firms per 10k inhabitants			-0.034**	-0.032***
			(0.02)	(0.01)
Population			-0.031	-0.079***
			(0.05)	(0.01)

R2	0.85	0.85	0.85	
N	1936	1936	1936	1694
AR1 (p-value)				0.00
AR2 (p-value)				0.62
Hansen (p-value)				0.24

Note: For GMM model (col. 4) the table presents the p-values of the Arellano-Bond tests for zero autocorrelation in first-differenced residuals of order one (AR1) and two (AR2), as well as the Hansen test for overidentifying restrictions. Standard errors in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 2. Civil courts: writ of payment cases

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Resolved writ-of-payment cases (lagged)				0.066***
				(0.00)
Judges	0.026	0.016	0.012	0.043***
	(0.02)	(0.02)	(0.02)	(0.00)
New writ-of-payment cases	0.89***	0.89***	0.89***	0.85***
	(0.02)	(0.02)	(0.02)	(0.00)
Pending writ-of-payment cases	0.071***	0.071***	0.071***	0.057***
	(0.00)	(0.00)	(0.00)	(0.00)
Full-trial cases (caseload)	0.023**	0.022**	0.022**	0.030***
	(0.01)	(0.01)	(0.01)	(0.00)
Non-full trial cases (caseload)	0.007	0.004	0.004	0.005**
	(0.01)	(0.01)	(0.01)	(0.00)
Other cases (caseload)	-0.013	-0.016	-0.016	-0.019***
	(0.01)	(0.01)	(0.01)	(0.00)
Legal clerks		0.005	0.004	0.029***
		(0.01)	(0.01)	(0.00)
Court clerks		0.017	0.017	0.017***
		(0.02)	(0.02)	(0.00)
Assistants		0.0071	0.007	-0.004
		(0.01)	(0.01)	(0.00)
Income per capita			0.006	0.020***
			(0.01)	(0.00)
Share of private enterprises			0.003	0.002***
			(0.00)	(0.00)

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Firms per 10k inhabitants			-0.007	0.009***
			(0.01)	(0.00)
Population			-0.046	-0.059***
			(0.04)	(0.00)
R2	0.96	0.96	0.96	
N	1936	1936	1936	1694
AR1 (p-value)				0.00
AR2 (p-value)				0.57
Hansen (p-value)				0.42

Note: See note to Table 1.

Table 3. Civil courts: non-trial cases

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Resolved non-full trial cases (lagged)				0.040***
				(0.00)
Judges	0.058***	0.067***	0.067***	0.082***
	(0.02)	(0.02)	(0.02)	(0.00)
New non-full trial cases	0.94***	0.94***	0.94***	0.92***
	(0.01)	(0.01)	(0.01)	(0.00)
Pending non-full trial cases	0.16***	0.16***	0.16***	0.092***
	(0.02)	(0.03)	(0.03)	(0.00)
Full-trial cases (caseload)	-0.032***	-0.030***	-0.029***	-0.0039
	(0.01)	(0.01)	(0.01)	(0.00)
Writ-of-payment cases (caseload)	0.0068	0.0081	0.0082	-0.012***
	(0.01)	(0.01)	(0.01)	(0.00)
Other cases (caseload)	-0.022**	-0.019**	-0.018**	0.016***
	(0.01)	(0.01)	(0.01)	(0.00)
Legal clerks		0.001	-0.001	0.00023
		(0.01)	(0.01)	(0.00)
Court clerks		-0.021	-0.013	0.039***
		(0.02)	(0.02)	(0.00)
Assistants		0.001	-0.001	-0.001
		(0.01)	(0.01)	(0.00)

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Income per capita			0.004	-0.007***
			(0.01)	(0.00)
Share of private enterprises			0.006	0.003***
			(0.00)	(0.00)
Firms per 10k inhabitants			0.0013	0.006***
			(0.01)	(0.00)
Population			0.0031	-0.097***
			(0.03)	(0.00)
R2	0.98	0.98	0.98	
N	1936	1936	1936	1694
AR1 (p-value)				0.00
AR2 (p-value)				0.63
Hansen (p-value)				0.55

Note: See note to Table 1.

Table 4. Civil courts: other cases

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Resolved other cases (lagged)				0.031***
				(0.00)
Judges	0.052***	0.034*	0.034*	0.009**
	(0.02)	(0.02)	(0.02)	(0.00)
New other cases	0.85***	0.85***	0.85***	0.84***
	(0.02)	(0.02)	(0.02)	(0.00)
Pending other cases	0.17***	0.16***	0.16***	0.13***
	(0.02)	(0.02)	(0.02)	(0.00)
Full-trial cases (caseload)	0.004	-0.001	-0.002	-0.011***
	(0.01)	(0.01)	(0.01)	(0.00)
Writ-of-payment cases (caseload)	0.003	-0.005	-0.001	-0.028***
	(0.01)	(0.01)	(0.01)	(0.00)
Non-full trial cases (caseload)	0.010	0.004	0.0025	-0.006***
	(0.01)	(0.01)	(0.01)	(0.00)
Legal clerks		0.012	0.012	0.024***
		(0.01)	(0.01)	(0.00)

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Court clerks		0.041**	0.033*	0.092***
		(0.02)	(0.02)	(0.00)
Assistants		0.002	0.003	0.014***
		(0.01)	(0.01)	(0.00)
Income per capita			-0.005	0.018***
			(0.01)	(0.00)
Share of private enterprises			-0.006	-0.006***
			(0.01)	(0.00)
Firms per 10k inhabitants			-0.014*	-0.019***
			(0.01)	(0.00)
Population			0.032	-0.042***
			(0.05)	(0.00)
R2	0.98	0.98	0.98	
N	1936	1936	1936	1694
AR1 (p-value)				0.00
AR2 (p-value)				0.21
Hansen (p-value)				0.59

Note: See note to Table 1.

Table 5. Commercial courts: full trial cases

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Resolved full-trial cases (lagged)				0.15***
				(0.046)
Judges	0.20***	0.19***	0.19***	0.32***
	(0.05)	(0.05)	(0.04)	(0.074)
New full-trial cases	0.69***	0.69***	0.69***	0.50***
	(0.04)	(0.04)	(0.04)	(0.062)
Pending full-trial cases	0.12***	0.11***	0.11***	0.18***
	(0.04)	(0.04)	(0.04)	(0.050)
Writ-of-payment cases (caseload)	-0.11***	-0.11***	-0.11***	-0.16***
	(0.03)	(0.03)	(0.03)	(0.060)
Other cases (caseload)	-0.0091	-0.010	-0.0094	0.035
	(0.02)	(0.02)	(0.02)	(0.026)

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Legal clerks		0.035	0.035	0.022
		(0.02)	(0.02)	(0.054)
Court clerks		-0.021	-0.043	-0.11
		(0.05)	(0.06)	(0.10)
Assistants		0.068***	0.067***	0.094***
		(0.02)	(0.02)	(0.034)
Income per capita			0.024	0.038
			(0.03)	(0.056)
Share of private enterprises			-0.003	0.014
			(0.01)	(0.011)
Firms per 10k inhabitants			0.031	-0.032
			(0.02)	(0.035)
Population			-0.14	0.026
			(0.08)	(0.054)
R2	0.94	0.94	0.94	
N	669	669	669	605
AR1 (p-value)				0.000
AR2 (p-value)				0.722
Hansen (p-value)				0.743

Note: See note to Table 1.

Table 6. Commercial courts: writ-of-payment cases

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Resolved writ-of-payment cases (lagged)				-0.002
				(0.026)
Judges	0.031	0.038*	0.039*	0.068*
	(0.02)	(0.02)	(0.02)	(0.038)
New writ-of-payment cases	0.91***	0.91***	0.91***	0.92***
	(0.03)	(0.03)	(0.03)	(0.026)
Pending writ-of-payment cases	0.050***	0.050***	0.050***	0.071***
	(0.01)	(0.01)	(0.01)	(0.010)
Full-trial cases (caseload)	0.028*	0.027	0.027	-0.055***
	(0.02)	(0.02)	(0.02)	(0.019)

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Other cases (caseload)	-0.023**	-0.022**	-0.022**	0.001
	(0.01)	(0.01)	(0.01)	(0.005)
Legal clerks		0.025*	0.025*	0.043**
		(0.01)	(0.01)	(0.022)
Court clerks		-0.003	-0.006	-0.049
		(0.03)	(0.03)	(0.038)
Assistants		-0.008	-0.009	0.009
		(0.01)	(0.01)	(0.018)
Income per capita			0.006	-0.010
			(0.01)	(0.010)
Share of private enterprises			-0.001	-0.002
			(0.00)	(0.002)
Firms per 10k inhabitants			0.001	0.001
			(0.01)	(0.005)
Population			-0.015	0.006
			(0.04)	(0.010)
R2	0.95	0.95	0.95	
N	669	669	669	605
AR1 (p-value)				0.00
AR2 (p-value)				0.32
Hansen (p-value)				0.13

Note: See note to Table 1.

Table 7. Commercial courts: other cases

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Resolved other cases (lagged)				-0.025
				(0.020)
Judges	0.034*	0.037*	0.046**	0.091**
	(0.02)	(0.02)	(0.02)	(0.035)
New other cases	0.92***	0.92***	0.92***	0.89***
	(0.01)	(0.01)	(0.01)	(0.017)
Pending other cases	0.084***	0.083***	0.083***	0.16***
	(0.02)	(0.02)	(0.02)	(0.023)

	(1)	(2)	(3)	(4)
	OLS-FE	OLS-FE	OLS-FE	GMM-IV
Full-trial cases (caseload)	-0.016	-0.018	-0.017	-0.078***
	(0.01)	(0.01)	(0.01)	(0.027)
Writ-of-payment cases (caseload)	-0.045***	-0.044***	-0.043***	-0.040**
	(0.02)	(0.01)	(0.01)	(0.019)
Legal clerks		0.0018	0.001	-0.003
		(0.01)	(0.01)	(0.023)
Court clerks		-0.014	-0.034	0.004
		(0.02)	(0.03)	(0.044)
Assistants		0.013	0.013	0.005
		(0.01)	(0.01)	(0.017)
Income per capita			0.021	-0.010
			(0.02)	(0.009)
Share of private enterprises			-0.007*	-0.001
			(0.00)	(0.003)
Firms per 10k inhabitants			0.008	-0.004
			(0.01)	(0.006)
Population			-0.057	0.007
			(0.05)	(0.015)
R2	0.98	0.98	0.98	
N	669	669	669	605
AR1 (p-value)				0.00
AR2 (p-value)				0.11
Hansen (p-value)				0.22

Note: See note to Table 1.

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 16.02.2025; accepted 31.08.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.12

Does macroeconomic stability matter for non-performing loans? The case of European Union countries

ALEKSANDRA OSTROWSKA

corresponding author
Department of Finance, Faculty of Economic Sciences, University of Warmia and Mazury in Olsztyn, ul. M. Oczapowskiego 2, 10-719 Olsztyn, Poland
aleksandra.ostrowska@uwm.edu.pl
ORCID: 0000-0001-5814-0530

Abstract

Motivation: The quality of a loan portfolio is a key determinant of banks' credit risk, profitability, and financial stability. It is influenced by both internal and external factors, with macroeconomic stability playing a crucial role. Macroeconomic stability affects both the demand for loans and the banks' ability to supply credit. Growing research interest in this area stems from the recurrence of economic crises and the importance of understanding these dynamics for economic policymakers, banking sector supervisors, bank managers, and borrowers.
Aim: This article aims to identify and assess the impact of selected macroeconomic stability indicators on non-performing loans (NPLs) in EU countries during the period 2014–2023, using panel data models.
Results: The results of the study showed that one-year lagged NPL values, economic growth, and the unemployment rate had a significant impact on NPL levels. GDP per capita exhibited a statistically significant negative effect, indicating that its growth is associated with an increase in NPLs. In contrast, the lagged NPL values and the unemployment rate had a significant positive effect, suggesting that increases in these variables are associated with a decrease in NPLs. The inflation rate, public debt, and current account balance were found to be statistically insignificant. These relationships were consistent across both the pre-crisis

period (2014–2019) and the crisis period (2020–2023). Based on these findings, recommendations were formulated for monetary and fiscal policy, as well as for the supervision of the banking sector.

Keywords: non-performing loans; NPL; macroeconomic stability, European Union countries
JEL: E32; E44; E30; G2

1. Introduction

One of the primary functions of banks is to provide credit. The efficiency of lending activities is reflected in the quality of the loan portfolio, which is the main factor shaping banks' credit risk, profitability, and financial stability. The quality of the loan portfolio is determined by both internal factors (dependent on banks' policies) and external factors (independent of banks). These are largely influenced by macroeconomic stability, which is considered a public good (Van Gunten, 2024, p. 149). Macroeconomic stability affects both the demand for loans and the supply of credit offered by banks. Banks formulate their credit policies in response to changes in the economic environment, which also influence the borrowing decisions, creditworthiness, and repayment ability of non-financial sector entities.

Since 2020, the global economy has faced a series of shocks, including the COVID-19 pandemic, the escalation of the Russia–Ukraine conflict, and surging inflation driven by rising energy prices. These events, often referred to as 'black swans' (Mic, 2024, p. 115; Gong et al., 2025, p. 6), have contributed to a deterioration in macroeconomic stability and a rise in non-performing loans (NPLs) in most EU countries.

The article aims is to identify and assess the impact of selected indicators of macroeconomic stability on the NPL in the EU countries between 2014––2023. This study contributes to the growing body of literature on the relationship between macroeconomic stability and NPLs by employing econometric panel models. Unlike previous studies, the research also included the period of the COVID-19 pandemic and the escalation of the Russian-Ukrainian conflict. To the author's knowledge, the research period in previous studies ended in 2022 or did not take into account all EU countries in this period (e.g. Тмава, К., & Спахіу (2025), Fitriani et al. (2025). In addition, the basic conditions for macroeconomic stability were assessed, also taking into account the current account balance as an explanatory variable, which was not encountered in previous studies for EU. Unlike previous studies, the EU countries were also divided into old and new EU countries, which was not seen in other studies during the period indicated (Gallas et al. (2025)). The use of different research periods and country groups also ensured the robustness of the results. To ensure robustness, both static and dynamic

models were also applied. Static models were estimated using Ordinary Least Squares (OLS) with fixed effects (FE) and random effects (RE). The optimal model was selected based on the results of the Wald, Breusch–Pagan, and Hausman tests. After verifying the properties of the estimated models, robust standard errors (HAC) were used. Additionally, one-year lagged NPL values were included as an explanatory variable in the dynamic models. The practical contribution of the study is formulating recommendations for monetary and fiscal policy, as well as for banking sector supervision.

The article is structured as follows. Section 1 presents of literature review. Section 2 describes the variables and the research methodology. Section 3 presents the results of econometric modelling. Section 4 provides a discussion.

2. Literature review

The quality of a loan portfolio is commonly measured by the share of non-performing loans (NPLs) in a bank's total loan portfolio (Lepczyński & Penczar, 2016, p. 936). A loan is classified as non-performing when the repayment is overdue by more than 90 days (Khoirunisa et al., 2022, p. 66). NPLs represent one of the most significant risks for banks. The ability to effectively manage loan portfolio quality has a positive impact on the overall stability of the banking sector (Mileris, 2012, p. 496). Furthermore, the quality of the loan portfolio is one of the key determinants of a country's financial and macroeconomic stability (Anita et al., 2022, p. 1). According to Castro (2013), the 2008 financial crisis highlighted the severe economic consequences of deteriorating credit quality and spurred increased academic interest in identifying its determinants, including the role of macroeconomic stability. Interest in the relationship between macroeconomic conditions and credit risk has intensified in the wake of recurring crisis events. Such crises often contribute to a decline in macroeconomic stability and an increase in credit risk within the banking sector, thereby raising the likelihood of systemic risk (Bouvatier & El Ouardi, 2023). In recent years, the COVID-19 pandemic significantly worsened the financial position of borrowers–both households and businesses–by increasing their vulnerability (Acheampong et al., 2024, p. 4415). The pandemic led to widespread business failures, a rise in unemployment, declining household income, and a deterioration of many countries' foreign trade balances. The need to finance emergency public spending also resulted in rising public debt. In the EU, the impact of the pandemic was asymmetrical, exacerbating disparities between countries. This divergence stemmed partly from differences in economic growth models and institutional frameworks (Celi et al., 2020).

Additionally, the escalation of the Russia–Ukraine conflict accelerated inflation, primarily through higher energy prices. This inflationary pressure may have further worsened NPL levels by raising operating costs and reduc-

ing borrower incomes. As a response, central banks–first in non-eurozone countries and later the European Central Bank–began raising interest rates (Herr & Nettekoven, 2022, p. 21). Throughout the research period, banks also placed increasing emphasis on incorporating Environmental, Social, and Governance (ESG) criteria into their lending policies (Bruno et al., 2024, p. 4).

During the analyzed period, the secondary market for non-performing loans (NPLs) was further developed, having been initiated in 2017. This market allows banks to sell distressed loans to specialized entities that assume the associated recovery risk. The system remains under close regulatory oversight, as reflected in ongoing reforms. A key example is the action plan adopted by the European Commission on December 16, 2020, which aimed to prevent a rise in NPLs across EU countries in the wake of the COVID-19 pandemic. The plan included measures such as the further development of the secondary NPL market, reforms of EU rules on corporate insolvency and debt recovery, support for the creation and cooperation of national asset management companies (AMCs) at the EU level, and the implementation of prudential measures–including public support where necessary–to ensure continued financing of the real economy, in accordance with the EU Bank Recovery and Resolution Directive (BRRD) and the EU State Aid Framework. Another significant initiative is Directive (EU) 2021/2167 of the European Parliament and of the Council, adopted on November 24, 2021, on credit servicers and credit purchasers, which amends Directives 2008/48/EC and 2014/17/EU. This directive seeks to promote the development of the secondary market for NPLs within the EU by removing barriers to the transfer of NPLs from credit institutions to credit purchasers, while simultaneously safeguarding the rights of borrowers.

Macroeconomic stability is a broad concept, generally associated with the long-term internal and external equilibrium of an economy (Ocampo, 2008, p. 63). The configuration of macroeconomic indicators serves as the foundation for sustainable economic growth (Comporek et al., 2022, p. 133), which is the primary objective of macroeconomic policy in every country (Obidike & Nduka, 2022, p. 1; Kotliński, 2023, p. 602). The relationship between macroeconomic stability and non-performing loans (NPLs) can be examined from both theoretical and empirical perspectives.

For example, Hyman Minsky, in his Theory of Financial Instability, identified several stages in financial markets: disruption, overtrading, monetary expansion, revulsion, and discredit. Disruption refers to an external shock that alters expectations, such as wars, pandemics, or changes in government. Overtrading is characterized by speculative behavior, where market participants overestimate profit opportunities or the effects of leverage, resulting in a collective euphoria about the potential for quick profits. Monetary expansion occurs during periods of economic recovery and growing speculation,

leading to a sharp increase in the money supply. In the stage of revulsion, there is a buildup of debt, accompanied by the insolvency of individuals and businesses. This phase reflects a loss of confidence in the stability of the monetary system, which can lead to a collapse in asset prices, panic, a run on banks, and a flight from illiquid assets into money. The full cycle of a financial crisis concludes with discreditation, where the financial system collapses, triggering widespread panic (Surdej, 2000, pp. 190–191). Another theory that explains these relationships is the Financial Accelerator Theory, developed by Bernanke, Gertler, and Gilchrist (1998). This theory amplifies the boom-bust cycle by highlighting the impact of a company's financial situation on its access to external financing. A key element of this model is the asymmetry of information between banks and firms. Banks do not have complete knowledge of the risks and activities of companies, which creates issues characteristic of agency theory. As a result, banks incur costs to monitor debtors' actions, and borrowing costs rise when a firm has a weak financial position (low net worth). During a recession, declining profits and asset values reduce the firm's net worth, which increases the risk premium, leading to reduced investment and reinforcing the economic downturn. Loan defaults thus exacerbate macroeconomic shocks. In times of economic prosperity, banks face greater temptation to increase risk by expanding the supply of loans and engaging in speculative activities. This accumulated risk eventually materializes during economic downturns, leading to disruptions in loan repayments and triggering financial and macroeconomic crises.

The relationship between macroeconomic stability and non-performing loans (NPLs) in the context of EU countries has also been the subject of empirical research. Notable studies in this area include those by Makri et al. (2014), Tanasković & Jandrić (2015), Roman & Bilan (2015), Dimitrios et al. (2016), Rachuba (2018), Szarowska (2018), Ciukaj & Kil (2020), Kozarić & Dželihodžić (2020), Ofria & Mucciardi (2022), Ostrowska (2023), Zawadzki (2023), Filičková (2024), Artenisa & Hyrije (2023), and Christodoulou-Volos (2025). The results of these studies vary, depending on the group of countries analyzed, the research period, and the methodologies employed.

In conclusion, the growing interest in macroeconomic stability and its impact on non-performing loans (NPLs) remains highly relevant to the current developments affecting EU countries and is of particular concern to EU institutions. A review of the existing literature has highlighted a research gap in this area.

Based on the findings from the literature, the current study has formulated the following hypotheses:

H1: The growth in GDP per capita results in the decline of NPLs.
H2: The increase in unemployment rate results in the growth of NPLs.
H3: The increase in inflation rate results in the decline of NPLs.
H4: The increase in public debt results in the growth of NPLs.

H5: The increase in current account balance results in the decline of NPLs.
H6: The increase in one year lagged NPL results in the decline of NPLs.

The practical contribution is the formulation of recommendations for monetary policy, fiscal policy and supervision of the banking sector.

3. Methods

The research conducted was based on panel data. Annual data for 27 EU countries from 2014 to 2023 were obtained from the ECB Data Warehouse and Eurostat. The availability and completeness of statistical data limited the research period. The characteristics of the variables are presented in Table 1. NPL was used as the dependent variable, while indicators of macroeconomic stability, such as GDP per capita, unemployment rate, inflation rate, public debt (as a percentage of GDP), and current account balance (as a percentage of GDP) were used as independent variables. Descriptive statistics, including the mean, standard deviation, minimum, and maximum, are presented in Table 2.

Next, tests for the stationarity of the variables were conducted. The results of the Augmented Dickey-Fuller (ADF) test indicate that all variables were stationary at their levels, as shown in Table 3. The next step was to calculate the linear correlation coefficients between the variables, with the results displayed in Table 4. According to Schober et al. (2018), a strong correlation is considered when the correlation coefficient exceeds 0.70, while Khan et al. (2020) suggest that a value above 0.80 may indicate potential collinearity. None of the correlation coefficients exceeded these thresholds, allowing the variables to be included in a single model. Graphical correlations between the macroeconomic stability indicators and NPLs are shown in Charts 1-5, which also support the validity of the research hypotheses. Models were estimated using the OLS estimator, FE, and RE. The following model was adopted for the OLS approach (Kufel, 2011, pp. 173–178):

$$y_{it} = y_{it}\beta + \varepsilon_{it} \tag{1}$$

where:

y_{it} – dependent variable;

x_{it} – independent variable (in general, the vector of independent variables);

β – vector of the N dimension of the models' structural parameters;

v_{it} – total random error composed of the purely random part ε_{it} and individual effect u_{it} pertaining to the specific i-th unit of the panel ($v_{it} = \varepsilon_{it} + u_{it}$).

The model with FE assumed the form:

$$y_{it} = y_{it}\beta + u_i + \varepsilon_{it}, \tag{2}$$

The model with RE looked as follows:

$$\hat{\beta}_{RE} = (X^T \Omega^{-1} X)^{-1} X^T \Omega^{-1} y, \quad (3)$$

where:

$\hat{\beta}_{RE}$ – generalized estimator of the least square of structural parameters;

X –matrix of independent variables;

y – vector of dependent variables;

Ω – a reversible matrix of variance and covariance of the total random error.

The validity of the models was assessed with the Wald, Breusch-Pagan and Hausman tests (Kośko et al., 2007, pp. 416-418). Then robust HAC robust standard errors were imposed on the estimators and the models were reestimated.

Dynamic panel models were also estimated, taking into account the one-year lagged NPL. The following model was adopted for the dynamic approach (Arellano, Bond, 1991, p. 278):

$$y_{it} = \alpha\, y_{i\,(t-1)} + \eta_i + \nu_{it}, \quad (4)$$

where:

$y_{i\,(t-1)}$ – lagged dependent variable;

η_i – individual effect.

4. Results

The results of the static econometric models and relevant tests are presented in Tables 5-16. The results of the Wald test for each research period (p-value = 0.000<0.050) indicate that the hypothesis of the OLS model being correct should be rejected, supporting the alternative hypothesis that the fixed effects (FE) model is more appropriate. The results of the Breusch-Pagan test (p-value = 0.000 < 0.050) suggest that the hypothesis of the OLS panel model being correct should be rejected, in favor of the alternative hypothesis that the random effects (RE) model is more suitable. The decision was further supported by the Hausman test, which, with a p-value of 0.000<0.050, rejected the hypothesis that the RE models are correct, supporting the alternative hypothesis. The results of the Hausman test (p-value = 0.010 > 0.050 and 0.295 < 0.050) only in the model for 'new Union' countries in 2014–2019 and 2020–2023 showed the need to use the RE estimator.

After selecting the estimator, the models were diagnosed for cross-sectional dependence, autocorrelation, and heteroskedasticity. The results of the CD-Pesaran test (p-value = 0.000 <0.050) indicate the presence of cross-sectional dependence. The Wooldridge test results (p-value = 0.000<0.050) reveal the presence of autocorrelation in all static models. Additionally, the results of the Wald test (p-value = 0.000<0.050) indicate heteroskedasticity in

all static models. As a result, robust HAC standard errors were applied to the estimator, and the models were re-estimated. This approach was also utilized by Anita et al. (2022) and Claveria (2022) in their studies.

Following the estimation of the OLS models, the variance inflation factor (VIF) was analyzed. The VIF values, which were below 10, indicate the absence of collinearity among the variables (Salmerón et al., 2020, pp. 2–3). The FE model with robust HAC explains the variation in the response variable to a significant extent. The within R^2 coefficient explains the variance in the NPL evaluation, accounting for the lack of individual effects across countries, thus highlighting the relatively minor role of time effects in comparison to the individual effects of different countries.

Dynamic panel models with one-year lagged NPL were also estimated. The results for the dynamic models are presented in Table 8. The results of the AR(1) test for the model covering the entire study period, the years 2019–2023, and 'New Union' countries in years (p-value=0.049, 0.023, and 0.035 < 0.050) indicate the presence of autocorrelation, which is typical for macroeconomic panels. For the EU-27 in years 2014-2019, 'Old Union' countries in years 2014–2023, and 2014–2019 period, and 'New Union' countries in 2014–2019 (p-value = 0.236, 0.270, 0.072, 0.472 > 0.050), the absence of first-order autocorrelation was observed. Regarding the AR(2) test for the estimated dynamic models (p-value = 0.177, 0.258, 0.121, 0.227, 0.784, 0.147, and 0.133 > 0.050), the absence of second-order autocorrelation was not rejected. This suggests no correlation with the error term.

5. Discussion

The parameter estimates reveal a significant negative impact of GDP per capita, although the coefficients were low. These relationships were consistent in both static and dynamic models, regardless of the research period and country group considered. During the research period, the development of the COVID-19 pandemic and the escalation of the armed conflict led to a substantial decline in GDP and an increase in interest rates. These events likely contributed to an increase in credit risk. Despite this, a negative relationship was observed. GDP is a key macroeconomic indicator, and its positive dynamics, including GDP per capita, signal an improvement in the macroeconomic environment. This should, in turn, lead to a reduction in NPLs, as higher incomes for borrowers increase their ability to repay loan obligations (Kocisova & Pastyriková, 2020). A negative relationship between GDP per capita and NPLs was also found by Louzis et al. (2012), Ahmad & Bashir (2013), Castro (2013), Ghosh (2015), Idris & Nayan (2016), Mazreku et al. (2018), Ferreira (2022), Ostrowska (2023), Artenisa and Hyrije (2023), and Christodoulou-Volos (2025). Therefore, the first research hypothesis was not rejected.

In most of the estimated models, the parameter for the unemployment rate was significant and positive. The exception was the dynamic model for EU-27 in the period 2020-2023, where the parameter was insignificant and negative. This could be attributed to the limited number of observations and may represent a disturbance in the data. An increase in the unemployment rate results in a decrease in income and a reduction in the demand for goods and services, which diminishes borrowers' ability to repay loan debt. This finding aligns with the research of Louzis et al. (2012), Ahmad & Bashir (2013), Castro (2013), Wdowiński (2014), Ghosh (2015), Idris & Nayan (2016), Zhang et al. (2022), Ostrowska (2023), Zawadzki (2023), Filičková (2024), Artenisa and Hyrije (2023), and Christodoulou-Volos (2025). Thus, the second research hypothesis was not rejected.

The next indicator of macroeconomic stability is the inflation rate. In the static models for the entire study period and for the years 2020-2023, this parameter was negative and insignificant, while in 2014–2019, it was insignificant but positive, as was observed in the dynamic models. An acceleration of inflationary processes worsens the macroeconomic environment by increasing prices and thereby reducing the purchasing power of money. This directly affects the financial situation of borrowers, as it reduces the value of their disposable income, potentially hindering their ability to repay loans on time (Lekupanai & Makori, 2024). Additionally, inflation often leads to an increase in interest rates. A negative effect of the inflation rate was shown by Ahmad & Bashir (2013). However, the inflation rate was insignificant in the studies by Tanasković & Jandrić (2014), Idris & Nayan (2016), and Artenisa & Hyrije (2023). A positive effect of the inflation rate was observed by Mileris (2012), Abid et al. (2014), Mazreku et al. (2018), and Zhang et al. (2022). Therefore, the third research hypothesis was rejected.

Public debt reflects the condition of public finances. Its increase is primarily driven by a negative difference between state revenues and expenditures, as well as the need for budgetary borrowing. An increase in public debt raises the cost of servicing it and can lead to several negative consequences, including the potential for tax hikes on the population and a reduction in budget revenues. Public debt can also result from a trade or budget deficit (Koju et al., 2018, p. 121). If public debt rises excessively, the government may resort to measures such as reducing social spending. This increase can, in turn, lead to a deterioration in the quality of banks' loan portfolios. The parameter estimates from the models reveal an insignificant but positive impact of public debt for the entire study period. In the sub-periods, this impact was significant and positive in some cases, but insignificant and negative in dynamic models. A positive impact was also identified by Ofria & Mucciardi (2022) and Zawadzki (2023). An insignificant, positive effect in the short term was observed in the study by Karadima & Louri (2022). On the other hand, a negative impact of government debt on the share of non-performing

loans was reported by Anjom & Karim (2016), Dimitrios et al. (2016), and Anita et al. (2022). The fourth hypothesis is not rejected solely in the context of static models.

Another key condition for macroeconomic stability is external balance, particularly in foreign trade. A favorable external balance, where exports exceed imports, is positive for macroeconomic stability and indicates healthy trends in international trade. To enhance their competitive advantage, companies engage in foreign trade by exporting goods and services. Exports are a crucial component of national income in open economies, benefiting not only exporters but also the broader economy (Yahaya & Oni, 2016). A decline in exports can lead to a reduction in business revenues, which, in turn, diminishes the ability to repay loans, contributing to a higher share of non-performing loans (NPLs) in total loans (Clichici & Colesnicova, 2014, p. 1032). In most of the estimated models, the current account balance (as a percentage of GDP) proved to be an insignificant explanatory variable. It is worth noting that, in recent years, the current account balance has deteriorated in most EU countries, particularly in Central and Eastern European (CEE) countries, a trend that began with the closure of economies in 2020. The development of the COVID-19 pandemic and the escalation of the armed conflict may have disrupted the expected relationships in terms of external stability. The lack of a significant impact of export dynamics on NPLs was also supported by the study by Shonhadji (2020). Similarly, the insignificance of the current account balance (as a percentage of GDP) on NPLs was found by Kauko (2012) and Tiryaki (2014). Therefore, the fifth research hypothesis was rejected.

In all dynamic models, the one-year lagged NPL was a significant explanatory variable. This relationship was also observed in other studies, such as those by Gashi et al. (2022), Artenisa & Hyrije (2023), and Christodoulou-Volos (2025). Therefore, the sixth research hypothesis was not rejected.

The results of the conducted research allowed for the confirmation of three out of the six postulated hypotheses. The fourth hypothesis was only supported by static models. The panel analysis results show that the key determinants of the level of non-performing loans (NPL) in EU countries were the one-year lagged NPL, GDP per capita, and the unemployment rate. The impact of other macroeconomic variables, such as the inflation rate, public debt, and the current account balance, was statistically insignificant, which requires further explanation. The insignificance of the inflation rate may be attributed to the fact that it remained relatively low in EU countries for most of the period under review. It experienced a slight increase during the COVID-19 pandemic, but it was only the escalation of the armed conflict that caused a sharp rise, which was subsequently brought under control. Thus, the high inflation rate persisted for a relatively short period, which may explain why it did not have a statistically significant impact. The

increase in inflation, however, led to higher interest rates, which may have had a more direct impact on NPLs. The insignificance of public debt in the models may be due to the fact that NPLs primarily affect the private sector, not the public sector. Therefore, public debt may not have had a direct effect on the results of this study. Its indirect influence could be observed through fiscal policies, such as government spending on business aid or social support for households. Other factors could be related to the design of the panel models. The inclusion of one-year lagged NPLs may have explained most of the variability, causing less significant variables to lose their relevance. Additionally, public debt could be correlated with other variables already incorporated in the models, such as fiscal policies. The insignificance of the current account balance (CAB) may stem from the fact that it directly influences exports and imports but only indirectly affects the financial situation of enterprises, which in turn impacts their loan repayment capacity. It is also possible that the exchange rate could have played a role in influencing NPLs, and its exclusion from the model may have impacted the results. Finally, the lack of significance of certain variables could also be influenced by structural factors, such as the judicial system or banking regulations, which were not accounted for in this study.

The study conducted has certain limitations. Firstly, it focused exclusively on macroeconomic variables. As noted earlier, the insignificance of some of these variables may have been influenced by country-specific characteristics that were not captured in the estimated models. Another limitation is the research period. The division into sub-periods resulted in a relatively small number of observations in each panel, especially for the years 2020-2023. Additionally, the relatively short duration of the macroeconomic shocks during the study period could have influenced the results.

Future research should incorporate additional variables, including bank-specific, structural, institutional, regulatory, and microeconomic factors, which may influence the significance of macroeconomic variables. Another avenue for investigation would be to divide EU countries into 'old Union' and 'new Union' member states and examine the differences between them. It would also be beneficial to extend the research period by incorporating, for instance, quarterly data, which would increase the number of observations, particularly for the years 2020–2023. Additionally, alternative measures of loan portfolio quality, such as the ratio of non-performing loans covered by provisions, could be explored. Modifications to dynamic models, such as adding lags of explanatory variables, introducing other variables like interest rates or loan values, and excluding irrelevant ones, could provide further insights. Due to the scope limitations of this article, these aspects were not addressed in the current research.

Based on the results, recommendations for monetary policy, fiscal policy, and banking sector supervision have been formulated. Measures that affect

both the financial situation of potential and existing borrowers, as well as the situation of banks and their loan portfolios, are important. At the centre of monetary policy within the framework of macroeconomic stability remains inflation, which affects the real income of borrowers. In the context of inflation, it is important to properly set interest rates, which affect inflation and NPLs. Another area is the use of open market operations and reserve requirements. By buying securities and lowering the reserve requirement, the central bank increases liquidity and stimulates inflation, which can encourage loan restructuring or easier refinancing and lower NPLs. Selling them and raising the reserve requirement, on the other hand, leads to a decrease in liquidity and an increase in NPLs. The central bank's information policy is also important. Predictable central bank policy makes financial planning easier for borrowers and banks, which affects inflation expectations and lower NPLs. During economic downturns, reducing interest rates can help stimulate economic activity, benefiting both businesses and households. However, it is important to note that prolonged low interest rates can lead to excessive borrowing, which may overheat the economy and create repayment difficulties for borrowers.

Fiscal policy should focus on improving the labor market situation, particularly by supporting long-term employment. It is recommended to implement activation programs and invest in job creation. However, such measures require additional spending, which could lead to an increase in public debt. Nevertheless, as the research has shown, public debt appears to be an insignificant factor in this context. As part of fiscal policy, it is also important to support borrowers. These can include permanent or temporary tax breaks for both households and businesses. Provided they are properly utilized, they can contribute to improving NPLs. Another solution, particularly in crisis situations, is to provide support to borrowers in the form of installment subsidies, as exemplified by the Borrower Support Fund in Poland. Another solution is the so-called credit vacations, which should be applied only to borrowers in difficult financial situations, as they can generate losses for banks. Another measure could be contribution subsidies for housing loans.

Banking sector supervision should promote a more flexible, cyclical approach to credit risk assessment, such as creating incentives for banks to build up capital buffers during economic booms. Emphasizing stress tests that account for scenarios involving economic downturns and rising unemployment would also be beneficial. Supporting efforts to detect credit problems early, such as through modern scoring systems, could help reduce NPLs. Referring to existing solutions, further development of the secondary market for NPLs within the EU should be prioritized. Additionally, it would be valuable to introduce a unified system for monitoring overdue receivables across the EU. It is important to note that while macroeconomic stability impacts NPLs, NPLs themselves can weaken both the banking sector and

the broader economy due to the costs they generate. As part of banking sector supervision, regular monitoring of current NPL levels is crucial, as past values have also been identified as a significant variable.

6. Conclusion

The article aims is to identify and assess the impact of selected macroeconomic stability indicators on NPLs in EU countries from 2014 to 2023 using panel models. Both static and dynamic panel models were employed in the research. The study period was divided into two sub-periods: 2014–2019 and 2020–2023. The EU countries were also divided into 'old' and 'new' EU countries. In the static models, OLS, FE, RE and robust standard errors estimators were used. These solutions ensured the robustness of the results.

The results of the study showed that economic growth, one-year lagged NPL values, and the unemployment rate were significant determinants of NPLs. These relationships were observed both in the pre-crisis period (2014–2019) and the crisis period (2020–2023). This has also been observed in the 'old' and 'new' Union countries. Thus, the results showed that macroeconomic stability is an important factor shaping NPL in EU countries regardless of the research period adopted. Economic growth and labor market conditions represent key components of macroeconomic stability that significantly affect the level of non-performing loans, chiefly by influencing borrowers' income. The inflation rate, public debt, and the current account balance were found to be insignificant.

GDP per capita exhibited a significant negative impact, meaning that its growth leads to a decrease in NPLs. In a favorable economic climate, households and businesses have higher incomes, making it easier for them to service their obligations on time. As a result, the share of NPLs in banks' portfolios tends to decline. In contrast, during economic downturns or recessions, the risk of default increases, leading to an increase in the number of defaulted loans. The lagged values of NPLs and the unemployment rate showed a significant positive effect, indicating that their increase results in a rise in NPLs. Historically high levels of NPLs can limit banks' ability to make new loans and increase risks to the stability of the financial system. Also important is the unemployment rate, which correlates strongly with household solvency. Rising unemployment reduces the ability of borrowers to service their debt, especially for consumer loans and mortgages.

Therefore, effective economic policies and labor market measures are important for reducing credit risk. The main role in maintaining macroeconomic stability is played by central banks and governments of individual countries. An important role in managing existing NPLs is played by banking sector supervision. Banking sector supervision should adopt a more flexible,

cyclical approach to credit risk assessment, with increased focus on stress tests that consider scenarios of economic downturns and rising unemployment. Additionally, it is important to develop a secondary market for non-performing loans (NPLs) to help banks remove bad loans from their portfolios. Close coordination between monetary policy, fiscal policy, and banking sector supervision is essential to mitigate the risks posed by deteriorating macroeconomic stability on NPLs.

References

Abid, L., Ouertani, M.N., & Zouari-Ghorbel, S. (2014). Macroeconomic and bank-specific determinants of household's non-performing loans in Tunisia: A dynamic panel data. *Procedia Economics and Finance*, 13, 58–68. https://doi.org/10.1016/s2212-5671(14)00430-4.

Acheampong, A., Ibeji, N., & Danso, A. (2024). COVID-19 and credit risk variation across banks: International insights. *Managerial and Decision Economics*, 45(7), 4415–4431. https://doi.org/10.1002/mde.4271.

Ahmad, F., & Bashir, T. (2013). Explanatory power of macroeconomic variables as determinants of non-performing loans: Evidence form Pakistan. *World Applied Sciences Journal*, 22(2), 243–255. https://doi.org//10.5829/idosi.wasj.2013.22.02.1863.

Anita, S.S., Tasnova, N., & Nawar, N. (2022). Are non-performing loans sensitive to macroeconomic determinants? Empirical from banking sector of SAARC countries. *Future Business Journal*, 8(1), 7. https://doi.org/10.1186/s43093-022-00117-9.

Anjom, W., & Karim, A.M. (2016). Relationship between non-performing loans and macroeconomic factors with bank specifc factors: a case study on loan portfolios–SAARC countries perspective. *ELK Asia Pacifc Journal of Finance and Risk Management*, 7(2), 1–29. https://doi.org//10.16962/EAPJFRM/issn. 2349-2325/2015.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies, 58*(2), 277–297. https://doi.org/10.2307/2297968.

Artenisa, B., & Hyrije, A.A. (2023). The impact of economic growth on non-performing loans in Western Balkan countries. *Journal for the International and European Law, Economics and Market Integrations*, 10(2), 117–130. https://doi.org/10.22598/iele.2023.10.2.6.

Bernanke, B.S., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. *Handbook of Macroeconomics*, 1, 1341–1393.

Bouvatier, V., & El Ouardi, S. (2023). Credit gaps as banking crisis predictors: A different tune for middle- and low-income countries. *Emerging Markets Review*, 54, 101001. https://doi.org/10.1016/j.ememar.2023.101001.

Bruno, E., Iacoviello, G., & Giannetti, C. (2024). Bank credit loss and ESG performance. *Finance Research Letters*, *59*, 104719. https://doi.org/10.1016/j.frl.2023.104719.

Castro, V. (2013). Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Economic Modelling*, 31(1), 672––683. https://doi.org/10.1016/j.econmod.2013.01.027.

Christodoulou-Volos, C. (2025). Determinants of Non-Performing Loans in Cyprus: An Empirical Analysis of Macroeconomic and Borrower-Specific Factors. *International Journal of Economics and Financial Issues*, 15(1), 190–201. https://doi.org/10.32479/ijefi.17398.

Celi, G., Guarascio, D., & Simonazzi, A. (2020). A fragile and divided European Union meets COVID-19: further disintegration or 'Hamiltonian moment'?. *Journal of Industrial and Business Economics*, *47*(3), 411–424. https://doi.org/10.1007/s40812-020-00165-8.

Ciukaj, R., & Kil K. (2020). Determinants of the non-performing loan ratio in the European Union banking sectors with a high level of impaired loans. *Economics and Business Review*, 6(1), 22–45. https://doi.org/10.18559/ebr.2020.1.2.

Claveria, O. (2022). Global economic uncertainty and suicide: Worldwide evidence. *Social Science & Medicine*, 305, 115041. https://doi.org/10.1016/j.socscimed.2022.115041.

Clichici, D., & Colesnicova, T. (2014). The Impact Of Macroeconomic Factors On Non-Performing Loans In The Republic Of Moldova, *Journal of Financial and Monetary Economics*, 1(1), 73–8.

Comporek, M., Kowalska, M., & Misztal, A. (2022). Macroeconomic stability and transport companies' sustainable development in the Eastern European Union. *Journal of Business Economics and Management*, 23(1), 131–144. https://doi.org/10.3846/jbem.2021.15913.

Dimitrios, A., Helen, L., & Mike, T. (2016). Determinants of non-performing loans: Evidence from Euro-area countries. *Finance Research Letters*, 18, 116–119. https://doi.org/10.1016/j.frl.2016.04.008.

Directive (EU) 2021/2167 of the European Parliament and of the Council of 24 November 2021 on credit servicers and credit purchasers and amending Directives 2008/48/EC and 2014/17/EU.

Ferreira, C. (2022). Determinants of non-performing loans: A panel data approach. *International Advances in Economic Research*, 28(3), 133–153. https://doi.org/10.1007/s11294-022-09860-9.

Filičková, N. (2024). Key determinants of non-performing loans: evidence from European Union countries. *Scientia Iuventa*, 47, 47–58.

Fitriani, F., Yusuf, M., & Maksar, M.S. (2025). Evolution and Determinants

of Non-Performing Loan Burden in The Group of Seven (G7) Banking Sector. *Golden Ratio of Finance Management*, 5(2), 372–385. https://doi.org/10.52970/grfm.v5i2.1211.

Gallas, S., Bouzgarrou, H., & Zayati, M. (2025). Analyzing Macroeconomic Variables and Stress Testing Effects on Credit Risk: Comparative Analysis of European Banking Systems. *Journal of Central Banking Theory and Practice*, 2, 121–149. https://doi.org/10.2478/jcbtp-2025-0016.

Gashi, A., Tafa, S., & Bajrami, R. (2022). The impact of macroeconomic factors on non-performing loans in the Western Balkans. *Emerging Science Journal*, 6(5), 1032–1045. https://doi.org/10.28991/esj-2022-06-05-08.

Ghosh, A. (2015). Banking-industry specific and regional economic determinants of non-performing loans: evidence from US States. *Journal of Financial Stability*, 20, 93–104. https://doi.org/10.1016/j.jfs.2015.08.004

Gong, X.L., Ning, H.Y., & Xiong, X. (2025). Research on the cross-contagion between international stock markets and geopolitical risks: the two-layer network perspective. *Financial Innovation*, 11(1), 23. 1–23. https://doi.org/10.1186/s40854-024-00687-3.

Herr, H., & Nettekoven, Z.M. (2022). *Macroeconomic effects of the Covid-19 Pandemic in Germany and the European Monetary Union and economic policy reactions*, Working Paper, Institute for International Political Economy (IPE) Berlin, 185, 1–41.

https://finance.ec.europa.eu/publications/action-plan-tackling-non-performing-loans-npls-aftermath-covid-19-pandemic_en (18.04.2025).

Idris, I.T., & Nayan, S. (2016). The joint effects of oil price volatility and environmental risks on non-performing loans: evidence from panel data of organisation of the petroleum exporting countries. *International Journal of Energy Economics and Policy*, 6(3), 522–528.

Karadima, M., & Louri, H. (2022). Government debt accumulation and non-performing loans: An ARDL bounds testing approach. *Economics and Business Letters*, 11(4), 150-160. https://doi.org//10.17811/ebl.11.4.2022.150-160.

Kavkler, A., & Festić, M. (2010). The trade deficit and banking sector results in Romania and Bulgaria. *Economic Interferences*, 12(27), 199–213.

Khan, M.A., Siddique, A., & Sarwar, Z. (2020). Determinants of non-performing loans in the banking sector in developing state. *Asian Journal of Accounting Research*, 5(1), 135-145. https://doi.org/10.1108/ajar-10-2019-0080.

Khoirunisa, H., Hutauruk, C.M., & Muchtar, S. (2022). Factors affecting non-performing loans of conventional banking: Evidence in Indonesia stock exchange. *Jurnal Syntax Transformation*, 3(1), 65–78. https://doi.org/10.46799/jst.v3i1.494.

Koju, L., Koju, R., & Wang, S. (2018). Macroeconomic and bank-specific determinants of non-performing loans: Evidence from Nepalese banking

system. *Journal of Central Banking Theory and Practice*, 7(3), 111–138. https://doi.org/10.2478/jcbtp-2018-0026.
Kotliński, K. (2023). The macroeconomic stability of United Kingdom after Brexit. *Ekonomia i Prawo. Economics and Law*, 22(3), 599–611. https://doi.org/10.12775/EiP.2023.032.
Kocisova, K., & Pastyriková, M. (2020). Determinants of non-performing loans in European Union countries. In: Proceedings of Economics and Finance Conferences. International Institute of Social and Economic Sciences. https://doi.org/10.20472/EFC.2020.013.005.
Kośko M., Osińska M. and Stempińska J. (2007). Ekonometria współczesna. Wydawnictwo TNOiK, Toruń.
Kozarić, K., & Dželihodžić, E.Ž. (2020). Effects of macroeconomic environment on non-performing loans and financial stability: Case of Bosnia and Herzegovina. *Journal of Central Banking Theory and Practice*, 9(2), 5–17. https://doi.org//10.2478/jcbtp-2020-0011.
Kufel, T. (2011). Ekonometria. Rozwiązywanie problemów z wykorzystaniem programu GRETL, Wydawnictwo Naukowe PWN, Warszawa.
Lekupanai, L., & Makori, D. (2024). Effect of inflation on non-performing loans of non-liste dcommercial banks in Kenya. *The Strategic Journal of Business & Change Management*, 11 (4), 1007–1014. http://dx.doi.org/10.61426/sjbcm.v11i4.3135.
Lepczyński, B., & Penczar, M. (2016). Analiza porównawcza jakości kredytów sektorów bankowych krajów Europy Środkowo-Wschodniej. *Finanse, Rynki Finansowe, Ubezpieczenia*, 82, 931–943. https://doi.org//10.18276/frfu.2016.4.82/1-77.
Louzis, D.P., Vouldis, A.T., & Metaxas, V.L. (2012). Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking and Finance*, 36(4), 1012–1027. https://doi.org/10.1016/j.jbankfin.2011.10.012.
Makri, V., Tsagkanos, A., & Bellas, A. (2014). Determinants of non-performing loans: The case of Eurozone. *Panoeconomicus*, 61(2), 193–206. https://doi.org/10.2298/pan1402193m.
Mazreku, I., Morina, F., Misiri, V., Spiteri, J.V., & Grima, S. (2018). Determinants of the level of non-performing loans in commercial banks of transition countries. *European Research Studies Journal*, 21, 3–13. https://doi.org/10.35808/ersj/1040.
Mic, D.A. (2024). Theoretical Aspects of Black Swan Scenarios and Predictable Events Techniques. *Revista de Științe Politice. Revue des Sciences Politiques*, 82, 107–116.
Mileris, R. (2012). Macroeconomic determinants of loan portfolio credit risk in banks. *Engineering Economics*, 23(5), 496–504. https://doi.org/10.5755/j01.ee.23.5.1890.

Obidike, M.O., & Nduka, J.A. (2022). Effect of Selected Macroeconomic Variables on the Nigeria in Economy 1987–2020. *International Journal of Business & Law Research*, 10(3), 84–96.

Ocampo, J.A. (2008). A broad view of macroeconomic stability. The Washington consensus reconsidered, 63–94. https://doi.org/10.1093/acprof:oso/9780199534081.003.0006.

Ofria, F., & Mucciardi, M. (2022). Government failures and non-performing loans in European countries: a spatial approach. *Journal of Economic Studies*, 49(5), 876–887. https://doi.org//10.1108/JES-01-2021-0010.

Ostrowska, A. (2023). Makroekonomiczne determinanty jakości kredytów dla sektora niefinansowego w Polsce. *Bank i Kredyt*, 54(5), 541–556. https://doi.org/10.5604/01.3001.0054.5717.

Rachuba, J. (2018). Koniunktura gospodarcza a jakość portfeli kredytowych banków komercyjnych oraz banków spółdzielczych w Polsce. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 521, 153–162. https://doi.org/10.15611/pn.2018.521.15.

Roman, A., & Bilan, I. (2015). An empirical analysis of the macroeconomic determinants of non-performing loans in EU28 banking sector. *Revista Economică*, 67(2), 108–127.

Schober, P., Boer, C., & Schwarte, L.A. (2018). Correlation coefficients: appropriate use and interpretation. *Anesthesia & analgesia*, 126(5), 1763––1768. https://doi.org/10.1213/ane.0000000000002864.

Shonhadji, N. (2020). What Most Influence on Non-Performing Loan in Indonesia? Bank Accounting Perspective with Mars Analysis. *Journal of Accounting and Strategic Finance*, 3(2), 136–153. https://doi.org/10.33005/jasf.v3i2.85.

Surdej A. (2000). Historia kryzysów finansowych. *Historyka. Studia Metodologiczne*, 30, 189-192.

Szarowska, I. (2018). Effect of macroeconomic determinants on non-performing loans in Central and Eastern European countries. *International Journal of Monetary Economics and Finance*, 11(1), 20-35. https://doi.org/10.1504/ijmef.2018.10008415.

Tanasković, S., & Jandrić, M. (2015). Macroeconomic and institutional determinants of non-performing loans. *Journal of Central Banking Theory and Practice*, 4(1), 47-62. https://doi.org/10.1515/jcbtp-2015-0004.

Tiryaki, G. (2014). Banking leverage, credit indicators, current account balance and economic growth with their implications in Turkey (1999-2013). *Finansal Araştırmalar ve Çalışmalar Dergisi*, 6(11), 99–118. https://doi.org/10.14784/jfrs.2014117330.

Тмава, К., & Спахіу, М. (2025). Banking and macroeconomic drivers effects on non-performing loans: insights from Western Balkan countries. *Financial and credit activity problems of theory and practice*, 2(61), 40–53. https://doi.org/10.55643/fcaptp.2.61.2025.4682.

Van Gunten, T. S. (2024). Elite politics and economic crisis: Hyperinflation in Argentina, 1989–1990. *Political Power and Social Theory*, 41, 141–173. https://doi.org/10.1108/S0198-871920240000041006.

Wdowiński, P. (2014). Makroekonomiczne czynniki ryzyka kredytowego w sektorze bankowym w Polsce. *Gospodarka Narodowa*, 272(4), 55–77. https://doi.org/10.33119/gn/100880.

Yahaya, K.A., & Oni, O. (2016). Impact of Macroeconomic Factors on Non-Performing Loan in the Nigerian Deposit Money Bank. *Amity Global Business Review*, 11(1), 68–78 .

Zawadzki, A. (2023). Macroeconomic determinants of credit risk on the example of non-performing loans. *Central European Economic Journal*, 10(57), 275–286. https://doi.org/10.2478/ceej-2023-0016.

Zhang, P., Zhang, M., Zhou, Q., & Zaidi, S.A.H. (2022). The Relationship Among Financial Inclusion, Non-Performing Loans, and Economic Growth: Insights From OECD Countries. *Frontiers in Psychology*, 13, 1–11. https://doi.org/10.3389/fpsyg.2022.939426.

Acknowledgements

Author contributions: author has given an approval to the final version of the article.

Funding: this research was fully funded by the University of Warmia and Mazury in Olsztyn.

Appendix

Table 1. Characteristics of variables

Variables	Unit	Source	Expected relation with NPL
Bank non-performing loans to total gross loans (NPL)	%	ECB Data Warehouse	
GDP per capita (GDP)	euro/unit; market prices	Eurostat	-
Unemployment rate (UR)	%	Eurostat	+
Inflation rate; Hamonised index of consumer prices (HICP)	%	Eurostat	-
Public debt (PD)	% of GDP	Eurostat	+
Current account balance (CAB)	% of GDP	Eurostat	-

Source: Own preparation.

Table 2. Descriptive statistics

Variable	Mean	Std. dev.	Min	Max
NPL	12.719	13.320	0.389	67.367
GDP	31663	21150	7760	107850
UR	7.596	4.087	2.000	26.600
HICP	2.627	3.744	-1.600	19.400
PD	71.109	40.589	8.200	206.300
CAB	1.451	4.799	-20.700	18.900

Source: Own preparation.

Table 3. Results of ADF stationarity tests for variable levels

Variable	Variable level	p-value
NPL	-6.024	0.000
GDP	-4.519	0.000
UR	-5.258	0.000
HICP	-9.649	0.000
PD	-3.488	0.040
CAB	-5.122	0.000

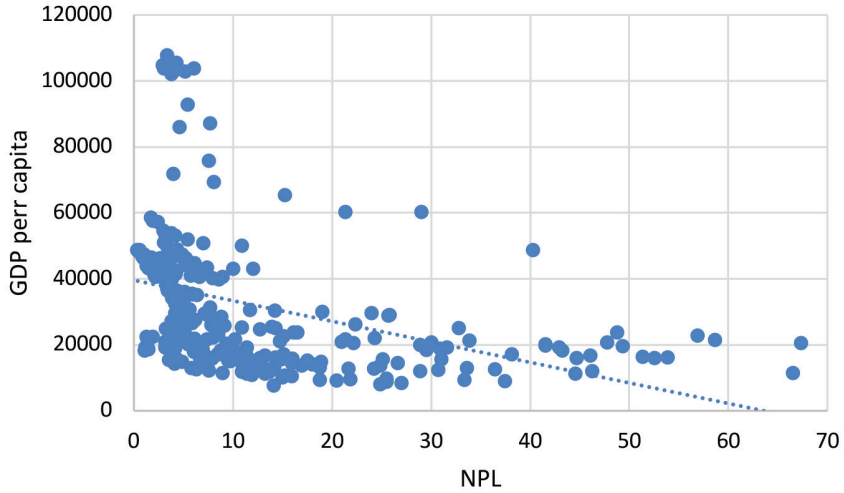
Source: Own preparation.

Table 4. Correlation matrix

Variable	NPL	GDP	UR	HICP	PD	CAB
NPL	1.000					
GDP	-0.392*	1.000				
UR	0.513*	-0.208*	1.000			
HICP	-0.323*	-0.039	-0.339*	1.000		
PD	0.303*	-0.202*	0.557*	-0.187*	1.000	
CAB	-0.157*	0.429*	-0.195*	-0.213*	-0.260*	1.000

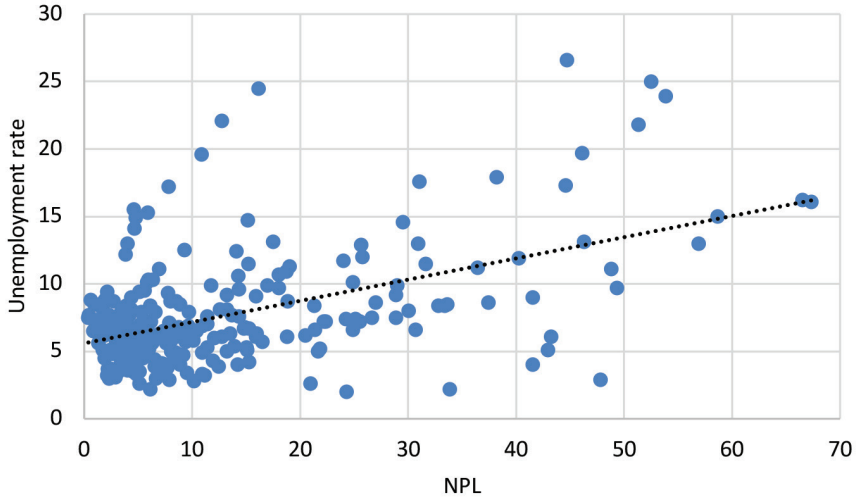
*means significance at the 0.10 level
Source: Own preparation.

Chart 1. Scatterplot–GDP per capita and NPL



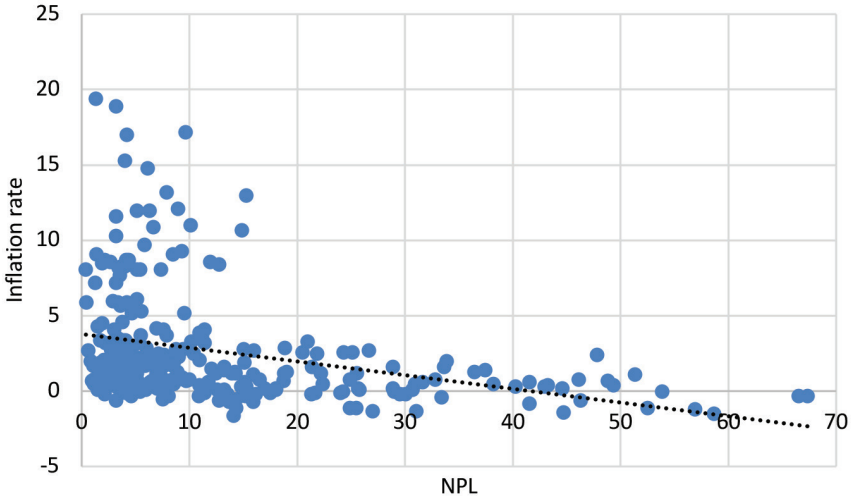
Source: Own preparation based on ECB Data Warehouse and Eurostat.

Chart 2. Scatterplot–unemployment rate and NPL



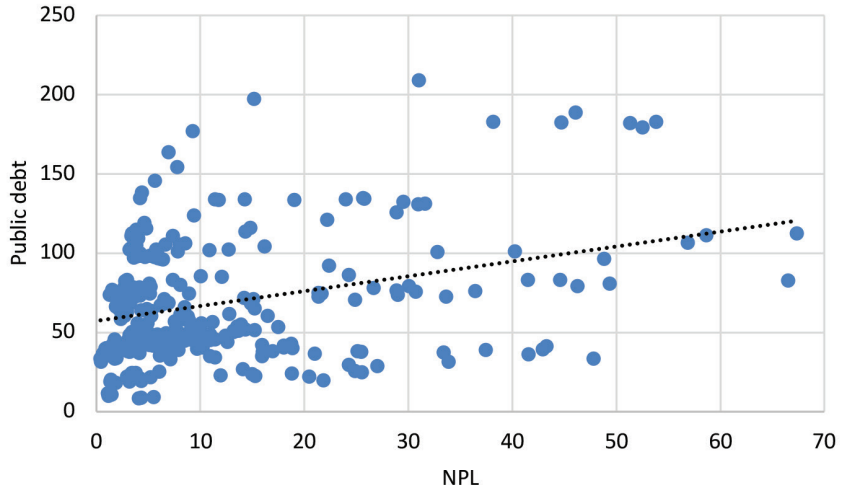
Source: Own preparation based on ECB Data Warehouse and Eurostat.

Chart 3. Scatterplot–inflation rate and NPL



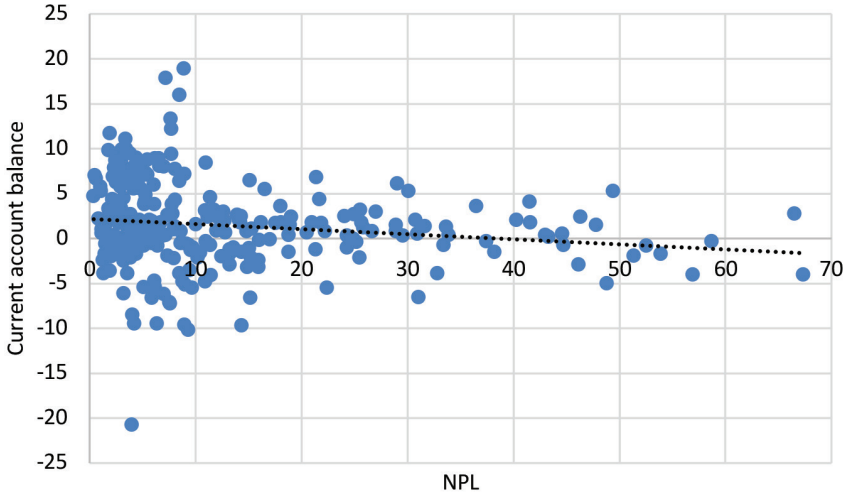
Source: Own preparation based on ECB Data Warehouse and Eurostat.

Chart 4. Scatterplot–public debt and NPL



Source: Own preparation based on ECB Data Warehouse and Eurostat.

Chart 4. Scatterplot–current account balance and NPL



Source: Own preparation based on ECB Data Warehouse and Eurostat.

Table 5. Model estimation, dependent variable: NPL, EU-27, years: 2014-2023, number of observations: 270

Variable	OLS	FE	RE	FE HAC)	VIF
Const.	11.783*** (0.000)	2.754 (0.762)	3.114 (0.467)	2.754 (0.352)	–
GDP	–0.002*** (0.000)	–0.001*** (0.008)	–0.002*** (0.000)	–0.001** (0.015)	1.252
UR	1.239*** (0.000)	2.549*** (0.000)	2.465*** (0.000)	2.549*** (0.000)	1.869
HICP	–0.728*** (0.000)	–0.110 (0.383)	–0.237* (0.055)	-0.110 (0.532)	1.244
PD	–0.001 (0.953)	0.075 (0.277)	–0.004 (0.927)	0.075 (0.433)	1.703
CAB	0.038 (0.811)	0.478*** (0.001)	0.418*** (0.002)	0.478** (0.013)	1.390
F-Stat./LSDV F-Stat.	33.206 (0.000)	33.555 (0.000)	–	–	–
R2 / LSDV R2	0.386	0.815	–	0.815	–
Adj. R2 / Within R2	0.374	0.608	–	0.608	–
Wald test	–	21.164 (0.000)	–	–	–
Breusch-Pagan test	–	–	369.356 (0.000)	–	–
Hausman test	–	–	25.898 (0.000)	–	–
CD-Pesaran test	–	8.109 (0.000)	–	–	–
Wooldridge test	–	21.465 (0.000)	–	–	–
Wald test	–	16002.4 (0.000)	–	–	–

Source: Own preparation.

Table 6. Model estimation, dependent variable: NPL, EU-27, years: 2014-2019, number of observations: 162

Variable	OLS	FE	RE	FE (HAC)	VIF
Const.	17.156***	−34.656	2.937	−34.656	–
	(0.000)	(0.145)	(0.628)	(0.215)	
GDP	−0.002***	−0.001	−0.001***	−0.001***	1.148
	(0.000)	(0.932)	(0.002)	(0.927)	
UR	0.666**	1.631***	1.789***	1.631***	2.333
	(0.034)	(0.000)	(0.000)	(0.001)	
HICP	−2.773***	0.590	0.119	0.590	1.299
	(0.005)	(0.257)	(0.824)	(0.410)	
PD	0.070**	0.552***	0.122**	0.552**	1.889
	(0.036)	(0.001)	(0.039)	(0.013)	
CAB	−0.124	0.193	0.208	0.193**	1.160
	(0.604)	(0.224)	(0.193)	(0.024)	
F-Stat./LSDV F-Stat.	22.417 (0.000)	45.603 (0.000)	–	–	–
R2 / LSDV R2	0.418	0.916	–	0.916	–
Adj. R2 / Within R2	0.399	0.576	–	0.576	–
Wald test	–	29.549 (0.000)	–	–	–
Breusch-Pagan test	–	–	214.841 (0.000)	–	–
Hausman test	–	–	29.603 (0.000)	–	–
CD-Pesaran test	–	0.727 (0.467)	–	–	–
Wooldridge test	–	12.959 (0.001)	–	–	–
Wald test	–	16565.7 (0.000)	–	–	–

Source: Own preparation.

Table 7. Model estimation, dependent variable: NPL, EU-27, years: 2020-2023, number of observations: 108

Variable	OLS	FE	RE	FE (HAC)	VIF
Const.	10.352***	(0.024)	3.366	(0.048)	–
	(0.000)	0.001	(0.245)	0.001***	
GDP	−0.001***	(0.523)	−0.001**	(0.268)	1.518
	(0.001)	1.312**	(0.032)	1.312	
UR	0.173	(0.010)	0.889**	(0.131)	1.779
	(0.441)	−0.064	(0.011)	−0.064	
HICP	−2.271**	(0.390)	−0.156**	(0.485)	1.321
	(0.018)	0.183***	(0.025)	0.184***	
PD	−0.004	(0.001)	0.023	(0.003)	1.851
	(0.801)	0.058	(0.416)	0.058	
CAB	−0.099	(0.546)	0.059	(0.302)	1.837
	(0.388)	16.300	(0.529)	–	
F-Stat./LSDV F-Stat.	6.412 (0.000)	(0.000)	–		–
		0.869		0.869	
R2 / LSDV R2	0.239		–		–
		0.534		0.534	
Adj. R2 / Within R2	0.202		–		–
		14.115		–	
Wald test	–	(0.000)	–		–

Variable	OLS	FE	RE	FE (HAC)	VIF
Breusch-Pagan test	–	–	63.904 (0.000)	–	–
Hausman test	–	–	34.338 (0.000)	–	–
CD-Pesaran test	–	6.136 (0.000)	–	–	–
Wooldridge test	–	13.653 (0.001)	–	–	–
Wald test	–	7363.99 (0.000)	–	–	–

Source: Own preparation.

Table 8. Model estimation, dependent variable: NPL, EU-27, dynamic models

Variable	2014-2023	2014-2019	2020-2023
NPL_{-1}	0.714*** (0.000)	0.803** (0.041)	0.584*** (0.000)
GDP	–0.001 (0.780)	0.001** (0.029)	–0.001** (0.013)
UR	1.519*** (0.000)	1.649* (0.054)	–0.479 (0.379)
HICP	0.094* (0.053)	0.354 (0,173)	0.023 (0.446)
PD	–0.059 (0.301)	–0.021 (0.937)	–0.019 (0.758)
CAB	0.076 (0.242)	–0.075 (0.329)	0.112 (0.072)
AR(1)	–1.964 (0.049)	–1.185 (0.236)	–1.634 (0.023)
AR(2)	–1.351 (0.177)	–1,132 (0.258)	–1.321 (0.121)
Sargan test	22.684 (0.946)	11.011 (0.275)	0.242 (0.886)
Wald test	1278.1 (0.000)	974.797 (0.000)	44.814 (0.000)

Source: Own preparation.

Table 9. Model estimation, dependent variable: NPL, 'Old Union' countries, years: 2014––2023, number of observations: 140

Variable	OLS	FE	RE	FE (HAC)	VIF
Const.	–21.283*** (0.000)	–0.139 (0.989)	–13.297* (0.065)	–0.139 (0.991)	–
GDP	0.002*** (0.001)	–0.001*** (0.004)	–0.001 (0.602)	–0.001*** (0.005)	2.500
UR	0.977*** (0.000)	2.240*** (0.000)	2.113*** (0.000)	2.240*** (0.001)	2.111
HICP	–0.635*** (0.007)	–0.158 (0.297)	–0.109 (0.483)	–0.158 (0.160)	1.140
PD	0.018*** (0.000)	0.067 (0.231)	0.066 (0.121)	0.067 (0.427)	4.123
CAB	0.476*** (0.003)	0.400*** (0.002)	0.353*** (0.007)	0.400** (0.028)	1.607
F-Stat./LSDV F-Stat.	48.587 (0.000)	33.555 (0.000)	–	–	–
R2 / LSDV R2	0.64	0.897	–	0.897	–

Variable	OLS	FE	RE	FE (HAC)	VIF
Adj. R2 / Within R2	0.631	0.728	–	0.728	–
Wald test	–	23.012 (0.000)	–	–	–
Breusch-Pagan test	–	–	127.184 (0.000)	–	–
Hausman test	–	–	35.630 (0.000)	–	–
CD-Pesaran test	–	2.977 (0.003)	–	–	–
Wooldridge test	–	283.698 (0.000)	–	–	–
Wald test	–	3479.2 (0.000)	–	–	–

Source: Own preparation.

Table 10. Model estimation, dependent variable: NPL, 'Old Union' countries, years: 2014––2019, number of observations: 84

Variable	OLS	FE	RE	FE (HAC)	VIF
Const.	–27.712*** (0.000)	–38.772 (0.057)	–26.350** (0.015)	38.772 (0.170)	–
GDP	0.002*** (0.000)	–0.001*** (0.000)	0.001 (0.613)	–0.001*** (0.007)	2.632
UR	0.430* (0.059)	1.148*** (0.000)	1.307*** (0.000)	1.148*** (0.000)	2.852
HICP	–2.396** (0.023)	1.166** (0.023)	0.744 (0.206)	1.166 (0.130)	1.388
PD	0.309*** (0.000)	0.072 (0.493)	0.251*** (0.000)	0.072 (0.640)	4.394
CAB	0.403** (0.038)	0.133 (0.269)	0.407*** (0.002)	0.133* (0.063)	1.272
F-Stat./LSDV F-Stat.	52.852 (0.000)	53.852 (0.000)	–	–	–
R2 / LSDV R2	0.772	0.972	–	0.972	–
Adj. R2 / Within R2	0.757	0.770	–	0.770	–
Wald test	–	35.664 (0.000)	–	–	–
Breusch-Pagan test	–	–	90.340 (0.000)	–	–
Hausman test	–	–	46.985 (0.000)	–	–
CD-Pesaran test	–	0.289 (0.000)	–	–	–
Wooldridge test	–	51.822 (0.000)	–	–	–
Wald test	–	1389.8 (0.000)	–	–	–

Source: Own preparation.

Table 11. Model estimation, dependent variable: NPL, 'Old Union' countries, years: 2020––2023, number of observations: 56

Variable	OLS	FE	RE	FE (HAC)	VIF
Const.	−8.623*** (0.005)	−33.340*** (0.004)	−17.802*** (0.001)	−33.340*** (0.000)	–
GDP	0.001*** (0.002)	0.001 (0.391)	0.001*** (0.004)	0.001 (0.103)	2.442
UR	0.212 (0.247)	1.534*** (0.002)	0.826*** (0.009)	1.534*** (0.132)	2.005
HICP	−0.212 (0.117)	−0.127 (0.338)	−0.106 (0.281)	−0.127 (0.110)	1.117
PD	0.094*** (0.000)	0.208*** (0.001)	0.110*** (0.001)	0.208*** (0.000)	4.824
CAB	0.075 (0.581)	−0.038 (0.799)	0.025 (0.829)	−0.038 (0.618)	2.800
F-Stat./LSDV F-Stat.	13.309 (0.000)	33.555 (0.000)	–	–	–
R2 / LSDV R2	0.571	0.815	–	0.902	–
Adj. R2 / Within R2	0.528	0.608	–	0.725	–
Wald test	–	9.616 (0.000)	–	–	–
Breusch-Pagan test	–	–	12.101 (0.000)	–	–
Hausman test	–	–	33.985 (0.000)	–	–
CD-Pesaran test	–	8.298 (0.000)	–	–	–
Wooldridge test	–	26.699 (0.000)	–	–	–
Wald test	–	1954.21 (0.000)	–	–	–

Source: Own preparation.

Table 12. Model estimation, dependent variable: NPL, 'Old Union' countries, dynamic models

Variable	2014-2023	2014-2019	2020-2023
NPL_{-1}	0.739*** (0.000)	1.403*** (0.000)	0.222*** (0.000)
GDP	0.001** (0.017)	0.001 (0.206)	−0.001 (0.288)
UR	1.375*** (0.001)	0.600 (0.342)	0.053 (0.784)
HICP	0.009* (0.849)	−1.243** (0,046)	−0.023 (0.564)
PD	−0.077 (0.198)	−0.348* (0.081)	0.081** (0.022)
CAB	−0.100*** (0.000)	−0.192*** (0.001)	0.003 (0.975)
AR(1)	−1.103 (0.270)	1.802 (0.072)	–
AR(2)	−1.209 (0.227)	−0.274 (0.784)	–
Sargan test	122.252 (0.000)	21.170 (0.012)	0.629 (0.730)
Wald test	4312.36 (0.000)	965.904 (0.000)	1028.56 (0.000)

Source: Own preparation.

Table 13. Model estimation, dependent variable: NPL, 'New Union' countries, years: 2014––2023, number of observations: 130

Variable	OLS	FE	RE	FE (HAC)	VIF
Const.	2.638 (0.569)	43.650** (0.010)	7.620 (0.397)	43.650 (0.148)	–
GDP	–0.001** (0.047)	–0.003*** (0.000)	–0.001** (0.010)	–0.003* (0.077)	1.329
UR	1.926*** (0.000)	2.136*** (0.000)	2.553*** (0.000)	2.136** (0.035)	1.500
HICP	–0.516** (0.037)	0.128 (0.530)	–0.128 (0.498)	0.128 (0.687)	1.428
PD	0.186*** (0.001)	0.064 (0.645)	0.198** (0.029)	0.064 (0.697)	1.322
CAB	0.304 (0.186)	0.483** (0.041)	0.539** (0.017)	0.483* (0.058)	1.309
F-Stat./LSDV F-Stat.	21.512 (0.000)	22.161 (0.000)	–	–	–
R2 / LSDV R2	0.465	0.771	–	0.771	–
Adj. R2 / Within R2	0.443	0.624	–	0.624	–
Wald test	–	12.477 (0.000)	–	–	–
Breusch-Pagan test	–	– –	110.873 (0.000)	–	–
Hausman test	–		11.992 (0.035)	–	–
CD-Pesaran test	–	1.326 (0.000)	–	–	–
Wooldridge test	–	12.840 (0.004)	–	–	–
Wald test	–	134.212 (0.000)	–	–	–

Source: Own preparation.

Table 14. Model estimation, dependent variable: NPL, 'New Union' countries, years: 2014––2019, number of observations: 78

Variable	OLS	FE	RE	RE (HAC)	VIF
Const.	–1.270 (0.854)	–45.643 (0.274)	–2.574 (0.849)	–2.754 (0.795)	–
GDP	–0.001 (0.786)	–0.001*** (0.937)	–0.001 (0.115)	–0.001* (0.067)	1.443
UR	1.494*** (0.009)	1.332** (0.042)	1.795*** (0.001)	1.795*** (0.007)	1.823
HICP	–0.581 (0.641)	0.876 (0.275)	0.845* (0.273)	0.846 (0.371)	1.539
PD	0.281*** (0.000)	1.143*** (0.003)	0.511*** (0.000)	0.511*** (0.000)	1.575
CAB	–0.098 (0.784)	0.556* (0.077)	0.401 (0.171)	0.401*** (0.000)	1.206
F-Stat./LSDV F-Stat.	12.662 (0.000)	26.870 (0.000)	–	–	–
R2 / LSDV R2	0.468	0.884	–	–	–
Adj. R2 / Within R2	0.431	0.618	–	–	–
Wald test	–	17.916 (0.000)	–	–	–

Variable	OLS	FE	RE	RE (HAC)	VIF
Breusch-Pagan test	–	–	83.606 (0.000)	–	–
Hausman test	–	–	8.995 (0.110)	–	–
CD-Pesaran test	–	0.126 (0.009)	–	–	–
Wooldridge test	–	10.190 (0.008)	–	–	–
Wald test	–	147.681 (0.000)	–	–	–

Source: Own preparation.

Table 15. Model estimation, dependent variable: NPL, 'New Union' countries, years: 2020-2023, number of observations: 52

Variable	OLS	FE	RE	RE (HAC)	VIF
Const.	15.605*** (0.000)	22.630 (0.267)	13.222** (0.039)	13.222 (0.129)	–
GDP	−0.001*** (0.000)	−0.001 (0.131)	−0.001*** (0.005)	−0.001*** (0.008)	1.164
UR	0.276 (0.531)	0.690 (0.606)	0.467 (0.490)	0.467 (0.599)	1.203
HICP	−0.229*** (0.112)	−1.000 (0.348)	0.149 (0.110)	−0.149 (0.262)	1.423
PD	0.049 (0.165)	0.079 (0.477)	0.090* (0.072)	0.090 (0.158)	1.210
CAB	0.193 (0.213)	−0.028 (0.863)	0.082 (0.520)	0.082** (0.097)	1.383
F-Stat./LSDV F-Stat.	4.843 (0.001)	10.657 (0.000)	–	–	–
R2 / LSDV R2	0.345	0.842	–	0.815	–
Adj. R2 / Within R2	0.274	0.470	–	0.608	–
Wald test	–	8.914 (0.000)	–	–	–
Breusch-Pagan test	–	–	29.951 (0.000)	–	–
Hausman test	–	–	6.120 (0.295)	–	–
CD-Pesaran test	–	–	3.041 (0.002)	–	–
Wooldridge test	–	–	4.393 (0.058)	–	–
Wald test	–	–	–	–	–

Source: Own preparation.

Table 16. Model estimation, dependent variable: NPL, 'New Union' countries, dynamic models

Variable	2014-2023	2014-2019	2020-2023
NPL_{-1}	0.697***	0.463**	0.919**
	(0.000)	(0.182)	(0.013)
GDP	–0.001	0.001	–0.002**
	(0.924)	(0.463)	(0.182)
UR	1.797***	2.880***	4.244
	(0.000)	(0.000)	(0.154)
HICP	0.113**	0.874**	–0.021
	(0.028)	(0.034)	(0.814)
PD	–0.012	0.373	–0.041*
	(0.887)	(0.254)	(0.082)
CAB	0.113	0.153	0.321
	(0.239)	(0.343)	(0.072)
AR(1)	–2.111	–0.719	–
	(0.035)	(0.472)	
AR(2)	–1.450	–0.150	–
	(0.147)	(0.133)	
Sargan test	46.747	23.514	1.288
	(0.089)	(0.005)	(0.525)
Wald test	561.532	286.129	39.804
	(0.000)	(0.000)	(0.000)

Source: Own preparation.

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 21.02.2025; accepted 31.08.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.13

Measuring Macroeconomic Uncertainty Using Internet Search Data: The Case of Poland

JACEK PIETRUCHA

corresponding author
Department of Economics, University of Economics in Katowice, 1 Maja 50, 40-287 Katowice
✉ jacek.pietrucha@ue.katowice.pl
ORCID: https://orcid.org/0000-0001-5777-9666

MICHAŁ GULEWICZ

Department of Economics, University of Economics in Katowice, 1 Maja 50, 40-287 Katowice
✉ michal.gulewicz@ue.katowice.pl
ORCID: https://orcid.org/0000-0001-7997-610X

Abstract

Motivation: Despite extensive discussion, measuring uncertainty – especially macroeconomic uncertainty – remains an open issue. While valuable, traditional data sources may be temporally or spatially limited and may not accurately capture public sentiment or the uncertainty perceived by diverse social groups such as households, especially considering the recent transition from traditional media to electronic.

Aim: A new Macroeconomic Uncertainty Index (MUI) for Poland, covering the period from 2004 to 2024 is presented and evaluated. This index utilizes the behavior of economic agents expressed through online search patterns, providing a real-time tool for assessing economic uncertainty.

Results: The MUI captures uncertainty perceived by diverse social groups, particularly considering the recent transition from traditional media to electronic channels of information flow. Comparative analysis revealed the unique characteristics of the MUI compared to other uncertainty indicators, such as survey-based and text-based measures, emphasizing the need

for multiple metrics to fully capture the multifaceted nature of macroeconomic uncertainty. The MUI provides an alternative to traditional measures, making it especially valuable for studies on public responses to macroeconomic changes.

Keywords: uncertainty, perception of uncertainty, Google Trends
JEL: E65, E71

1. Introduction

Uncertainty and its significance for macroeconomic processes have recently been among the most discussed topics (DeMartino et al., 2024). However, despite extensive discussion, measuring uncertainty – especially macroeconomic uncertainty – remains an open issue.

As is common in the social sciences, defining economic uncertainty to measure it requires addressing the challenges posed by the term's varied, ambiguous, and context-dependent interpretations. Uncertainty arises in various fields, including psychology, sociology, measurement, and forecasting. In economics, uncertainty is typically defined in the spirit of F. Knight's (1921) proposal: the inability to determine an event's probability or even the event's nature. The most discussed types of uncertainty are often interpreted as a lack of information. As Rowe (1994) states, '*Uncertainty is essentially the absence of information, information that may or may not be obtainable.*' However, it is important to note that this is not the only possible interpretation of the uncertainty. However, a similar view is standard in economics (DeMartino et al., 2024) and psychology (Alquist & Baumeister, 2023; Bar-Anan et al., 2009). From this perspective, uncertainty can be broadly described as a state of nature in which economic agents lack the information necessary to assess the current situation with sufficient confidence or to predict future outcomes. Economic agents – both businesses and consumers – find it difficult to estimate current and future economic conditions. Similarly, macroeconomic uncertainty is understood as uncertainty regarding agents' challenges in assessing the current or future states of macroeconomic processes, such as the behavior of macroeconomic variables and the relationships between them.

Initially, uncertainty was considered an unobservable variable. However, contemporary macroeconomics is heavily empirical, and thus, creating reliable tools for measuring uncertainty is a prerequisite for systematically incorporating uncertainty into macroeconomic research. Recently, numerous methods for indirect measuring uncertainty have been proposed (Cascaldi-Garcia et al., 2023). One prominent research approach involves utilizing text data, exemplified by the Economic Policy Uncertainty (EPU) index, which relies partially on text data from press articles (Baker et al., 2016). While

valuable, traditional data sources may not accurately capture the uncertainty perceived by diverse social groups, especially considering the recent transition from traditional media to electronic channels of information flow. Consequently, alternative sources of information for economic research emerged, such as Google Trends (GT).

This article proposes a new macroeconomic uncertainty index (MUI) that uses data from GT (2024). While the use of GT to assess economic and political uncertainty is not new (Bontempi et al., 2021), our proposed index introduces some novel features. First, it focuses on macroeconomics, whereas previous measures have typically covered a broad range of economic and political issues. MUI is more suitable for interpretation and application in macroeconomic research. Second, we address methodological issues related to constructing the index and using GT data, as Cebrián and Domenech (2023) outlined. Third, we take a different approach than Bontempi et al. (2021), using GT topics (i.e., aggregated queries from a specific area grouped into broader thematic categories) and not keywords (i.e. individual search terms). More generally, our primary motivation is to propose an alternative approach to measure uncertainty because uncertainty measurement is a relatively new area of research, and it is still necessary to propose alternative concepts.

The article's main aim is to present the methodology for calculating the indicator and its evaluation, including verifying its characteristics in relation to other existing uncertainty measures. To test the characteristics of the new indicator, we use data for Poland. The data cover the period from January 2004 to September 2024, aggregated on a monthly basis. It constitutes an additional added value of the article since, in the case of Poland, no indicator based on text data has been calculated so far (to the best of the authors' knowledge), with the exception of the proposal by Hołda (2019).

The remainder of the article is structured as follows. We begin with a literature review on the principles of uncertainty measurement. We then address methodological issues related to using GT to measure uncertainty, present the methodology for constructing the MUI, and examine its characteristics.

2. Literature review

In the past several years, uncertainty has become one of the key issues in macroeconomics, prompting the development of various methodologies for calculating uncertainty indicators. Cascaldi-Garcia et al. (2023) summarize the current state of research and propose a classification of four types of measurement – news-, survey- econometric- and market-based uncertainty and risk measures. The authors analyze the advantages of individual indicators and show their different interpretative values. For example, they show

that survey-based measures allow precision concerning the sector in which the uncertainty is located and the horizon over which the uncertainty prevails; these measures tend to be available at lower frequency and hence possibly be constantly relative to news-based or market-based measures.

An extensive review of all uncertainty measurement methods is beyond the scope of this article. Indicators using GT data can be interpreted as one of the approaches in constructing news-based measures, which is why we focus below on the discussion of literature concerning the approach to measuring uncertainty using text data and show the origins of the idea of using GT data to measure uncertainty.

Typically, these indicators are created by searching text databases, usually containing articles from daily newspapers, and focusing on the frequency of keywords related to uncertainty. In its simplest form, the searched text phrases often include the word uncertainty (in contexts related to the economy). This methodology was developed by Baker et al. (2016) when constructing the EPU index. This indicator is currently one of the most well-known approaches to measuring uncertainty and is calculated for several economies (Economic Uncertainty, 2024). Similar indicators use other text data sources. For example, the World Uncertainty Index (WUI), developed by the International Monetary Fund, uses Economist Intelligence Unit reports as its text data source (Ahir et al., 2022; IMF, 2024).

Uncertainty indicators that use data from GT are, to a large extent, an extension of the newspaper-based text data indicators. However, in this case, the data come not from newspaper articles but from queries entered into an internet search engine (usually Google, given its dominant market share). In other words, these indicators are based on the observed behavior of economic entities on the Internet, rather than on journalists' interpretations of economic uncertainty. This approach more accurately reflects contemporary channels of information dissemination among various social groups, including households, compared to traditional newspaper articles.

One of the key studies in the development of uncertainty indicators based on GT is the work of Castelnuovo and Tran (2017), who created an uncertainty indicator for the United States and Australia. Bontempi et al. (2021) proposed the Economic Uncertainty Related Queries (EURQ) index, which measures economic, political, and normative uncertainty, calculated for the USA and Italy.

In recent years, the use of GT data has expanded across various contexts. Eichenauer et al. (2022) developed a method for constructing consistent high-frequency time series using GT data, enabling the creation of real-time uncertainty indicators for German-speaking countries. Kupfer and Zorn (2020) constructed a Google economic policy uncertainty index for nine Eastern European countries, combining data related to the economy and politics. Bouri and Gupta (2021) compared the predictive power of un-

certainty measures based on internet searches versus those derived from newspaper analysis in the context of Bitcoin returns. They found that the indicator based on internet queries had stronger predictive power than the newspaper-based measure. In a series of recent articles, GT data have been used to analyze uncertainty in financial markets (Szczygielski et al., 2023, 2024). Pratap and Priyaranjan (2023) propose a high-frequency indicator to measure economic policy uncertainty in the context of India. Additionally, GT data have been used to construct uncertainty or risk indicators outside the field of economics, such as the geopolitical risk (GPR) index (Caldara & Iacoviello, 2022; Iacoviello et al., 2024) and grassroots socio-political risk (Puhr & Müllner, 2024). Donadelli and Gerotto (2019) studied uncertainty related to health, environmental, security, and political issues.

3. GT as a Data Source

GT is a service provided by Google that offers insights into the popularity of specific search terms within its search engine. It allows researchers to analyze search trends and gain valuable information about internet users' behavior. Reports, which include time-series data, are available for any user-selected period from 2004 to the present day and can be further refined to focus on searches conducted in a specific language or from a particular location.

One of the main advantages of using GT data is that they reflect the spontaneous behavior of a wide range of agents. The information comes from a large group of internet users who freely express their interests and concerns while searching for information. This distinguishes GT data from other data sources used in uncertainty indicators, which are often based on more limited datasets, such as text data from press materials, surveys, or analysts' assessments. Another benefit is the high frequency of available data. GT provides the ability to analyze daily, weekly, and monthly data, which is particularly useful for studying dynamic phenomena, such as changes in uncertainty. Additionally, GT data are freely available, facilitating research replication and increasing transparency.

However, despite its many advantages, GT also has limitations. One notable limitation is the lack of transparency regarding data collection and processing methods. Google does not provide complete documentation on the methodology used to generate and aggregate results, which may hinder data interpretation and limit independent researchers' ability to fully verify the results. That said, it is important to note that this issue is common across many types of data used in economic research. For instance, microdata, which underpin most aggregated economic variables, often lack detailed methodological transparency or are difficult to access (this is also the case with most public statistics).

Another issue that arises with GT data is the potential for misinterpretation. Increased interest in specific search terms may be driven by factors unrelated to actual economic processes. For example, a spike in searches for the keyword 'inflation' could be caused by rising inflation or increased media coverage on the topic. While this could limit the applicability of GT data in certain studies, it does not pose a significant obstacle to constructing uncertainty indicators, particularly when the focus is on public perception rather than strictly rational economic behavior. Narratives, public discourse, and emotions related to macroeconomic phenomena contribute to uncertainty as much as actual economic processes do. From the perspective of economic agents, the source of uncertainty is less important than its existence.

It is also important to note that GT data are based on sampling. Cebrián & Domenech (2023), who conducted a systematic analysis of the main quality dimensions of GT data and generally rated them positively, pointed out that Google does not report statistical errors associated with the data. Eichenauer et al. (2022) showed that this lack of error reporting could lead to variability in results, especially when analyzing high-frequency data (e.g., daily series) over long periods. However, they proposed a method to address this issue.

Despite these limitations, GT data have found wide application in various fields, particularly in marketing research, sentiment analysis, and even macroeconomic studies. For example, the OECD's GDP Tracker uses GT data to estimate trends in the real economy based on searches related to economic activity (Woloszko, 2020). Additionally, GT data have been shown to be useful for forecasting macroeconomic processes, such as private consumption (Woo & Owen, 2019), unemployment (Mulero & Garcia-Hiernaux, 2023), financial markets (Huang et al., 2020; Petropoulos et al., 2022), inflation (Bleher & Dimpfl, 2022), and subjective quality of life (Murtin & Salomon-Ermel, 2024).

4. Methodology

Measuring uncertainty using data from online information searches relies on the assumption that economic agents, represented by internet users, seek online information when they are uncertain. This assumption implies that the frequency of searches for terms related to uncertain future events increases when the level of uncertainty is high. This assumption is commonly adopted in all proposed uncertainty indicators of this type (Bontempi et al., 2021; Castelnuovo & Tran, 2017; Dzielinski, 2012).

Surprisingly, this assumption, which is crucial for constructing such indicators, has not been discussed extensively. As mentioned earlier, the information gap, or lack of information, plays a central role in understanding uncertainty. Uncertainty arises when knowledge or information is lacking, either about future events or current situations. This absence of informa-

tion leads to feelings of unpredictability and ambiguity, which, in turn, can influence decision-making, emotional responses, and behavioral strategies.

Numerous studies on responses to uncertainty have been conducted in psychology. Some studies suggest that information-seeking is a key strategy for coping with uncertainty (Alquist & Baumeister, 2023; Bar-Anan et al., 2009). People, aware of their lack of knowledge, often seek additional information – even if it may be unpleasant or useless – driven by a desire to reduce the discomfort associated with ignorance. While information-seeking is a dominant strategy, individuals can also exhibit other reactions, particularly under conditions of high uncertainty. For example, people may take more risks in uncertain situations. Not all responses to uncertainty are purely rational. In addition to information-seeking, individuals may rely on non-rational or in-between strategies, such as intuition, trust, hope, and faith (Schulz & Zinn, 2023; Zinn, 2016).

Thus, following the previous studies, we assume that when uncertainty arises economic entities (e.g., households, businesses) recognize their limited knowledge about current macroeconomic conditions and the potential outcomes of future events. In this sense, uncertainty can be understood as a state in which entities believe they cannot accurately define the key variables of their environment, such as estimating risks stemming from extraordinary events. In such situations, entities may show an increased interest in acquiring new information to restore a state in which they can accurately define key states of the world and thus make more informed predictions. This heightened search for information typically occurs for a limited period after a shock.

Of course, this understanding of uncertainty requires moving away from the rational choice assumptions that economic agents always have access to public, free information and can it easily process (such as households immediately adjusting their expectations according to an economic model with all available information). Instead, the information search is costly and time consuming. Information sought and found will include not only verified data but also narratives, interpretations, and opinions (Claus & Dedewanou, 2024; Dräger & Lamla, 2024; Johnson et al., 2023).

It is important to note that the methodology used to create uncertainty indicators does not distinguish between 'positive' and 'negative' events for two main reasons. First, both types of events–regardless of their definitions–can alter previous assessments of the state of the world, which may lead to incorrect evaluations of prior probabilities and, consequently, increase uncertainty. Second, determining what qualifies as a positive or negative event can be challenging, as it often depends on the observer's perspective and the criteria used for evaluation. For instance, when analyzing an inflation shock, it is crucial to differentiate between the notion that rising inflation complicates our understanding of the economic situation (which signals uncertainty) and whether inflation is viewed as a positive or negative phenomenon by any specific individual and in any specific economic condition.

Authors constructing indicators using GT data have approached the selection of keywords (i.e., search terms in the search engine) differently. Dzielinski (2012) and Donadelli and Gerotto (2019) analyze the search volume of a single keyword, while Szczygielski et al. (2024) use a few terms. On the other hand, Castelnuovo and Tran (2017) select a broad range of search terms. Bontempi et al. (2021) selected 184 policy-relevant search terms closely related to keywords in the U.S. Economic Policy Uncertainty Index developed by Baker, Bloom, and Davis (2016).

An obvious argument for using a large set of keywords is the more precise coverage of various economic areas and processes. However, this approach also has significant weaknesses. With a large set of keywords, the risk of correlation between terms increases (i.e., duplicating the same information). A large set of keywords naturally includes terms of lesser significance (e.g., *'tax rate – calculator'*) or terms referring to specific events (e.g., *'quantitative easing'*).

When constructing an index based on search data, one of the key issues is selecting keywords that are unrelated to specific events and have a general, rather than temporal or localized, nature. However, they must remain relevant within the local context (i.e., a specific country and language). In creating the initial list of keywords for the MUI, the principle of excluding terms related to single events (e.g., 'global financial crisis') was adopted. Universal terms referring to macroeconomic phenomena (e.g., gross domestic product, inflation, unemployment, etc.) were considered.

GT (2024) provides search data in two formats. Primarily, it distinguishes between search terms (i.e., actual queries) and topics (i.e., aggregated queries from a specific area grouped into broader thematic categories). Previously, using GT to construct an uncertainty indicator was mainly done with search terms (e.g. Castelnuovo & Tran, 2017; Bontempi et al., 2018; Donadelli & Gerotto, 2019). However, some newer studies have started using topics (Kupfer & Zorn, 2020; Puhr & Müllner, 2024).

We used topics to build the MUI. This approach offers several advantages over the search terms used in most previous uncertainty indicators. Because topics aggregate various search terms from a specific area, it is possible to bypass the problem of users entering similar but not identical search terms, issues related to Polish grammar (such as inflectional endings), and potential spelling errors or typos. An additional benefit is that topics also include terms entered in other languages (but from within Poland). This allows the MUI to include searches from Poland that were made in English (e.g., to access content unavailable in Polish or content considered more reliable).

The list of thematic areas and keywords was created in several steps. The starting point was the database of terms proposed in Baker et al. (2016) and Bontempi et al. (2021). This database was adjusted (shorted) because the point of interest is macroeconomic uncertainty. Next, this list was tailored

for Polish specifics. In the following step, the list was discussed with a group of macroeconomic experts to minimize potential bias arising from reliance on existing uncertainty indicator literature. This process resulted in the initial list of keywords. It should be emphasized that the index is very robust to adding or removing individual topics, as demonstrated in the section on the sensitivity study.

The raw set of keywords was then validated against the topics as defined in GT, and the relative popularity of these topics. In this step, a significant aggregation of terms was performed, considering the characteristics of the content of topics offered by GT. For example, for terms related to the situation on financial markets (e.g., stocks, stock indices), taking into account Polish specifics (e.g., WIG – the Polish stock exchange index), the aggregated topic with the highest number of searches was 'stock index.' Viewing this topic solely through the lens of the query (keyword) 'stock index' would be inadequate, because it would omit other key potential queries in this area. However, within GT, the aggregate encompassing various related queries is named 'stock index.'

It is essential to note that the list of topics used in constructing the MUI (Table 1) is not a list of individual keywords or search queries. Instead, it should be viewed as a collection of thematic aggregates that encompass many different queries within a specific area (i.e., a large number of keywords), as defined by GT. The names of topics and their associated keywords result from Google's algorithms. For example, the topic 'social security' should not be viewed as referring to users entering the query 'social security' into the search engine, but rather as a general category encompassing numerous terms related to various types of social benefits and other forms of social assistance.

The raw data for individual topics showed strong seasonality. For most topics, the number of queries decreased during the summer months, with the lowest point occurring in August. To address this, the data were seasonally adjusted using the X-13ARIMA-SEATS monthly seasonal adjustment method (Census, 2024), implemented in the statistical package EViews.

In the next step, the results for individual topics were aggregated using equal weights. This process yielded an aggregated indicator, which we refer to as the MUI. The MUI takes values from 0 to 100, with higher values indicating a higher level of aggregated macroeconomic uncertainty.

5. Results and discussion

5.1. Macroeconomic uncertainty in Poland as shown by MUI

To show the properties of the indicator we will now discuss the level of uncertainty in Poland as indicated by the MUI. The MUI (Fig. 1) identified several periods of heightened uncertainty, particularly in 2004, 2008–2012,

2020, and 2022. The lowest levels of macroeconomic uncertainty were observed short before 2008 and between 2014 and 2019. These periods of high and low uncertainty were primarily correlated with global events (with one notable exception) rather than local events in Poland.

The MUI identified the following periods of heightened uncertainty.

1. The beginning of the analyzed period (notably 2004): This period was characterized by relatively high macroeconomic uncertainty in Poland, which can be attributed to preparations for the country's accession to the European Union. This represented a significant economic and political shift. The uncertainty may have resulted from concerns about aligning Polish laws with EU standards, adapting the economy to the common market, and the potential effects of opening up European markets (particularly regarding the competitiveness of the Polish economy). This outcome is consistent with findings from other Central and Eastern European countries (Kupfer & Zorn, 2020) but differs from results observed in other regions (Bontempi et al., 2021).
2. The financial crisis (2008–2009): In 2008, the MUI experienced a sharp increase, which is understandable given the global financial crisis that severely impacted world economies. Although the direct consequences of the crisis for Poland (especially in the financial sector) were minimal – there was no banking crisis or recession in the real sector – the immediate effects included significant depreciation of the Polish zloty, some tensions in the labor market, and a deterioration in public finances. The global context and related narratives likely played a key role in the uncertainty observed in Poland, because this was the first major external shock following the opening of the Polish economy.
3. The eurozone debt crisis (2011–2012): During the eurozone crisis, the Polish economy was notably affected, which may explain the persistently high uncertainty during these years, although it was less pronounced than during the 2007+ financial crisis.
4. The COVID-19 pandemic (2020): A significant increase in the MUI occurred at the beginning of 2020, directly linked to the initial response to the COVID-19 pandemic. Lockdowns, changes in international trade, and a global recession contributed to heightened macroeconomic uncertainty. However, the effect, as shown by the MUI, was relatively short-lived and, interestingly, weaker than during the 2007+ crisis. This outcome may be surprising but can be explained by the concept of the index. First, the MUI measures macroeconomic uncertainty, which remained relatively lower during the pandemic, despite prolonged uncertainty surrounding health and daily life. This was due to public authorities in Poland (as in many other countries) easing macroeconomic policies to support the labor market. Furthermore, inflationary pressures resulting from these policies had not yet fully materialized. Sec-

ond, the index measures the perception of uncertainty across a broad group of agents, not just professional analysts or entrepreneurs.

5. The war in Ukraine (2022): The outbreak of the war in Ukraine in February 2022 led to an increase in the MUI in Poland. This reflected, primarily, the impact of geopolitical uncertainty and potential disruptions in supply chains. However, this period was also marked by high inflation and rising interest rates, which added further sources of macroeconomic uncertainty.

The MUI demonstrates a strong alignment with historical data, including periods typically associated with heightened uncertainty.

5.2. Sensitivity analysis

Aggregation Methods

Typically, data are aggregated using equal weights, a solution that is acceptable and often recommended when establishing a natural, problem-driven weighting system is challenging (OECD, 2008). However, it is worth conducting sensitivity analyses with different aggregation methods.

Two alternative indices were constructed to compare with our baseline MUI, which uses equal weights. In the first approach, thematic grouping was used for preliminary aggregation. Four areas of macroeconomic data were identified: the real economy, the labor market and social security, the monetary economy, and finance and investment. Topic values within each area were aggregated using equal weights, followed by aggregation across areas (MUI_sub).

In the second approach, factor analysis was used to reduce the number of variables and focus subsequent analyses on the resulting, mutually independent factors. Principal component analysis and varimax rotation were applied during the factor analysis. Five factors were identified using the Kaiser criterion. The values of the new variables obtained through factor analysis were then used for aggregation (MUI_fa).

The alternative MUIs calculated showed a strong correlation with our baseline MUI. MUI_sub, had a correlation of 0.99 with the baseline MUI, whereas MUI_fa had a correlation of 0.88. In the latter case, the indicator suggests a slightly stronger increase in uncertainty during the 2007+ crisis and the pandemic. Despite this difference, the periods of heightened and reduced uncertainty were generally consistent. Therefore, we can conclude that the choice of aggregation method does not significantly affect the results of the baseline MUI.

Sampling

A potential weakness of using GT is its reliance on sampling. Cebrián & Domenech (2023) noted that this can lead to discrepancies in outcomes depending on the day the data are retrieved, limiting accuracy and reliability.

To illustrate the effects of sampling, Cebrián & Domenech (2023) conducted an experiment by repeating the same search query for four Austrian cities on different days. They found that the obtained results were not identical, indicating a lack of result stability. Further analysis showed that Pearson correlation coefficients between individual time series ranged from 0.79 to 0.94. Although these results were highly correlated, they were not identical, highlighting the impact of sampling on the accuracy of GT data.

A similar procedure was conducted to examine the potential consequences of this issue for the MUI. In addition to the data used to construct the MUI, additional data on the same topics were collected three times between October 16 and October 28, 2024. Our procedure focused on five topics: gross domestic product, inflation, unemployment, international trade, and exchange rates. Pearson linear correlation coefficients were then calculated for pairs of the same topic across the four sampling waves: during the MUI data collection and the three waves in the experiment.

Very high correlations were observed between all the data collection waves (in all cases, exceeding 0.99). Therefore, we can conclude that there are no significant threats to data stability related to the timing of data collection.

Choice of topics

An analysis was conducted to determine how the method of selecting topics for constructing the MUI impacts its overall value. We created indicators using different sets of topics and compared these indicators with the MUI. Specifically, a series of indicators was developed by omitting individual topics. Following this, we calculated the correlation between the new indicators and the MUI. The results showed that all these indicators are highly correlated with the MUI, usually around 0.99. This indicates that omitting or adding individual topics does not significantly affect their value. In other words, the MUI is robust to slight changes in the topics selected for its construction.

5.3. Characteristics of MUI compared to other uncertainty indicators

A comparative analysis was conducted to assess the characteristics of the MUI relative to existing uncertainty indicators. Only a few uncertainty indicators have been calculated for Poland so far. The EPU index is not publicly available for Poland at the time of writing this article (Economic Uncertainty, 2024). Although Hołda (2019) calculated a text-based index using Gazeta Wyborcza newspaper articles, this data is publicly unavailable. Therefore, only the available data were used for comparison. These include indicators prepared by the International Monetary Fund (IMF, 2024) and survey-based indicators calculated by the European Commission (2024). The WUI time series began in 2008. The European Commission's aggregate indicator for

Poland (EC_a) is available starting from January 2021, and a slightly longer series is available for consumer surveys (from May 2020), denoted as EC_c. Additionally, we used the GPR index, which measures the occurrence of threats and escalations of geopolitical events related to wars, terrorism, and international tensions (Caldara & Iacoviello, 2022).

For comparison purposes, an index based on data from the Polish Statistical Office (GUS) was also calculated, following the approach proposed by Bachmann et al. (2013). The indices calculated for Poland for this publication were sourced from the economic condition survey conducted by GUS (Statistics Poland, 2024). The survey included the question: '*What changes do you expect in the general economic situation of the country over the next 12 months?*' The index (denoted as GUS_c) was calculated using the metric proposed by Bachmann et al. (2013). Monthly data from 2018 through September 2024 were used. An aggregate index (denoted as GUS_a) was also constructed using other questions from the GUS survey, specifically those related to the household's personal situation, unemployment, and inflation (Statistics Poland, 2024). Each of these four questions was used to construct a separate series, which was then aggregated using equal weights to form the overall index. A summary of the indicators and data sources used in the study is provided in Table 2.

To assess how similar the various uncertainty indicators are in signaling uncertainty levels in Poland, linear (Pearson) correlations were calculated between individual uncertainty measures for the period when data were available for all indicators (i.e., January 2021 to September 2024) (Table 3).

The results indicate that the informational value of individual indicators differs, which is consistent with the literature (Cascaldi-Garcia et al., 2023). These indicators reflect different areas of uncertainty and use different data sources. The results should not be interpreted as weaknesses of individual research approaches but rather as indicating that different measures capture a partial picture of the multifaceted and often ambiguous phenomenon of uncertainty.

As expected, relatively high correlations exist between indicators calculated using similar methodologies and based on the same data. The MUI shows the highest correlation with the GPR, but only during periods of significant geopolitical shocks (2021–2024). The correlation is lower over a longer period without geopolitical shocks (for the entire period of MUI data availability, i.e., from 2004), at 0.40 (Figure 2).

The MUI also has a high correlation with indicators constructed using survey data. This is particularly true for indicators based on GUS data, which tend to show stronger uncertainty inertia. Among the studied indicators, the IMF's WUI exhibits distinctly different characteristics. This difference may be because the source of text data for the WUI is IMF documents, and the uncertainty assessments by IMF analysts may differ significantly from household perceptions of uncertainty.

Figures 2 and 3 compare the month-over-previous-month percentage change of individual indexes and provide a closer examination of the differences among the indicators. The WUI, which generates signals for Poland that are significantly different from those of other indicators, is the least correlated with the MUI. The WUI can be challenging to interpret and often shows surprising and delayed responses. For example, it indicated extremely high levels of uncertainty in the second quarter of 2015 and the fourth quarter of 2016. In contrast, it showed average uncertainty in the first quarter of 2020 (at the onset of the pandemic) and a level of uncertainty well below average in the first half of 2022 (at the beginning of the war in Ukraine). For the remaining indicators, the relatively short time series make analysis challenging. However, the case of the war in Ukraine is particularly interesting. The start of the war in Ukraine is characterized by a sharp increase in the GPR, while survey-based uncertainty indicators (GUS) show only moderate changes. These findings align with intuition – Poland experienced a significant rise in geopolitical risk during this period, but this did not strongly translate into economic perceptions by agents. Nevertheless, when considering macroeconomic phenomena, the period was dominated by uncertainty arising from heightened inflation, which was well captured by the MUI.

Thus, MUI is a valuable alternative to existing uncertainty measures. Moreover, the features of this indicator, including the data source, make it very suitable for real-time tracking of uncertainty, especially in the perception of households, not analysts and researchers.

5. Conclusion

This study presents the construction and evaluation of the MUI. As case study we use Poland, covering the period from 2004 to 2024. The MUI, based on GT data, successfully captures periods of heightened economic uncertainty, including the financial crisis, the eurozone debt crisis, the COVID-19 pandemic, and the war in Ukraine. Our analysis demonstrates that the MUI provides valuable insights into macroeconomic uncertainty in Poland.

The MUI offers a new approach to measuring uncertainty by leveraging the behavior of economic agents as expressed through internet search patterns. Despite potential limitations, such as reliance on GT's sampling methodology, the MUI may provide a high-frequency, real-time perspective on macroeconomic uncertainty in the general public's perception, not analysts or researchers.

The comparative analysis highlights also the distinct characteristics of the MUI compared to other uncertainty indicators. While the MUI aligns closely with geopolitical risk measures during periods of significant global shocks, it also provides a unique perspective that complements survey-based and text-based measures of uncertainty. The differences among these indicators

underscore the need for a diverse set of tools to fully capture the multifaceted nature of macroeconomic uncertainty.

In conclusion, the MUI represents a promising alternative to traditional uncertainty measures, particularly for capturing public sentiment in response to macroeconomic shocks. Future research could extend this methodology to other countries and regions, which is possible considering GT features.

References

Alquist, J.L., & Baumeister, R.F. (2023). Dealing with uncertain situations. The Journal of Positive Psychology, 1–24. https://doi.org/10.1080/17439760.2023.2282781.

Baker, S.R., Bloom, N., & Davis, S.J. (2016). Measuring Economic Policy Uncertainty. The Quarterly Journal of Economics, 131(4), 1593–1636. https://doi.org/10.1093/qje/qjw024.

Bar-Anan, Y., Wilson, T.D., & Gilbert, D.T. (2009). The feeling of uncertainty intensifies affective reactions. Emotion, 9(1), 123–127. https://doi.org/10.1037/a0014607

Bleher, J., & Dimpfl, T. (2022). Knitting Multi-Annual High-Frequency Google Trends to Predict Inflation and Consumption. Econometrics and Statistics, 24, 1–26. https://doi.org/10.1016/j.ecosta.2021.10.006.

Bontempi, M.E., Frigeri, M., Golinelli, R., & Squadrani, M. (2021). EURQ: A New Web Search-based Uncertainty Index. Economica, 88(352), 969––1015. https://doi.org/10.1111/ecca.12372.

Bouri, E., & Gupta, R. (2021). Predicting Bitcoin returns: Comparing the roles of newspaper- and internet search-based measures of uncertainty. Finance Research Letters, 38, 101398. https://doi.org/10.1016/j.frl.2019.101398.

Caldara, D., & Iacoviello, M. (2022). Measuring Geopolitical Risk. American Economic Review, 112(4), 1194–1225. https://doi.org/10.1257/aer.20191823.

Cascaldi-Garcia, D., Sarisoy, C., Londono, J.M., Sun, B., Datta, D.D., Ferreira, T., Grishchenko, O., Jahan-Parvar, M. R., Loria, F., Ma, S., Rodriguez, M., Zer, I., & Rogers, J. (2023). What Is Certain about Uncertainty? Journal of Economic Literature, 61(2), 624–654. https://doi.org/10.1257/jel.20211645.

Castelnuovo, E., & Tran, T. D. (2017). Google It Up! A Google Trends-based Uncertainty index for the United States and Australia. Economics Letters, 161, 149–153. https://doi.org/10.1016/j.econlet.2017.09.032.

Cebrián, E., & Domenech, J. (2023). Is Google Trends a quality data source? Applied Economics Letters, 30(6), 811–815. https://doi.org/10.1080/13504851.2021.2023088.

Census (2024). https://www.census.gov/data/software/x13as.X-13ARIMA-SEATS.html.
Claus, E., & Dedewanou, F.A. (2024). Expectations, beliefs, and perceptions in the modern economy: An overview. Journal of Economic Surveys, 38(2), 297–302. https://doi.org/10.1111/joes.12610.
DeMartino, G., Grabel, I., & Scoones, I. (2024). Economics for an uncertain world. World Development, 173, 106426. https://doi.org/10.1016/j.worlddev.2023.106426 https://doi.org/10.1016/j.worlddev.2023.106426
Donadelli, M., & Gerotto, L. (2019). Non-macro-based Google searches, uncertainty, and real economic activity. Research in International Business and Finance, 48, 111–142. https://doi.org/10.1016/j.ribaf.2018.12.007.
Dräger, L., & Lamla, M.J. (2024). Consumers' macroeconomic expectations. Journal of Economic Surveys, 38(2), 427–451. https://doi.org/10.1111/joes.12590.
Dzielinski, M. (2012). Measuring economic uncertainty and its impact on the stock market. Finance Research Letters, 9(3), 167–175 https://doi.org/10.1016/j.frl.2011.10.003.
Economic Uncertainty (2024). Economic Policy Uncertainty Index. https://www.policyuncertainty.com/ Accessed 14.10.2024.
European Commission. (2024). Uncertainty indicators. https://economy-finance.ec.europa.eu/economic-forecast-and-surveys/business-and-consumer-surveys/download-business--and-consumer-survey-data/time-series_en Accessed 14.10.2024.
Eichenauer, V.Z., Indergand, R., Martínez, I.Z., & Sax, C. (2022). Obtaining consistent time series from Google Trends. Economic Inquiry, 60(2), 694–705. https://doi.org/10.1111/ecin.13049.
GT. (2024). https://trends.google.com/trends/ Accessed 14.10.2024
Hołda Z. (2019). Newspaper-based economic uncertainty indices for Poland, NBP Working Paper No. 310.
Huang, M.Y., Rojas, R.R., & Convery, P.D. (2020). Forecasting stock market movements using Google Trend searches. Empirical Economics, 59(6), 2821–2839. https://doi.org/10.1007/s00181-019-01725-1.
Iacoviello, M., Caldara, D., Penn, M., & Conlisk, S. (2024). Do Geopolitical Risks Raise or Lower Inflation? SSRN Scholarly Paper 4852461. Social Science Research Network. https://doi.org/10.2139/ssrn.4852461.
IMF. (2024). World Uncertainty Index. https://worlduncertaintyindex.com/data/ Accessed 14.10.2024.
Johnson, S.G.B., Bilovich, A., & Tuckett, D. (2023). Conviction Narrative Theory: A theory of choice under radical uncertainty. Behavioral and Brain Sciences, 46, e82. https://doi.org/10.1017/S0140525X22001157.
Kupfer, A., & Zorn, J. (2020). A Language-Independent Measurement of Economic Policy Uncertainty in Eastern European Countries. Emerging

Markets Finance and Trade, 56(5), 1166–1180. https://doi.org/10.1080/1540496X.2018.1559140.
Mulero, R., & Garcia-Hiernaux, A. (2023). Forecasting unemployment with Google Trends: Age, gender and digital divide. Empirical Economics, 65(2), 587–605. https://doi.org/10.1007/s00181-022-02347-w.
Murtin, F., & Salomon-Ermel, M. (2024). Nowcasting subjective well-being with Google Trends. A meta-learning approach. OECD Papers on Well-Being and Inequalities, 28(27). https://doi.org/10.1787/f758bd20-en.
OECD (2008). Handbook on Constructing Composite Indicators. Methodology and User Guide, Paris https://doi.org/10.1787/9789264043466-en.
Petropoulos, A., Siakoulis, V., Stavroulakis, E., Lazaris, P., & Vlachogiannakis, N. (2022). Employing Google Trends and Deep Learning in Forecasting Financial Market Turbulence. Journal of Behavioral Finance, 23(3), 353–365. https://doi.org/10.1080/15427560.2021.1913160.
Pratap, B., & Priyaranjan, N. (2023). Macroeconomic effects of uncertainty: A Google trends-based analysis for India. Empirical Economics, 65(4), 1599–1625. https://doi.org/10.1007/s00181-023-02392-z.
Puhr, H., & Müllner, J. (2024). Vox populi, vox dei: A concept and measure for grassroots socio-political risk using Google Trends. Journal of International Management, 30(2), 101096. https://doi.org/10.1016/j.intman.2023.101096.
Rowe, W.D. (1994). Understanding Uncertainty. Risk Analysis, 14(5), 743–750. https://doi.org/10.1111/j.1539-6924.1994.tb00284.x.
Schulz, M., & Zinn, J.O. (2023). Rationales of risk and uncertainty and their epistemological foundation by new phenomenology. Journal of Risk Research, 26(3), 219–232. https://doi.org/10.1080/13669877.2022.2162105.
Statistics Poland. (2024). Koniunktura konsumencka – grudzień 2023 roku. https://stat.gov.pl/obszary-tematyczne/koniunktura/koniunktura/koniunktura-konsumencka-wrzesien-2024-roku,1,130.html Accessed 14.10.2024.
Szczygielski, J.J., Charteris, A., & Obojska, L. (2023). Do commodity markets catch a cold from stock markets? Modelling uncertainty spillovers using Google search trends and wavelet coherence. International Review of Financial Analysis, 87, 102304. https://doi.org/10.1016/j.irfa.2022.102304.
Szczygielski, J.J., Charteris, A., Bwanya, P.R., & Brzeszczyński, J. (2024). Google search trends and stock markets: Sentiment, attention or uncertainty? International Review of Financial Analysis, 91, 102549. https://doi.org/10.1016/j.irfa.2023.102549.
Woloszko, N. (2020). Tracking activity in real time with Google Trends, OECD Economics Department Working Papers, No. 1634, OECD Publishing, Paris, https://doi.org/10.1787/6b9c7518-en.
Woo, J., & Owen, A.L. (2019). Forecasting private consumption with Google Trends data. Journal of Forecasting, 38(2), 81–91. https://doi.org/10.1002/for.2559.

Zinn, J.O. (2016). 'In-between' and other reasonable ways to deal with risk and uncertainty: A review article. Health, Risk & Society, 18(7–8), 348––366. https://doi.org/10.1080/13698575.2016.1269879.

Acknowledgements

Author contributions: authors have given an approval to the final version of the article. Author's total contribution to the manuscript: Jacek Pietrucha (70%); Michał Gulewicz (30%).

Funding: The research was co-financed by the Polish Ministry of Science grant 'Uncertainty: Measurement and Macroeconomic Effects' under the Regional Initiative of Excellence.

Appendix

Table 1. GT topics used for the calculation of MUI

Topics (in polish)	Topics (in English, for information purposes only)
bankomat, bezrobocie, ceny, ceny paliw, curriculum vitae, dług publiczny, gotówka, handel zagraniczny, indeks giełdowy, inflacja, kredyt, kryzys finansowy, kryzys gospodarczy, kurs walutowy, obligacja, odsetki, praca, produkt krajowy brutto, recesja gospodarcza, stopa procentowa, upadłość, urząd pracy, waluta, WIBOR, wzrost gospodarczy, zabezpieczenie społeczne, zwolnienia grupowe	ATM, unemployment, prices, fuel prices, curriculum vitae, public debt, cash, foreign trade, stock exchange index, inflation, credit, financial crisis, economic crisis, exchange rate, bond, interest, work, gross domestic product, economic recession, interest rate, bankruptcy, employment office, currency, WIBOR, economic growth, social security, collective layoffs

Source: Own preparation.

Table 2. Source of data

	Methodology	Source of data
WUI	News based indicator of uncertainty	IMF (2024)
GPR	Index of geopolitical risks (measures the occurrence of threats and escalations of geopolitical events related to wars, terrorism, and international tensions)	Iacoviello et al. (2024)
EC_a	Survey-based indicator of uncertainty; aggregated indicator	European Commission (2024)
EC_c	Survey-based indicator of uncertainty; consumers survey	European Commission (2024)
GUS_a	Survey-based indicator of uncertainty; aggregated	Statistics Poland (2024a); own calculation
GUS_c	Survey-based indicator of uncertainty	Statistics Poland (2024a); own calculation
MUI	Macroeconomics Uncertainty Indicator	Google Trends (2024); own calculation

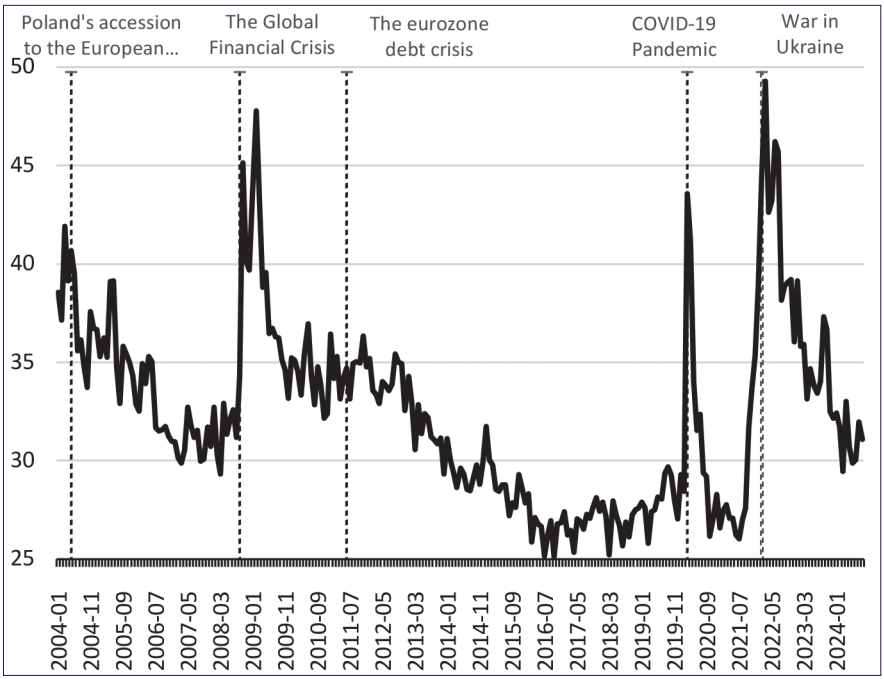
Source: Own preparation.

Table 3. Correlation matrix of uncertainty indicators

	WUI	GPR	EC_a	EC_c	GUS_c	GUS_a	MUI
WUI	1.00						
GPR	0.07	1.00					
EC_a	0.43	0.49	1.00				
EC_c	0.37	0.47	0.78	1.00			
GUS_c	0.32	0.60	0.83	0.72	1.00		
GUS_a	0.47	0.59	0.57	0.76	0.66	1.00	
MUI	0.17	0.80	0.50	0.66	0.66	0.78	1.00

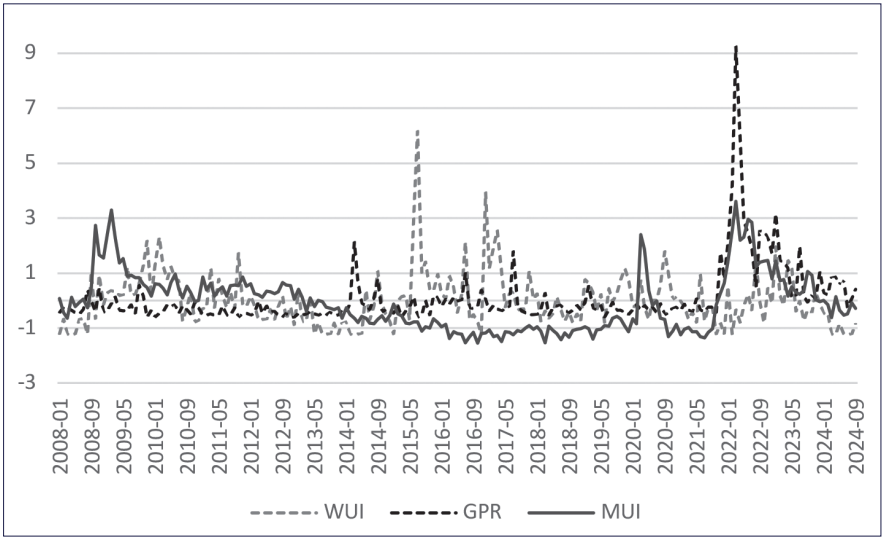
Source: Own calculations.

Figure 1. Macroeconomic Uncertainty Index (Poland)



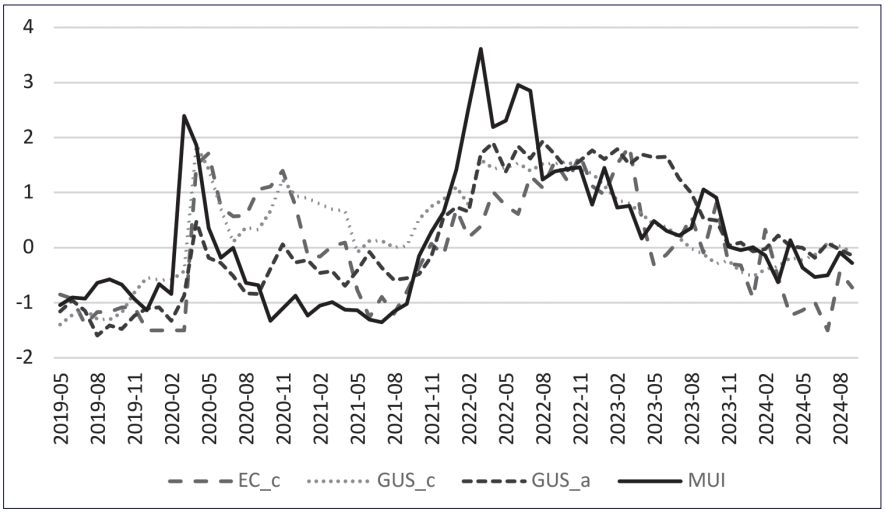
Source: Own calculations.

Figure 2. Comparative dynamics of uncertainty indicators: WUI, GPR, and MUI in Poland



% change m-o-m
All indicators have been standardized
Source: Own calculations; Iacoviello et al. (2024); IMF (2024).

Figure 3. Comparative dynamics of uncertainty indicators: EC, GUS, and MUI in Poland



% change m-o-m
All indicators have been standardized
Source: Own calculation; Statistics Poland (2024a); European Commission (2024).

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 21.02.2025; accepted 31.08.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.14

The impact of the insurance market on economic growth: evidence from Türkiye

MUHAMMED VEYSEL KAYA
Department of Finance and Banking, Faculty of Financial Sciences, Ankara Hacı Bayram Veli University, Ankara, Türkiye
✉ mveyselkaya@yahoo.com
ORCID: 0000-0001-9322-1694

MUHARREM UMUT
Department of Insurance, Faculty of Financial Sciences, Ankara Hacı Bayram Veli University, Ankara, Türkiye
✉ muharrem.umut@gmail.com
ORCID: 0000-0002-9213-1440

ENES AKKURT
corresponding author
Department of Insurance, Institute of Graduate Programs, Ankara Hacı Bayram Veli University, Ankara, Türkiye
✉ eakkurt24@gmail.com
ORCID: 0000-0002-7770-7704

Abstract

Motivation: The insufficient academic studies in the field of insurance in Türkiye and the lack of studies in the literature aimed at identifying the relationship between the financial market and the economic market have motivated this study.
Aim: One of Türkiye's emerging financial markets is the insurance market. This study aims to determine the direction of the relationship between the growth of Türkiye's emerging insurance market and economic growth.

Results: The analyses have revealed that there is either a unidirectional causal relationship between the variables used and economic growth or, in some cases, no causal relationship at all. Particularly, the results indicate a unidirectional causality and both short-term and long-term relationships between GDP and the variables of total premium production, claim payments, and market share. However, no causal relationship was found between the GDP variable and operating expenses, with only a long-term relationship with economic growth detected, and no short-term relationship identified. The research provides valuable insights for future research plans by revealing the interaction between the insurance sector in Türkiye and economic growth.

Keywords: insurance market growth; emerging financial markets; GDP; granger causality test; ARDL bounds test
JEL: A10; C32; G22; O4

1. Introduction

The onset of the COVID-19 pandemic in 2019 triggered a global economic downturn. Although the world economy contracted by 3.2% in 2022, projections for 2023 suggest a modest recovery with an estimated growth of 2.6% (OECD, 2023). Nevertheless, the prolonged effects of the pandemic, coupled with the Russia-Ukraine conflict and prevailing geopolitical uncertainties, have continued to constrain economic performance (IMF, 2024). Rising inflationary pressures, disruptions in global supply chains, and surging commodity prices have further exacerbated these challenges.

Financial markets constitute one of the primary engines of economic growth. Within this structure–comprising the banking, insurance, and capital markets–the insurance sector holds a particularly strategic position, accounting for approximately 5% of financial market activity following banking (TSB, 2022). Functioning as a risk transfer mechanism, insurance plays an indispensable role in maintaining economic continuity by enabling individuals and institutions to mitigate potential losses (Yang, 2024; Mili et al., 2024).

In recent years, the insurance industry has undergone a substantial transformation through digitalization and innovation. The emergence of Insurtech–encompassing technologies such as artificial intelligence, blockchain, and big data analytics–has significantly enhanced customer experience and improved underwriting accuracy (Qodirov et al., 2024). However, the sector is also increasingly exposed to adverse developments, such as climate change, pandemics, and cyber risks, which have resulted in higher claims and financial burdens (Krauss, 2024).

According to the SwissRe Sigma (2023) report, global insurance premium volume declined by 1.1% in 2022, amounting to $6.8 trillion. Nonetheless, a recovery is anticipated with a 1.7% increase in 2023, reaching $7.1 trillion. The global insurance penetration rate was 6.8%, and the average per capita

premium stood at $853. In Turkey, total premium production reached $13.1 billion, 90% of which originated from non-life insurance lines. Insurance penetration remained relatively low at 1.5%, with a per capita premium of $154 (SwissRe, 2023).

National data provided by the Insurance Association of Türkiye (IAT) indicate that, in 2023, non-life insurance premiums increased by 110.3%, while life insurance premiums rose by 83.7%, bringing total premium production to 486 billion TRY. With total assets amounting to 1.4 trillion TRY, the insurance sector ranks as the second-largest component of the financial system after the banking sector. Moreover, it contributes significantly to economic resilience, offering coverage totaling 576 trillion TRY–equivalent to 24 times the country's GDP–thus playing a vital role in sustaining economic activity (IAT, 2023).

Furthermore, the regulatory amendments introduced by the *Regulation Amending the Regulation on Insurance Agencies, published in the Official Gazette on January 22, 2025, have* imposed significant reforms on the insurance agency landscape (Regulation, 2025). These reforms encompass revised minimum capital requirements, enhanced qualification standards for technical personnel, alignment with international regulatory frameworks, sectoral stabilization measures, and the digitalization of administrative and registration processes.

As these figures indicate, the insurance market holds a very important position in both financial markets and the national economy. Direct or indirect growth in insurance will also trigger economic growth. Conversely, any negative development or stagnation in the insurance market will negatively impact economic growth. Furthermore, with the integration of markets and technology today, this impact occurs very quickly. In this context, examining the relationship between finance and growth is crucial. Identifying a positive or negative relationship will guide the importance given to or investments made in this area. In the literature, the relationship between insurance growth and economic growth within financial growth is generally observed to be positive (Adam et al., 2009). This relationship can be explained by the insurance market's contribution to economic growth and the increased demand for insurance with economic growth. However, this relationship is not always unequivocally positive. Some studies suggest that excessive growth or mispricing in the insurance market can threaten financial stability and exacerbate economic crises (Changa et al., 2014). Additionally, high insurance premiums can affect consumer spending and thus restrict economic growth. Therefore, the impact of the insurance market on economic growth is complex and multifaceted, requiring consideration of various factors (Ward and Zurbregg, 2000).

In this regard, it has been decided to conduct a study to determine the direction of the relationship between insurance growth and economic growth

in Türkiye. The insufficient academic studies in the field of insurance in Türkiye and the lack of studies in the literature aimed at identifying the relationship between the financial market and the economic market have motivated this study. The purpose of this study is to determine and evaluate the direction of the relationship between the insurance market in financial markets and economic growth in the long term. To investigate the causality relationship between the insurance market and economic growth, five variables are used: GDP, total gross premium production, gross claim payments, market share, and operating expenses of insurance companies. Using data spanning 30 years from 1993 to 2022 for these variables in Türkiye, the ARDL Bounds Test Approach and Granger Causality Test (GCT) are applied to explain the direction of the relationship.

The aim of this study is to determine and evaluate the direction of the long-term relationship between the insurance market in financial markets and economic growth. To investigate the causality relationship between the insurance market and economic growth, five variables are utilized: GDP, total gross premium production, gross claims paid, market share, and operating expenses of insurance companies. Using 30 years of data from 1993 to 2022 for these variables in Turkey, the ARDL Bound Test approach and Granger Causality Test (GCT) are applied to explain the direction of this relationship.

This paper is structured as follows: Following the introduction, the second section reviews the relevant literature on the relationship between the insurance market and economic growth. The third section presents the data and methodology, including a detailed explanation of the ARDL Bound Test and Granger Causality Test. The fourth section discusses the empirical findings based on the analysis of Turkey's insurance market and economic growth variables. Finally, the fifth section concludes the study with policy implications and suggestions for future research.

2. Literature review

Although there are various studies in the literature suggesting that financial growth stimulates economic growth, opposing views also exist. The first comprehensive study examining the relationship between insurance growth and economic growth was conducted by Ward and Zurbruegg (2000). Subsequently, Kugler and Ofoghi (2005) investigated the link between insurance companies' premium production and economic growth, finding that while insurance premium production affects economic growth in the short term, this effect does not persist in the long term.

Research conducted in Europe and the European Union (Ching, Kogid, and Furuoka, 2010; Ching et al., 2011; Jamil and Setiawan, 2023) has identified a causal relationship between the insurance market and economic

growth. Similarly, Akınlo (2013), examining Nigeria's insurance sector, found a unidirectional relationship between premiums, inflation, interest rates, and economic growth.

Analyses conducted in OECD countries (Changa, Lee, and Chang, 2014; Demirci and Eren, 2017; Apergis and Poufinas, 2020) have demonstrated a significant relationship between the insurance sector and economic growth. Research focusing on African countries (Akınlo, 2015; Alhassan and Biekpe, 2016) also revealed a positive link between the insurance market and economic growth.

Pradhan et al. (2017), investigating the insurance sector and economic growth in Eurozone countries, reported a bidirectional relationship. Further studies within Europe and the European Union (Peleckienė et al., 2019; Mitrasević, 2022) found that the insurance market contributes positively to economic growth.

Singhala, Goyal, and Singhal (2020) examined the causality between the insurance economy and overall economic conditions in 19 developing Asian countries, concluding that the insurance market has a unidirectional impact on the economy. Mouloudi and Benladgham (2020) analyzed the relationship between Morocco's life and non-life insurance markets and economic growth using Granger causality and ARDL tests, concluding that non-life insurance contributes to long-term economic growth, whereas life insurance has a short-term effect.

Ergün (2022) studied the relationship between private pension insurance and economic growth, finding no short-term relationship but a significant long-term link. Dalkılıç and Gülcemal (2022) investigated the impact of GDP and insurance expenditure growth on the insurance market share in Turkey and concluded that both variables contributed to the increase in market share. Yıldırım (2022) tested the contribution of premium production in the insurance sector to economic growth and identified a positive, unidirectional relationship. The study emphasized that economic growth positively affects premium production in the insurance sector and that premium production is a driving factor for economic growth.

Tran et al. (2023) examined the relationship between the insurance sector and economic growth in Vietnam and found that life insurance has both short-term and long-term relationships with economic growth, while non-life insurance affects only the long term. Saleh, Jawabreh, and Ali (2023) analyzed the relationship between the insurance market and economic growth in Jordan, identifying a long-term relationship.

Unlike the aforementioned literature, the present study aims to investigate the relationship between specific variables of the insurance market and Turkey's economic growth in both the short and long term.

3. Methods

3.1. Data Set and Variables

To investigate the Granger causality between the insurance market and economic growth, five macroeconomic variables were used. While the GDP variable represents economic growth, the variables representing the insurance market are total gross premium income (TGPI), total gross claims paid (TGCP), insurance market share (IMS), and operating expenses (OE) (Dalkılıç and Gülcemal, 2022; Apergis and Poufinas, 2020).

The dataset used in the research was compiled from publicly available annual data published by the Organization for Economic Co-Operation and Development (OECD), the Insurance Association of Türkiye (IAT), and the Turkish Statistical Institute (TSI). The study covers a period of 30 years from 1993 to 2022.

3.2. Model Formulation

The analyses in this study were conducted using the EViews 12 SV program. Firstly, the normality of the data was tested using the Jarque-Bera test. To test for the presence of a unit root in a time series, the Augmented Dickey-Fuller (ADF) test was employed (Ghimire, 2014). Following the unit root test, the ARDL Bound Test and Granger Causality Test (GCT) were used to determine the existence of relationships between different variable groups. The ARDL (Autoregressive Distributed Lag) Bound Test allows for the analysis of relationships between variables that are not stationary at the same order. In the ARDL (Autoregressive Distributed Lag) test, 'lag' (abbreviated as 'l') refers to the inclusion of a variable's past (lagged) values in the model. This allows for the examination of how both the dependent and independent variables past values influence their current values.

The ARDL Bound Test offers various advantages over other tests. It can identify relationships between variables with different levels of stationarity, it can be applied to small sample sizes, and it provides more reliable and consistent results due to the unrestricted error correction model, offering both long-term and short-term analysis results (Karaş, 2023). The ARDL Bound Test is mathematically formulated as follows (Gülmez, 2015):

The ARDL Bound Test comprises three stages. In the first stage, it is tested whether there is a long-term relationship between the relevant variables. Assuming the existence of a cointegration relationship, the second and third stages involve obtaining short-term and long-term elasticities. The formula used in the first stage of the test, adapted to this study, is as follows:

$$\Delta LGDP = a_0 + \sum_{i=1}^{k} a_i \Delta LGDP_{t-i} + \sum_{i=0}^{k} a_{2i} \Delta LTGCP_{t-i} + \sum_{i=0}^{k} a_{3i} \Delta LIMS_{t-i} + \sum_{i=0}^{k} a_{4i} \Delta LOE_{t-i} + a_5 \Delta LGDP_{t-1} + a_6 \Delta LTGPI_{t-1} + a_7 \Delta LIMS_{t-1} + a_8 \Delta LOE_{t-1} + \varepsilon_t \quad (1)$$

The variables used in this model aim to analyze the short- and long-term relationships between the insurance sector and economic growth in Turkey. LGDP represents the logarithm of Gross Domestic Product and serves as the dependent variable, reflecting economic growth. LTGPI is the logarithm of total gross premium income generated by insurance companies and indicates the production volume within the sector. LIMS refers to the logarithm of the insurance market share, representing the relative size of the insurance sector within financial markets. LOE denotes the logarithm of the total operating expenses of insurance companies and reflects the level of operational costs in the sector. The symbol Δ (delta) indicates the first difference of the variable, capturing its period-over-period change and representing short-term dynamics. k refers to the maximum lag length used in the model, while ε_t stands for the error term, representing random shocks or unexplained variations. This model structure enables the examination of both short- and long-term effects of insurance sector indicators on economic growth.

To test for the presence of a cointegration relationship, the differences of the variables used in Equation 1 were first taken, and the lag length value, denoted ask, was determined. For this purpose, information criteria such as Akaike (AIC) and Schwarz (SIC) are used in the literature. After determining the lag length, the presence of a cointegration relationship was tested by examining the significance of the lagged level values of the dependent and independent variables in Equation 1. The hypothesis tested and adapted for this study is as follows:

$$H_0 = a_5 = a_6 = a_7 = a_8 = 0$$

To test the above hypothesis, the standard F-statistic was used. If the calculated F-statistic is greater than the upper bound value (I), the presence of a cointegration relationship can be inferred. Subsequently, the second and third stages are carried out. The following formulas pertain to stages 2 and 3.

$$\Delta LGDP = a_0 + \sum_{i=1}^{k} a_i \Delta LGDP_{t-i} + \sum_{i=0}^{l} a_{2i} \Delta LTGPI_{t-i} \sum_{i=0}^{m} a_{3i} \Delta LIMS_{t-i} \sum_{i=0}^{n} a_{4i} \Delta LOE_{t-i} + \varepsilon_i \quad (2)$$

Equation 2 is used for the long-term ARDL bounds test.

$$\Delta LGDP = a_0 + \sum_{i=1}^{k} a_i \Delta LGDP_{t-i} + \sum_{i=0}^{l} a_{2i} \Delta LTGPI_{t-i} \sum_{i=0}^{m} a_{3i} \Delta LIMS_{t-i} \sum_{i=0}^{n} a_{4i} \Delta LOE_{t-i} + \beta ECT_{t-1} + \varepsilon_i \quad (3)$$

Equation 3 is used for the short-term ARDL bounds test and is examined with the error correction model. The error correction term is denoted by ECT. A coefficient of the ECT between 0 and -1 indicates a monotonic convergence to the long-term equilibrium, while a coefficient between -1 and -2 suggests convergence with dampening oscillations, and a coefficient smaller than -2 indicates divergence from equilibrium.

The Granger Causality Test (GCT), used in this study alongside the ARDL Bounds Test to enhance the reliability of the results, allows for the analysis of the lagged relationships between variables and is conducted with time series data. GCT statistically measures the direction of the relationship between the variables used in the analysis. It is an analysis method that tests the hypotheses of the presence or absence of a relationship between variables (Öner, 2022). GCT is calculated using the following formula (Doğan, 2024: 39):

$$X_t = a + \sum_{j=1}^{i} bixt - i + \sum_{j=1}^{i} ciyt - i + \varepsilon_t \quad (4)$$

$$Y_t = a + \sum_{j=1}^{i} bixt - i + \sum_{j=1}^{i} ciyt - i + \varepsilon_t \quad (5)$$

Equations 4 and 5 provide the formulas for the causality relationship between two variables. Through these equations, the direction of causality is determined in the presence of a lagged relationship between the two variables.

4. Results

Testing for Granger causality requires that the data used be normally distributed. A normality test has been conducted, and the Jarque Bera (J-B) statistic along with its probability value has been calculated. The results of the normality test are provided in Table 1.

In Table 1, the p-value of the Jarque-Bera statistic for all 5 variables was found to be above 5%. This indicates that the entire dataset follows a normal distribution. The data is suitable for the Granger causality test.

The Augmented Dickey-Fuller (ADF) test was applied to test for the presence of unit roots in the variables used in the analysis. Table 2 presents the results of the unit root test.

Upon examining the results in Table 2, it is observed that according to the Augmented Dickey-Fuller (ADF) unit root tests conducted on the variables, all series do not contain unit roots, indicating stationarity. When first-order

and second-order differences are taken for non-stationary variables, they become stationary. This indicates that all variables are stationary.

In this study, variables representing the insurance market indicators and the GDP value representing economic growth were analyzed to investigate the relationship between the insurance market and economic growth using the ARDL Bound Test. The diagnostic pre-test statistics measured for the ARDL Bound Test, where GDP is defined as the dependent variable, are provided in Table 3.

According to the diagnostic statistics results provided in Table 3, the analysis reveals no issues of autocorrelation (LM Test) or heteroscedasticity (Heteroskedasticity Test), and the model demonstrates a normal distribution (Jarque-Bera). These results indicate that the established model is highly reliable.

After confirming the analysis with diagnostic pre-tests, an F-test was applied to examine the long-term relationship between the variables and to identify the cointegration relationship. The results of the F-test are presented in Table 4.

The results presented in Table 4 show that the F-statistic value of 16.55 is greater than the upper bound critical values at the 1%, 2.5%, 5%, and 10% significance levels. The fact that the F-statistic value exceeds these critical values indicates a long-term relationship between GDP and the other variables used in the analysis. In other words, it demonstrates the existence of a cointegration relationship between GDP and the independent variables. After identifying the presence of a long-term relationship through the F-statistic value, the next step is to estimate the long-term coefficients in the analysis. The ARDL long-term coefficients and their probability values are presented in Table 5.

According to the ARDL long-term estimation results presented in Table 5, total gross premium income (TGPI) and insurance market share (IMS) have a statistically significant impact on the GDP variable at the 1% significance level, while total gross claims paid (TGCP) and operating expenses (OE) have a significant impact at the 5% significance level. These results indicate that increases in TGPI and OE positively and significantly affect GDP, whereas increases in TGCP and IMS negatively and significantly affect GDP.

The CUSUM test was employed to assess the coefficient stability of all explanatory variables included in the model. To determine whether there are any structural breaks in the analysis, or in other words, to measure the stability of the coefficients of the variables, the CUSUM and CUSUMQ tests were used. The graphs for these tests are presented in Figure 1.

The CUSUM and CUSUMQ graphs presented in Figure 1 show that the plotted lines remain within the boundary region at the 5% significance level. Accordingly, based on the results of the CUSUM and CUSUMQ tests for the ARDL bound test approach, it is observed that there are no structural breaks in the long-term analysis and that the model is stable.

In the final stage of the ARDL bound test, the ECM (Error Correction Model) coefficient was estimated to determine the short-term relationship between the relevant variables. The short-term results obtained from this estimation are presented in Table 6.

In the short-term estimation results presented in Table 6, the ECM coefficient is found to be negative (-0.4213) and statistically significant at the 1% level. This indicates that short-term deviations will converge to equilibrium in the long term. Specifically, 42.13% of a short-term deviation will be corrected in the following period. Thus, short-term deviations will reach equilibrium approximately 2.4 periods later, after which these deviations will be eliminated.

The Granger causality test demonstrates the dynamic relationship between variables. In the study, variables representing the insurance market and the GDP value, which represents economic growth, were examined. The relationship between the insurance market and economic growth was analyzed using the Granger causality test approach.

The results from the Granger causality analyses are presented in Table 7. The findings indicate either a unidirectional causality relationship between the variables and economic growth or no causality relationship at all. According to the results, there is a unidirectional causality relationship between the GDP variable and the TGPI, TGCP, and IMS variables. However, no causality relationship has been detected between the GDP variable and the OE variable.

The obtained results are similar to the findings of studies conducted by Kugler and Ofoghi (2005), Ching, Kogid, and Furuoka (2010), Ching et al. (2011), Akınlo (2013), Changa, Lee, and Chang (2014), Akınlo (2015), Alhassan and Biekpe (2016), Pradhan et al. (2017), Demirci and Zeren (2017), Peleckienė et al. (2019), Singhala, Goyalb, and Singhalc (2020), Apergis and Poufinas (2020), Mitrasević (2022), Yıldırım (2022), Saleh, Jawabreh, and Ali (2023), and Setiawan (2023), while they differ from the studies conducted by Ergün (2022) and Dalkılıç and Gülcemal (2022). This study offers several original contributions to the existing literature. First, it utilizes a long-term dataset spanning 30 years, which enhances the robustness and reliability of the findings by capturing structural changes and long-run dynamics in the relationship between the insurance sector and economic growth. Second, unlike many previous studies that relied on older or shorter datasets, the use of updated and extended time series data allows for a more accurate reflection of current economic and sectoral trends. Third, the study employs both the ARDL bounds testing approach and Granger causality analysis, offering a comprehensive methodological framework that investigates both long-term equilibrium relationships and the direction of causality. Fourth, while earlier research typically used a limited number of variables to represent the insurance sector, this study incorporates four distinct indicators, thereby

enriching the scope and depth of the analysis. Additionally, the study adopts a novel perspective by addressing the issue from both macroeconomic and policy-oriented angles, providing actionable recommendations for sectoral stakeholders and public authorities alike. These aspects collectively underscore the originality and practical relevance of the study.

5. Conclusion

Recently, global economies have faced significant challenges in economic growth, particularly exacerbated by the Covid-19 pandemic. The pandemic in 2019, followed by the Russia-Ukraine war, global warming, climate change-induced disasters such as earthquakes and floods, geopolitical factors, inflation, rising commodity prices, and disruptions in supply chains have continuously impacted economies negatively. Although there were signs of recovery in 2023, the desired growth has not yet been achieved. Türkiye's economic growth has also been affected by these factors and has not reached the expected high levels, despite positive developments in export growth supported by the depreciation of the Turkish lira as a result of high inflation. While sectors such as foreign trade, manufacturing, construction, and health play a role in growth, developments in financial markets, whether positive or negative, directly affect economic growth. Within financial markets, the insurance market holds significant importance following the banking sector. This is because the guarantees and protection provided by the insurance market enable other sectors to continue their activities with confidence.

Thus, there is a direct relationship between the growth of the insurance market and economic growth. However, this relationship can be either positive or negative, depending on developments in the markets. Studies in the literature have been conducted to determine the direction of this relationship. These studies show that the direction of the relationship varies based on the data obtained and differs from country to country. Therefore, it is not always possible to assert that there is a positive relationship between the growth of the insurance market and economic growth.

This study aims to determine the nature of the relationship between Türkiye's economic growth and the growth in the insurance market, both in the short and long term, using 30 years of data from 1993 to 2022. The Granger Causality Test and the ARDL Bound Test were employed for this purpose. Within this framework, Türkiye's economic growth (GDP), total premium production in the insurance market, total claim payments, market share, and operating expenses were selected as variables, and causality was investigated.

The analysis and the 30 years of data revealed that there is a unidirectional causality relationship between the used variables and economic growth, or in some cases, no causality relationship at all. It was concluded that the insurance market affects economic growth through various variables both

in the short and long term. Specifically, there is a unidirectional causality relationship between the GDP variable and the variables of total premium production, claim payments, and market share. Additionally, these variables were found to be related to economic growth both in the short and long term. However, no causality relationship was found between the GDP variable and the operating expenses variable, with a relationship being identified only in the long term and not in the short term.

Therefore, when premium production, claim payments, and the market shares of companies in the insurance market increase, GDP growth occurs; conversely, negative growth occurs when these decreases. Currently, the insurance market's share in financial markets is 5%, and its share in GDP (insurance penetration), including the private pension sector, is approximately 2%, which is still insufficient. In other words, there is substantial potential for growth. By increasing premium production and the number of policies, and better managing claims, it is possible to enhance the size of the insurance market and thereby increase its contribution to economic growth.

References

Akınlo, T. (2013). The Causal Relationship Between Insurance And Economic Growth In Nigeria (1986-2010). *Australian Journal of Business and Management Research,* 12(12), 49–57. http://dx.doi.org/10.52283/NSWRCA.AJBMR.20120212A07.

Akınlo, T. (2015). Causal Relation between Insurance and Economic Growth in selected Sub-Saharan Africa: A Heterogeneous Panel Causality Approach. *Canadian Open Economics Journal,* 2(1), 1–22. http://crpub.com/Journals.php.

Alhassan, A.L. & Biekpe, N. (2016). Insurance market development and economic growth: Exploring causality in 8 selected African countries. *International Journal of Social Economics,* 43(3), 321–339. http://dx.doi.org/10.1108/IJSE-09-2014-0182.

Apergis, N. & Poufinas, T. (2020). The Role Of Insurance Growth İn Economic Growth: Fresh Evidence From A Panel Of OECD Countries. *North American Journal of Economics and Finance,* 53, 1–16. https://doi.org/10.1016/j.najef.2020.101217.

Changa, T., Lee, C.C. & Chang, C.H. (2014). Does Insurance Activity Promote Economic Growth? Further Evidence Based On Bootstrap Panel Granger Causality Test. *The European Journal of Finance,* 20(12), 1187––1210. https://doi.org/10.1080/1351847X.2012.757555.

Ching, K.S., Kogid, M. & Furuoka, F. (2010). Causal Relation Between Life Insurance Funds and Economic Growth: Evidence From Malaysia. *ASEAN Economic Bulletin,* 27(2), 185–199. http://dx.doi.org/10.1355/ae27-2c.

Ching, K.S., Kogid, M. & Mulok, D. (2011). Insurance Funds and Economic Growth in Malaysia: Further Empirical Evidence. *Interdisciplinary Review of Economics and Management,* 1(1), 1–9. https://www.researchgate.net/publication/231228044_Insurance_Funds_and_Economic_Growth_Further_Evidence_from_Malaysia.

Dalkılıç, N. & Gülcemal, M.E. (2022). Insurance Expenditures and Gross Domestic Product Variables Effect on Insurance Market Share. *Journal Of Business Research,* 14(1), 449–464. https://doi.org/10.30520/tjsosci.1055973.

Demirci, Ş.D. & Zeren, F. (2017). Insurance Premium and Economic Growth: Evidence from OECD Countries. *Journal of Business Science,* 5(1), 1–11. https://doi.org/10.22139/jobs.286819.

Doğan, Y. (2024). Stock market participation, liquidity and stock return: Evidence from Türkiye. *Doctoral Thesis,* Ankara: Ankara University, Social Sciences Institue, Department Of Business Administration. https://tez.yok.gov.tr/UlusalTezMerkezi/TezGoster?key=cr4SkWLaRMhkDRBjqthpsZwuoQp7KpUD9SpcBM9f8qAMLv3fvknZZyeFVSk5NB1C.

Ergün, T. (2022). The Relationship Between Private Pension Insurance and Economic Growth: A Time Series Analysis. *Kastamonu University Journal of Faculty of Economics and Administrative Sciences,* 24(2), 161–177. https://doi.org/10.21180/iibfdkastamonu.1121965.

Ghimire, R. (2014). Insurance Industry and Economic Growth in Nepal: A Study with Granger Causality Test Approach. *Hermeneutics,* 4(2), 1–6. https://ssrn.com/abstract=2557006.

Gülmez, A. (2015). The Relationship Between Foreign Sources Of Finance And Economic Growth In Türkiye: An Ardl Bounds Testing Approach. *The International Journal of Economic and Social Research,*11(2), 139–152. https://dergipark.org.tr/tr/pub/esad/issue/38966/456083#article_cite.

Jamil, I.R. & Setiawan, M. (2023). Market Share And Efficiency: Causality Test in Indonesian General Insurance Industry. *Jurnal Economi & Studi Pembangunan,* 24(1), 144–163. https://doi.org/10.18196/jesp.v24i1.17092

IMF. (2024). *World Economic Outlook*. Retrevied from: https://www.imf.org/en/publications/weo.

Karaş, E. (2023). Investigation of The Relationship between Budget Balance and Inflation in Türkiye: ARDL Boundary Test Approach. *The Journal of International Scientific Researches*, 8(3), 550–565. http://dx.doi.org/10.23834/isrjournal.1317738.

Krauss, A. (2024). The insurance implications of climate change. In *Living with Climate Change* (pp. 295–341). Elsevier. https://doi.org/10.1016/B978-0-443-18515-1.00024-1.

Kugler, M. & Ofoghi, R. (2005). Does Insurance Promote Economic Growth? Evidence from the UK. *Research Group Conference 2005 8,* Money Mac-

ro and Finance Research Group. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=5fa4f443350ad4662a2c3f252937aaa2d224bf75.

Mitrasević, M., Pjanić, M. & Burić, M.N. (2022). Relationship Between Insurance Market and Economic Growth in the European Union. *Politická ekonomie,* 70(4), 395–420. https://doi.org/10.18267/j.polek.1358.

Mouloudi, A. & Benladgham, F. (2020). The Relationship Between Insurance market and Economic Growth in Morocco: An ARDL Approach. *Al Bashaer Economic Journal,* 6(1), 957–970. http://dx.doi.org/10.33704/1748-006-001-058.

OECD. (2023). Retrieved from: *Global growth has slowed since the start of the war*. https://www.oecd.org/economic-outlook/march-2023/.

Öner, M.H. (2022). The Relationship Between Participation Insurance And Economic Growth And Consumer Confidence Index. *Research of Financial Economic and Social Studies,* 7(3), 462–471. https://doi.org/10.29106/fesa.1140629.

Peleckienė, V., Peleckis, K., Dudzevičiūtė, G. & Peleckis, K.K. (2019). The Relationship Between Insurance And Economic Growth: Evidence From The European Union Countries. *Economıc Research-Ekonomska Istrazıvanja,* 32(1), 1138–1151. http://dx.doi.org/10.1080/1331677X.2019.1588765.

Qodirov, A., Malafeyev, O., Zaitseva, I., Kosovskaya, T., Rubtsova, E., Bogolyubova, I., & Belyaeva, S. (2024, March). Comparison of blockchain technologies for the digitalization of the social insurance healthcare system and their economic profitability. In *AIP Conference Proceedings* (Vol. 3102, No. 1). AIP Publishing. https://pubs.aip.org/aip/acp/article-abstract/3102/1/030020/3279616/Comparison-of-blockchain-technologies-for-the?redirectedFrom=fulltext.

Pradhan, R.P., Dash, S., Maradana, R.P., Jayakumar, M. & Gaurav, K. (2017). Insurance Market Density And Economic Growth İn Eurozone Countries: The Granger Causality Approach. *Pradhan et al. Financial Innovation,* 3(17), 2–24. https://doi.org/10.1186/s40854-017-0065-x.

Saleh, M.H., Jawabreh, O. & Ali, B.J.A. (2023). The Role of Performance Jordanian Insurance Companies in Economic Growth: Evidence from the PMG Panel-ARDL Approach. *Cuadernos de Economía*, 46(131), 30–42. https://doi.org/10.32826/cude.v2i131.1104.

Singhal, N., Goyal, S. & Singhal, T. (2020). Insurance–Growth Nexus: Empirical Evidence From Emerging Asian Markets. *Transnational Corporations Review,* 12(3), 1–13. https://doi.org/10.1080/19186444.2020.1756170.

SwissRe. (2023). *World insurance: stirred, and shaken No:3/2023.* İsviçre: Swiss Re Instute Sigma. https://www.swissre.com/institute/research/sigma-research/sigma-2023-03.html.

Tran, Q., Huynh, N. & Huynh, N. (2023). Can Insurance Ensure Economic Growth in an Emerging Economy? Fresh Evidence from a non-linear

ARDL Approach. *Journal of Financial Economic Policy,* 15(6), 596–612. https://dx.doi.org/10.2139/ssrn.4121938.
IAT. (2022). *Industry Report. Istanbul: Türkiye Insurance Association.* Retrieved from: https://www.IAT.org.tr/tr/yayin/sektor-raporlari.
IAT. (2023). Türkiye Insurance Association, Statistics: Retrieved from: https://www.IAT.org.tr/tr/istatistik/genel-sigorta-verileri/prim-adet.
Mili, K., Bengana, I., Ouassaf, S., & Kabdi, M. (2024). Testing the co-integration relationship between auto insurance premiums and risk compensation amount. *Computers in Human Behavior Reports*, *13*, 100377. https://doi.org/10.1016/j.chbr.2024.100377.
Regulation (2025). *Regulation Amending the Regulation on Insurance Agencies,* Retrieved from: https://www.resmigazete.gov.tr/eskiler/2025/01/20250122-2.htm.
Yang, Y. (2024). *Risk Management in Insurance and Finance in Response to Model Uncertainty* (Doctoral dissertation, UNSW Sydney).
Yıldırım, İ. (2022). The Impact of Insurance market Premium Production on Economic Development. *Journal of Economics and Administrative Sciences,* 23(2), 492–501. https://doi.org/10.37880/cumuiibf.1021397.
Ward, D., & R. Zurburegg, (2000). Does Insurance Promote Economic Growth? Evidence form OECD Countries, *Journal of Risk and Insurance,* 67(4): 489–506. https://doi.org/10.2307/253847.

Acknowledgements

Author contributions: Authors have given an approval to the final version of the article. Authors contributed to this work as follows: M.V.K., M.U., E.A. developed the concept and designed the study, E.A. collected the data, M.V.K., M.U., E.A. analysed and interpreted the data, M.V.K., M.U., E.A. prepared the draft of the article, M.V.K., M.U. revised the article critically for important intellectual content.

Appendix

Table 1. Normality Test of Variables

VARIABLES	GDP	TGPI	TGCP	IMS	OE
Jarque - Bera	3.27	3.34	3.72	2.52	3.33
P value	0.19	0.18	0.15	0.28	0.18
Observations	30	30	30	30	30

Table 2. Unit Root Tests of Variables

Augmented Dickey-Fuller (ADF) Test						
VARIABLE	LEVEL		1ST DİFFERENCE		2 ST DİFFERENCE	
	INTERCEPT	INTERCEPT AND TREND	INTERCEPT	INTERCEPT AND TREND	INTERCEPT	INTERCEPT AND TREND
GDP	1.98	0.05	-0.73	-2.69	-4.18*	-4.36*
TGPI	-0.22	-2.52	-2.45	-2.37	-9.84*	-9.60*
TGCP	-1.25	-0.44	-2.32	-4.96*	-10.13*	
IMS	-1.06	-1.77	-2.30	-2.62	-9.47*	-9.23*
OE	-0.91	-3.78**	-5.67*			

***, ** and * indicate significance at the 1%, 5% and 10% significance level, respectively.

Table 3. Diagnostic Statistics Results

Diagnostic Preliminary Tests	Test Statistic	Prob.
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.88	0.13
Breusch-Godfrey Serial Correlation LM Test	1.99	0.18
Jarque-Bera Normality Test	0.81	0.66
R-squared		0.99
Adjusted R-squared		0.99
Durbin-Watson stat		2.58

Table 4. F-test Results

Test Statistic	Value	Prob.	I(0)	I(1)
		%10	2.45	3.52
F-istatistiği (Wald)	16.55	%5	2.86	4.01
		%2.5	3.25	4.49
		%1	3.74	5.06

Table 5. ARDL Long-Term Forecast Results

VARIABLES	Coefficient	Std. Dv.	t- Statistic	Prob.
TGPI	467.77	44.43	10.52	0.0000***
TGCP	-314.67	120.92	-2.60	0.0219**
IMS	-0.19	46.80	-4.08	0.0013***
OE	561.00	237.58	2.36	0.0345**
C	661791.00	181569.40	3.64	0.0030***

***, ** and * indicate significance at the 1%, 5% and 10% significance level, respectively.

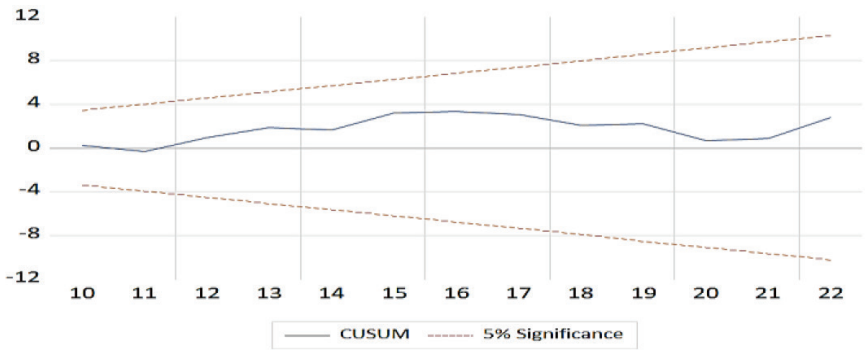
Table. 6. ARDL Short-Term Forecast Results

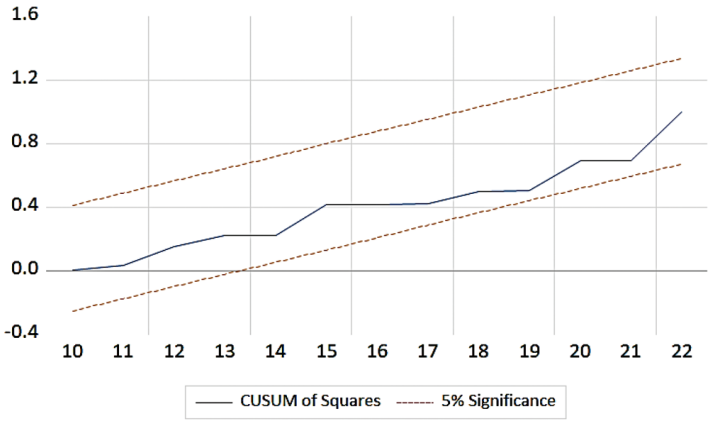
VARIABLES	Coefficient	Std. Dv.	t- Statistic	Prob.
D(GDP)	-0.64	0.13	-4.64	0.0005
D(TGCP)	-95.68	29.56	-3.23	0.0065
D(IMS)	-0.54	63.33	3.83	0.0021
D(OE)	0.42	50.54	0.84	0.4142
CointEq (-1)	-0.42	0.04	-10.40	0.0000

Table 7. Granger Causality Test Results

1-Granger Causality Test (GDP - TGPI)				
H_0	Chi-sq	Prob	df	Number of Observations
GDP is not the cause of TGPI.	14.06	0.0071	4	30
TGPI is not the cause of GDP.	4.37	0.3578	4	30
2-Granger Causality Test (GDP - TGCP)				
H_0	Chi-sq	Prob	df	Number of Observations
GDP is not the cause of TGCP.	5.84	0.2108	4	30
TGCP is not the cause of GDP.	18.16	0.0011	4	30
3-Granger Causality Test (GDP - IMS)				
H_0	Chi-sq	Prob	df	Number of Observations
GDP is not the cause of IMS.	13.61	0.0086	4	30
IMS is not the cause of GDP.	4.24	0.3740	4	30
4-Granger Causality Test (GDP - OE)				
H_0	Chi-sq	Prob	df	Number of Observations
GDP is not the cause of OE.	6.95	0.1381	4	30
OE is not the cause of GDP.	1.43	0.8388	4	30

Figure 1. CUSUM and CUSUMQ Test Results




1.6
1.2
0.8
0.4
0.0
-0.4
10
11
12
13
14
15
16
17
18
19
20
21
22
CUSUM of Squares
5% Significance

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 08.04.2025; accepted 31.07.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.15

Socio-economic development as a determinant of migration transition in Central and Eastern European Countries

ŁUKASZ KAROL BUGOWSKI

corresponding author
Department of Socio-Economic Development, Faculty of Economics and Finance, University of Białystok, Warszawska 63, 15-062 Białystok
l.bugowski@uwb.edu.pl
ORCID: 0000-0002-8347-0723

Abstract

Motivation: A concept that links the question of the intensity and direction of migration process with the process of socio-economic transformation is the migration transition theory. The migration transition comprises two phases. In the first phase, there is a significant increase in emigration processes due to the intensely increasing birth rate. In the second phase, on the other hand, an increase in immigration processes is observed, which is preceded or accompanied by a zero or negative natural increase. Currently, a similar change from negative to positive net migration balance can be observed in the countries of Central and Eastern Europe.

Aim: The aim of this article is the evaluation of the intensity and directions migration processes in the countries of Central and Eastern Europe. The research question is whether the positive net migration balances achieved by the countries of Central and Eastern Europe can be considered as confirmation that these countries are in the second phase of the migration transition. The research question is validated by analysing statistical data (Eurostat) and the results of the European Social Survey, which is preceded by a review of the literature in question.

Results: As a result of the progressive socio-economic development, Central and Eastern Europe is attracting new residents. The scale of this phenomenon is evidenced not only by the number of registered migrations, but above all by the number of first residence permits for work, education and family reasons. Stable economic growth and increasing labour shortages have created ideal conditions for labour immigration in recent years. It can therefore be concluded that the socio-economic development of the macro-region under study has contributed to the second stage of the migration transition, characterised by a positive net migration balance.

Keywords: migration, migration transition, crude rate of net migration, Central and Eastern Europe
JEL: J11, J15, R10

1. Introduction

One of the contemporary global trends shaping socio-economic life is migration. While it can be noted that the share of migrants in the global population has remained more or less the same at 2.8%-3.6% over the last quarter century (McAuliffe and Oucho, 2024, p. 8), the issue of migration has attracted the attention not only of academia but also of the general public. Indeed, 'population migration is a big deal - so big that it shapes the politics of the United States and much of Europe' (Duflo and Banerjee, 2022, p. 25). This is because migration, unlike other demographic categories, is mostly explained by differences in the level of socio-economic development between receiving and sending regions of migrants. Moreover, most migration processes directly influence the transformation of social structures (Wiśniewski, 2020, p. 15), which has socio-economic implications.

A concept that links the question of the intensity and direction of migration process with the process of socio-economic transformation is the migration transition theory. Its origin should be linked to the example of Western Europe, which after World War II became an area with a positive net migration balance after many decades of emigration of citizens, in particular to the United States (Chesnais, 1986). Essentially, the migration transition comprises two phases, which are correlated with the phases of the demographic transition. In the first phase, there is a significant increase in emigration processes, due to the intensely increasing birth rate. This is a consequence of the falling death rate while the birth rate remains high. In the second phase, on the other hand, an increase in immigration processes is observed, which is preceded or accompanied by a zero or negative natural increase. Bearing in mind the positive net migration in the second phase, Dassetto distinguished three sub-phases. The first sub-phase involves the influx of low-skilled workers from countries with low levels of socio-economic development. The second sub-phase concerns reunification of migrant families, resulting in

numerous social tensions and increasing pressure on social infrastructure. The last sub-phase is related to a long-term process of immigrant integration and full participation in socio-economic life (Dassetto, 1990; Okólski, 2012).

Currently, a similar change from negative to positive net migration balance can be observed in the countries of Central and Eastern Europe. Comparing 2014 with 2022 in the group of countries studied in the article, the change from a negative migration balance to a positive one occurred in Bulgaria, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania and Slovakia. In the case of Czechia and Slovenia, the indicator reached positive values in both 2014 and 2022. As a result, the aim of this article is the evaluation of the intensity and directions of migration processes in the countries of Central and Eastern Europe. At the same time, it should be noted that the current increase in immigration in the studied macro-region is accompanied by increasing instability of the macroeconomic and political environment, while 'the speed of change seems to be as, if not more, transformative than its direction itself' (Krastev, 2024). This is not without its impact on the intensity and sustainability of migration processes. Therefore, the research question is whether the positive net migration balances achieved by the countries of Central and Eastern Europe can be considered as confirmation that these countries are in the second phase of the migration transition? In particular, are there indications that the positive net migration balances will be sustainable and long-term in accordance with the delimitation proposed by Dassetto? Similarly, the question of how the societies of the Central and Eastern European countries perceive themselves in terms of migration is also relevant. That is, whether they see themselves as emigration or immigration countries, and what consequences of the influx of immigrants are perceived in the countries surveyed. An analysis of openness to migration and an assessment of the impact of migrants on economic and social life, as expressed by the opinions of the inhabitants of the countries surveyed, may provide an indication of the long-term nature of the reversal of migration flows in favour of immigration.

The article is divided into four main sections. The first section discusses the literature on the demographic transition, i.e., the link between the socioeconomic transformation process and the directions and intensity of migration. The second section presents the research method, the sources used (Eurostat, European Social Survey), and identifies the countries under analysis. The next section presents the results of the analysis and conclusions regarding the link between the socio-economic transformation and demographic variables related to migration in selected Central and Eastern European countries. The final section summarizes the conducted analysis and answers to the research questions.

2. Literature review

Migration processes, although strongly correlated with the level of socio-economic development in terms of direction and intensity, are also linked to phases of demographic transition. The birth rate depends on the phase of demographic transition that a given country is in and, consequently, what number of people may become potential emigrants. Similarly, if a country has a negative birth rate, the intensity of emigration decreases and the number of immigrants increases.

The first demographic transition is characterised by an increase in birth rates and a decrease in death rates. As a result, there is a large natural increase, which declined over time towards a stationary population. This is linked to the transition from traditional reproduction to so-called modern reproduction, thanks, among other things, to birth control. The second demographic transition, on the other hand, emphasises the discontinuity of the transition and concerns demographic behaviour related not only to fertility but also to nuptiality. In particular, attention is drawn to the change in living conditions and attitude to having children, which is characteristic of most developed countries. In addition, remote communication technologies and mass media are spreading new views and attitudes in all regions of the world (Lesthaeghe and Surkyn, 2004, p. 22). In the second phase, the low fertility rate is not cyclical, but stable and determined by changes in values, e.g. the need for self-fulfilment, social acceptance of diverse lifestyles. Although the concepts of demographic transition do not directly take into account the impact of migration on the population, it is possible to find statements in the literature that low fertility naturally leads to an increase in immigration, while emigration reaches its maximum at the peak of the population's demographic development (Coleman, 2006, p. 402). In this situation, emigration has become the easiest regulator of population size, which helps to prevent pauperisation and lack of funds for living for a large part of the population (Okólski, 2021, p. 152).

Bearing in mind the facts mentioned above, migration is mostly explained by the difference in the level of socio-economic development between migrant-receiving and migrant-sending regions. The impact of socio-economic development on migration opportunities is positive but non-linear and resembles the S-curve typical of diffusion processes, i.e. it first increases rapidly, then stagnates or decreases, but never returns to low values. This is because socio-economic development entails an increase in life aspirations of citizens. Initially, this goes along with rapidly accelerating emigration, which declines only when the gaps in personal and professional opportunities between sending and receiving countries decrease significantly. At the

same time, as the original sending countries develop socio-economically, they gradually become more attractive to migrants from poorer countries. It can therefore be concluded that, as societies develop socio-economically, they tend to go through a characteristic sequence of migration processes (Haas, 2010, p. 19).

A concept that explains long-term structural changes in migration patterns by referring to processes of social and economic transformation, is the migration transition theory (Haas, 2010, p. 11). This concept makes international mobility easier to understand, while its name is used in different contexts, which causes ambiguous use (Okólski, 2021, p. 154). Similarly, the meaning of the concept of migration transition has evolved over time. In the 1970s, the idea of transition was associated with the process of modernisation. It was noted that there were specific patterns of upward mobility in space and that their regularity was an important component of the modernisation process (Zelinsky, 1971, pp. 221–222). Wilbur Zelinsky linked the different types of migration - rural-urban, urban-urban, borderland, international and circular - to a vital transition and corelated it with changes in society, i.e. premodern traditional society, early transitional society, late transitional society, advanced society and future super-advanced society (Zelinsky, 1971, pp. 230–231). Despite criticisms of the idea of a modernisation process, it should be recognised that this was the first attempt to place migration in the same framework as the other two demographic variables, i.e. fertility and mortality. Thus, it complemented the demographic transition theory, which took births and deaths into account. The transition could only be a true demographic transition if a third migration variable was included (Skeldon, 2012, p. 157)

The term migration transition was introduced largely independently of demographic transition theory, to describe the transition from net emigration to net immigration in the countries of western and southern Europe and eastern Asia (Chesnais, 1986; Fields, 1994; King et al., 1997). Chesnais is considered to be the main developer and populariser of the concept of migration transition, having introduced the idea of migration transition as a specifically European phenomenon, associated with the European model of modernisation. On the basis of this concept, it can be concluded that modern Europe is experiencing a long-term three-stage demographic cycle, i.e.: long-term stabilisation or stagnation of population, systematic population growth over two or three generations, and long-term stabilisation (or stagnation) of the state of population (at this stage without significant fluctuations over shorter periods), albeit at a much higher level than in stage one. The second stage of the cycle relates directly to the theory of demographic transition. Parallel to this cycle is the migration cycle, the first and third stages of which are characterised by a relatively low intensity of international migration. As a result, the phases of the migration transition are strongly dependent on, or

at least correlated with, the individual phases of the demographic transition (Okólski 2021, pp. 154-155).

Although it is likely that Chesnais was not familiar with Zelinsky's theory as published in Geographical Review, a specialised journal for geographers (Okólski, 2021, p. 164), links can nevertheless be found with Zelinsky's model (Skeldon, 1997, p. 52). As countries went through significant vital transitions, upward pressure was brought on wages. Consequently industrialisation moved to areas where labour was cheaper. In addition, capital-intensive industries associated with the development of economy based on knowledge and information technology were growing. As a result, not all the skilled labour required for this type of economy could be generated locally and global labour market for skills emerged. The above processes formed the basis on which the era of mass immigration appeared. The importance of the international migration transition model was that, unlike Zelinsky's transition, it was clearly linked to changes in the size and composition of labour force, as well as to changes in the economy. This helped to further explain the links between mobility and socio-economic change (Skeldon, 2012, p. 161).

The level of international migration, unlike other demographic characteristics, is explained by the difference between the level of socio-economic development of the receiving and sending migrants' countries (Wisniewski, 2020, p. 15). The higher level of development of the receiving country is reflected in various aspects of economic and social life relevant to potential migrants (for more details, see Truskolaski and Bugowski, 2024; Wickramasinghe and Wijitapure Wimalaratana, 2016, p. 16–18). Beginning in the late 19th century, the prevailing view in the literature is that people will move from low-income areas to high-income areas (Ravenstein, 1889). Similarly, neoclassical and other models of migration developed in the 20th century largely explain migration through geographic differences in wage levels as the primary motivating factor for the influx of migrants (Hicks 1932; Fei and Ranis 1961). Later scholarly work additionally takes into account income disparities arising also from non-wage elements (Harris and Todaro, 1970). Attention has also been paid to social, cultural or psychological factors, but in addition to the key role of economic factors (Todaro, 1976).

In general, it can be said that migration theories based on or drawing on neoclassical theories link the migration process to the economic calculus of profits and losses. However, wage and income differentials did not provide a complete answer to the causes of migration. A shift from the individual to the household perspective can be seen in The New Economics of Labor Migration (NELM). NELM conceptualizes migration as a collective household strategy aimed at overcoming market imperfections and spreading income risk, rather than merely a reaction of income-maximizing individuals to expected wage differentials (de Haas, 2011, p. 9). In other words, some causes of migration should not be analysed at the individual level but at

the group level (family, community, society), because they are embedded in and reproduced by patterns of interpersonal relationships. In this context, the cumulative theory of migration is worth mentioning. The first migrants come from the middle levels of socioeconomic hierarchies, which means they have adequate resources to cover the costs and risks of emigration. Family and friends then leverage ties with these migrants to reduce the costs and risks associated with movement. As a result, migration networks are created, which increase the benefits of migration (Docquier and Rapoport, 2008, pp. 20–21). Therefore, it can be concluded that migration is determined not only by economic factors, but also by social and family ones. Furthermore, contemporary studies on the causes of migration differentiate motivation, for example, depending on the migrant's age. Depending on the stage of life, reasons for migration may include employment prospects, education, family, or lifestyle (Bernard and Kalemba,2022). Nevertheless, it should be noted that economic and social factors (prospects for higher wages, improved living standards, personal development, job opportunities, good welfare standards and labour demands) remain the main reasons for the decision to migrate (Urbański, 2022, p. 13).

In summary, it can be concluded that there is a relationship between the level of economic development and population mobility patterns. At the same time, it should be stressed that the direction and intensity of migration are not entirely explained by the level of socio-economic development. Factors of a cultural or political nature are important in some cases. For example, the rise of populist or nationalist rhetoric may induce certain segments of society to emigrate, which is particularly true of managers or highly skilled workers (Vezzoli, 2024, p. 8). However, it can be assumed that such events are of an extra-coordinate nature that do not undermine the sense of looking for regularities in migration flows, despite important methodological limitations. On this basis, it is justified to conclude that a high level of economic development implies the emergence of an integrated migration system consisting of both global and local movements. In contrast, a low level of economic development corresponds to migration of a local nature (Skeldon, 1997, p. 52).

3. Methods

The research questions are (1) whether the positive net migration balances achieved by the countries of Central and Eastern Europe can be considered as confirmation that these countries are in the second phase of the migration transition, and (2) are there indications that the positive net migration balances will be sustainable and long-term. These questions were validated by analyzing statistical data (Eurostat). The third research question, i.e. (3) how the societies of the Central and Eastern European countries perceive them-

selves in terms of migration, was answered based on the results of the European Social Survey (ESS). Data analysis was preceded by a review of the literature in question.

Eleven Central and Eastern European countries were included in the survey. It should be noted that this area is not clearly defined in the scientific literature. In this article it is assumed that the area consists of the following members of the European Union: Estonia, Latvia, Lithuania, Poland, Czechia, Slovakia, Hungary, Romania, Bulgaria, Slovenia and Croatia. The rationale for the above delimitation is common political and economic experiences, e.g. the transition from a command economy in the 1990s and the accession to the European Union at the beginning of the 21st century. Linking the relevant and common socio-economic events of the countries under study to the net migration balance is in line with the assumptions of migration transition theory. However, it should be borne in mind that although the migration transition process is common to European societies, the countries of Central and Eastern Europe form a cohort of countries where, for political and economic reasons, the process has been delayed for at least several decades (Okólski, 2021, p. 157), which justifies the selection of the countries included in the analysis.

With regard to the choice of years adopted for the analysis, 2014 and 2022 were chosen as marking the period when most of the studied countries went from negative to positive migration balance. In addition, in 2014, all of the studied countries were already members of the EU (Croatia entered the EU on July 1, 2014 as the last of the studied countries). In some cases, depending on the availability of data, the analysis was extended to 2008 and 2004, particularly with regard to demographics.

4. Results

With regard to the countries of Central and Eastern Europe, there were doubts whether they would follow a similar path as the countries of Western Europe. It should be noted that the peak of emigration in these countries did not coincide with their peak in population growth. The highest intensity of migration processes in the countries of Central and Eastern Europe followed policy decisions related to accession to the European Union (Black et al., 2010, p. 18). In other words, after accession to the Community, the increased level of emigration was due to the pre-existence of the so-called 'migration overhang', defining the number who were ready to emigrate but did not have the opportunity to do so for political reasons (Iglicka, 2020). Thus, on this basis, it can be concluded that in the countries of Central and Eastern Europe, the highest intensity of migration was not correlated with a demographic cycle characterised by high birth rates. On the contrary, the peak of immigration occurred in years when the countries studied achieved low fertility and natural change of population rates (Table 1.).

Nowadays, in Central and Eastern Europe, the number of immigrants exceeds the number of emigrants, which manifests itself in a positive net migration rate. According to Eurostat definitions regarding international migration statistics, an immigrant is considered to be a person who stays in his/her country of destination for a period of 12 months or more, while an emigrant is a person who leaves his/her country of previous residence for a period of 12 months or more (Eurostat, 2025c). At the same time, it should be noted that demographers, who introduced the concepts of the migration transition such as Zelinsky, did not explicitly define any numerical measures to describe this process. However, it can be assumed that while the demographic transition is described by fertility and mortality rates, there is also a need to analyse the migration transition using indicators - in this case migration rates (Wei, Jinju, 2021, p. 195). Data describing the net migration rate per 1000 inhabitants in the macro-region under study are included in Table 1.

It can be noted that the macro-region under study is currently experiencing a positive net migration rate. Despite the fact that for the Czechia, Estonia, Croatia, Hungary, Romania, Slovenia or Slovakia, the number of emigrants in 2022 was higher than in 2014, the number of immigrants in 2022 was higher than the number of emigrants in every country examined in the article (Table 2.). As a result, there is a reversal of the balance of migration flows. This is similar to the process observed in Western Europe in the second half of the 20th century, when overpopulation and emigration gave way to mass immigration (Okólski, 2021, p. 154). The reason for the change in migration flows is mainly due to the increasing level of socio-economic development in Central and Eastern Europe. In recent years, stable economic growth and increasing labour shortages have created ideal conditions for labour immigration, initially in low-paid domestic services and seasonal work in agriculture and construction, and later also in other sectors of economy (Górny and Kaczmarczyk, 2018).

A review of basic data describing socio-economic development confirms positive changes in the studied countries in this regard (Table 3). In the period 2024, the PPS indicator (purchasing power standard per inhabitant in percentage of the EU27 average) for selected countries ranged from 37% in Bulgaria to 76% in Estonia. Compared to 2014, the indicator level increased in all countries, i.e., from 3 percentage points to 20 percentage points in Lithuania. The greater attractiveness of the studied countries for immigrants as places to work and live is evidenced by indicators relating to unemployment and the standard of living. In the former case, the unemployment level ranged from 2.2% in Czechia to 6.9% in Latvia. Compared to 2024, the unemployment level decreased in all studied countries, i.e., from 1.7 percentage points in Estonia to 10.5 percentage points in Croatia. In the latter case, the level of people at risk of poverty or social exclusion ranged from 11.8% in Czechia to 34.4% in Romania. Compared to 2015, the level of the indicator

in question decreased in all countries except Estonia (an increase of 1.6 percentage points), i.e. from 0.8 percentage points in Slovakia to 12.2 percentage points in Hungary. A comprehensive discussion of socio-economic development indicators is a broad topic and would require a separate article.

It is not only positive net migration ratio that testify to the increasing level of socio-economic development and the rebalancing of migration flows. The immigration attractiveness of countries is also evidenced by residence permits issued to foreigners for professional, educational and family reasons. Taking Poland as an example, it can be noted that not only is a positive net migration rate recorded for registered migration since 2016, but also the highest number of first residence permits are issued to foreigners in the entire EU. On this basis, it can be concluded that Poland is currently undergoing a change in its migration system (Fihel, 2023, p. 271). The situation is similar in other countries of the studied macro-region (Table 4.). In 2022, the number of first residence permits exceeded one million in the studied macro-region, which is an almost fourfold increase compared to 2008. At the level of individual countries, a significant increase in the number of residence permits issued in 2022 can also be observed, particularly in Poland (44-fold increase). The exception is Czechia, where the number of permits slightly decreased by 12% compared to 2008 levels.

An important element in the analysis of residence permits for foreigners is the period of validity. Central and Eastern European countries differ in their permit granting policies. In the vast majority of cases, permits with a validity period of more than 12 months dominate the structure (from 50.1% in Bulgaria to 97.8% in Estonia). Only in the case of Poland and Croatia the share of long-term permits does not exceed one third and amounts to 21.7% and 28.1% respectively. For these countries, permits with a validity period of 6 to 11 months predominate. Overall, it can be seen that compared to 2014, the share of permits over 12 months is increasing in all countries (Table 5.).

Additionally, it is reasonable to ask to what extent temporary migration will lead to sustainability of migrants' integration into the societies of the countries studied. In other words, in which sub-phase of the second phase of the migration transition according to Dassetto's delimitation the countries under study are. An analysis of the reasons for residence permits can provide some information on the potential transformation of temporary residence into a permanent integration process in the host society (Chart 1.).

The dominant reason in most of the countries surveyed is employment (ranging from 28% in Estonia to 93% in Croatia). Family issues are another reason for granting residence to foreigners, with the highest share in Bulgaria, Czechia and Latvia (34%, 26% and 25% respectively). Education is also an important reason for a residence permit, in particular for Latvia (23%) and Czechia (19%). It should be noted that when comparing the data on first residence permits in 2022 in relation to 2014, first of all, it can be seen that they

have doubled. In addition, the structure of the reasons for issuing permits has changed (Chart 2.), i.e. in 2014 only in Poland the dominant reason was employment. On this basis, it can be concluded that in the period 2014–2022, the Central and Eastern European countries' economy developed a sustained and dynamically growing demand for labour force, which corresponds with an increasing number of foreigners. In addition, it can be assumed that the maintenance of a high share of education and family-related causes in 2022 for countries such as Latvia, Estonia and Czechia may indicate that they have reached the second sub-phase according to Dassetto's delimitation of family attachments and increased pressure on social infrastructure.

The presented data on registered migration and residence permits for foreigners indicate that the countries of Central and Eastern Europe have reached the second phase of the migration transition, i.e. the number of immigrants exceeds the number of emigrants. In view of the indisputability of the statistical data, it is also relevant to ask whether the societies of the countries studied are aware of the reversal of migration trends and how immigration is perceived by them? In this context, the three-phase concept of the second stage of migration transition mentioned in the introduction can correspond with attitudes of the host country population. As in Dassetto's concept, three phases can be distinguished in the process of public perception as an immigrant country. The initial phase is characterised by disbelief, ignorance and even denial. In other words, societies are either unaware of the influx of emigrants or, given previous experiences of long-term emigration, there has not been any mental change in the aspect of immigration yet. The second phase involves legal solutions that integrate immigrants into the structure of society with a certain level of public discontent. In this phase, immigrants not only become visible in society, but also, through e.g. family reunification they trigger an increase in pressure on the wider social infrastructure, i.e. from security to education and social assistance. The final phase comprises a period of deep and sustainable integration, although it should be emphasised that this is a model situation (Düvell, 2018, p. 196).

A full answer to the question of perceptions of immigration in host countries would require interdisciplinary quantitative and qualitative research. However, the results of the European Social Survey (ESS, Round 10, 2020-2021) are worth mentioning here. Latvia and Romania were not included in the survey. Among the numerous modules of the survey, questions on immigration and its impact on economy can be highlighted (Chart 3).

When asked whether immigration is beneficial to the economy, respondents chose an answer on a scale of 1 to 10, with 1 meaning definitely unfavourable and 10 definitely favourable. In all countries of the surveyed macroregion, the predominant answer was 5 (from 19.6% in Slovakia to 26.8% in Estonia). Among the countries where respondents most often indicated an answer above 5 were Poland (54.1% of answers above 5) and Estonia (46.7%

above 5). Residents of Slovakia and Hungary perceive immigration the least beneficial for economy (55.3% of responses ranging from 0 to 4).

The overall assessment of the impact of immigration on life in a country was expressed in the question, whether the country has become a better or worse place to live as a result of the influx of immigrants. Here, as in the question on the economy, the predominant answer was 5 (ranging from 23.4% in Czechia to 36.8% in Estonia). Residents of Poland and Croatia were the most positive about the impact of immigrants, with 50.6% and 42.1% of responses above 5 respectively. It can be seen that in all countries except Croatia, the positive impact of immigrants was several percentage points higher for the question on the economy than for the question on living conditions in the country in general. The highest number of responses below 5 indicating a negative impact of immigrants in a country was recorded for Czechia and Hungary, i.e. 51.6% and 49.3% respectively.

The ESS also included questions on openness of residents to immigrants, with a distinction between foreigners of the same race or ethnic group and others. In the first case (Chart 5), the most open to arrival and residence of foreigners were citizens of Poland and Slovenia (82.9% and 82% of the responses allow a certain number of people and allow a large number of people respectively). The least welcoming to foreigners were the citizens of Hungary and Czechia (59.8% and 54.9% of the responses allow no-one and allow only a few, respectively).

Inhabitants of the surveyed macro-region were less open in relation to foreigners of a different race or ethnic group. In this case, the most open were residents of Poland and Croatia (64.9% and 61.3% of the responses allow a certain number of people and allow a large number of people, respectively).

It should be noted that the residents of Croatia were the least dependent in their response on race or ethnic group, i.e. 61.3% of responses to allow a certain number of people and to allow a large number of people in relation to another race or ethnic group and 71.2% in relation to the same race or ethnic group. In contrast, residents of Hungary and Czechia were definitely closed to foreigners of a different race or ethnic group (83.5% and 72.1% of the responses allow no-one and allow only a few, respectively).

In summary, based on the European Social Survey, the Baltic States, Slovenia, Croatia and Poland were the most open to immigrants and perceived the positive impact of immigration on the economy and living conditions. In contrast, Czechia and Hungary were the least open to immigrants and sceptical about the positive impact of migration on the economy and living conditions.

5. Conclusion

Based on the analysis, it can be concluded that the macro-region under study is currently experiencing a positive net migration rate. In the past, unlike many countries that experienced migration changes in Western Europe, Southern Europe or Southeast Asia, high intensity of emigration was not primarily due to the demographic cycle, but was conditioned by socio-political events. Indeed, it can be noted that high emigration occurred after accession of the respective countries to the European Union with simultaneous low values of natural increase, which was caused by occurrence of the so-called migration overhang. However, stable economic growth and increasing labour shortages due to the mass exodus abroad have created ideal conditions for labour immigration in recent years. Consequently, Central and Eastern Europe from a macro-region being traditionally an area of mass emigration, has changed into a place attracting new residents.

The scale of this phenomenon is evidenced not only by the number of registered migrations, but above all by the number of first residence permits for work, education and family. It can therefore be concluded that the socio-economic development of the macro-region under study and the accompanying demand for labour force has contributed to the second stage of the migration transition, characterised by a positive net migration balance. However, it can be noted that, according to Dasseto's concept, particular countries are in different sub-stages of this stage. It seems reasonable to conclude that the first sub-phase involving the inflow of low-skilled workers from countries with a low level of socio-economic development is occurring in Poland or Romania, as may be evidenced by the dominant share of employment among the reasons for issuing residence permits to foreigners, the relatively high share of permits of less than 12 months' duration compared to the macro-region and the highest openness of the population to foreigners. The beginnings of a second sub-phase, involving the reunification of immigrant families, which causes numerous social tensions and increased pressure on social infrastructure, can be observed in Czechia, Estonia and Latvia. The rationale for this is the high share of education and family issues among the reasons for issuing residence permits, the high share of residence permits for foreigners with a duration of more than one year (about 90 per cent) and the relatively lower openness to migrants than, for example, in Poland, which may indicate emerging social tensions. For the remaining countries, it is difficult to clearly identify the nature of migration changes. Slovenia, for example, among the countries surveyed has the lowest level of net migration ratio and one of the lowest rates of issuing residence permits to foreigners per 1,000 inhabitants, with a high share of education and family

reasons in the issuance of permits. Hungary, on the other hand, has the lowest net migration balance (next to Slovenia) and the highest share of employment among the reasons for issuing residence permits. At the same time, it remains a reluctant country towards foreigners, i.e. as much as 37.8% do not accept any foreigner of a different race or ethnic group, another 45.7% accept only a few. With such an attitude of citizens, it seems reasonable to ask about the long-term nature of the positive net migration ratio in general. Nevertheless, it can be concluded that the studied macro-region as a whole has a positive net migration balance. Unless unforeseen events of an economic or political nature occur, it can be assumed that this trend will continue in the coming years. This assumption is not only justified by the analysis of migration data, but it is also conditioned by other demographic processes (ageing population) and the economy's need for labour force.

In addition to these considerations, it should be noted that migration research has its limitations. First, accurately determining migration levels is difficult, given the level of illegal migration. Second, the decision to migrate is multifaceted despite the dominant role of economic factors. Third, despite the finding that the countries studied achieve positive net migration levels, it is justified to question regional variations within the countries studied. In particular, whether positive net migration is characteristic of all regions within a given country or is concentrated in selected areas. This issue should be the subject of a separate study.

References

Bernard, A., & Kalemba, S. (2022). Internal migration and the de-standardization of the life course: A sequence analysis of reasons for migrating. Demographic Research, 46, 337–354. https://doi.org/10.4054/DemRes.2022.46.12.

Black, R., Engbersen G., Okólski, M., & Panțîru, C. (2010). *A Continent Moving West? EU Enlargement and Labour Migration from Central and Eastern Europe*. Amsterdam University Press.

Chesnais, J.C. (1986). *La transition démographique. Etapes, forms, implications économiques. Etude de series temporelles (1720-1984) relatives à 67 pays*. Presses Universitaires de France.

Coleman, D. (2006). Immigration and Ethnic Change in Low-Fertility Countries: A Third Demographic Transition. *Population and Development Review,* 32(3), 401–446. Advance online publication http://www.jstor.org/stable/20058898.

Dassetto, F. (1990). Pour une theorie des cycles migratoires. In A. Bastenier, & F. Dassetto (Eds.), *Immigration et nouveaux pluralismes: une confrontation de sociétiés* (pp. 11–40). Brussels: Armand Colin.

Docquier, F. & Rapoport H. (2008). Skilled migration: The perspective of developing countries. In J. Bhagwati & G. Hanson. *Skilled Migration: Prospects, Problems and Policies*. New York: Russell Sage Foundation.
Duflo, E., & Banerjee, A.V. (2022). *Good Economics. New Solutions to Global Problems*. Warsaw: Agora Publishing.
Düvell, F. (2018). From migration transition to integration challenge. *New Perspectives on Turkey*, 58, 179–200. Cambridge University Press. https://doi.org/10.1017/npt.2018.5.
European Social Survey (2020-2021). *Round 10, Policy Area*. Retrieved 20.01.2025 from: https://esspl.shinyapps.io/ess_app/.
Eurostat (2024a). Emigration by age and sex. https://doi.org/10.2908/MIGR_EMI2.
Eurostat (2024b). Fertility rates by age. https://doi.org/10.2908/DEMO_FRATE.
Eurostat (2024c). First permits by reason, length of validity and citizenship. https://doi.org/10.2908/MIGR_RESFIRST
Eurostat (2024d). First residence permits – per thousand persons. https://doi.org/10.2908/MIGR_RESPOP.
Eurostat (2024e). First residence permits by reasons – % of total first residence permits. https://doi.org/10.2908/MIGR_RESFPC.
Eurostat (2024f). Immigration by age and sex. https://doi.org/10.2908/MIGR_IMM8.
Eurostat (2024g). Population change - Demographic balance and crude rates at regional level. https://doi.org/10.2908/DEMO_R_GIND3.
Eurostat (2025a). Gross domestic product (GDP) at current market prices by NUTS 3 region. https://doi.org/10.2908/NAMA_10R_3GDP.
Eurostat (2025b). Persons at risk of poverty or social exclusion by age and sex. https://doi.org/10.2908/ILC_PEPS01N.
Eurostat (2025c). Statistics explained. Retrieved 29.07.2025 from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Migration/pl.
Eurostat (2025d). Total unemployment rate. https://doi.org/10.2908/TPS00203.
Fei, J.C.H. and Ranis, G. (1961). A Theory of Economic Development. *The American Economic Review,* 51, 533–565.
Fields, G.S. (1994). The migration transition in Asia. *Asian and Pacific Migration Journal*, 3(1), 7–30.
Fihel, A., Janicka, A., & Okólski, M. (2023). Predicting a Migration Transition in Poland and its Implications for Population Ageing. *Central and Eastern European Migration Review*, 12(1), 265–292. https://doi.org/10.54667/ceemr.2023.15.
Górny, A., & Kaczmarczyk, P. (2018). A Known But Uncertain Path: The Role of Foreign Labour in Polish Agriculture. *Journal of Rural Studies* 64, 177–188. https://doi.org/10.1016/j.jrurstud.2017.12.015.
de Haas, H. (2010). Migration transitions: a theoretical and empirical inquiry into the developmental drivers of international migration. *Working*

Papers, International Migration Institute. Advance online publication: https://heindehaas.org/wp-content/uploads/2015/05/de-haas-2010-migration-transitions-imi-wp-24.pdf.

de Haas, H. (2011). The determinants of international migration. Conceptualising policy, origin and destination effects. IMI Working Papers Series 2011, No. 32.

de Haas, H., Fransen, S., Natter, K., Schewel, K., & Vezzoli, S. (2020). Social Transformation. *IMI working papers*, 166(16), Advance online publication: https://www.migrationinstitute.org/publications/social-transformation.

Harris, J.R., & Todaro, M.P. (1970). Migration, Unemployment and Development: A Two-Sector Analysis. The American Economic Review, 60(1), 126-142. http://www.jstor.org/stable/1807860.

Hicks, J.R. (1932). The theory of wages. London: Macmillan.

Iglicka, K. (2019). *Poland's post-war dynamics of migration*. London and New York: Routledge.

King, R., Fielding, A., & Black, R. (1997). The international migration turnaround in Southern Europe. In King, R, & R. Black (Eds.), *Southern Europe and the New Immigrations Sussex* (pp. 1–25). Brighton: Academic Press.

Krastev, I. (2024). We are suffering from end of times syndrome, interview with: Mandeville L., Gazeta Wyborcza, Europa cycle. Retrieved 4.01.2025 from: https://wyborcza.pl/7,179012,31527971,ivan-krastev-cierpimy-na-syndrom-konca-czasow-to-grozniejsze.html.

Lesthaeghe, R., & Surkyn, J. (2004). *When History Moves On: The Foundations and Diffusion of a Second Demographic Transition*. Brussels: Free University of Brussels.

McAuliffe, M., & Oucho, L.A. (2024). *World Migration Report 2024*. Geneva: International Organization for Migration (IOM).

Okólski, M. (2012). Transition from Emigration to Immigration. Is It the Destiny of Modern European Countries? In M., Okólski (Eds.), *European Immigrations. Trends, Structures and Policy Implications* (pp. 23–44). Amsterdam: Amsterdam University Press.

Okólski, M. (2021). The Migration Transition in Poland. *Central and Eastern European Migration Review* 10(2), 151–169. https://doi.org/10.17467/CEEMR.2021.16.

Ravenstein, E.G. (1889). The laws of migration. *Journal of the Royal Statistical Society* 52, 214–301.

Skeldon, R. (1997). *Migration and development: A global perspective*. Essex: Longman.

Skeldon, R. (2012). Migration Transitions Revisited: Their Continued Relevance for the Development of Migration Theory. *Population, Space and Place* 18(2): 154–166. https://doi.org/10.1002/psp.667.

Todaro, M.P. (1976). Migration and economic development: a review of theory, evidence, methodology and research priorities. Occasional Paper 18. Nairobi: University of Nairobi. http://erepository.uonbi.ac.ke/handle/11295/2017.

Truskolaski, T., & Bugowski, Ł. (2024). Socio-economic determinants of development in reference to the change in population size in Central and Eastern Europe between 2008 and 2019. *Economics and Environment*, 89(2), 664. https://doi.org/10.34659/eis.2024.89.2.664.

Urbanski, M. 2022. Comparing Push and Pull Factors Affecting Migration. *Economies,* 10, 21. https://doi.org/10.3390/economies10010021.

Vezzoli, S. (2024). Understanding Rural Migration in the Mid-Twentieth Century: Examining Dimensions of Social Change and their Effects in Cisternino, a Southern Italian Town. *Journal of Migration History*, 10(1), 1–41. https://doi.org/10.1163/23519924-10010001.

Wei, C., & Jinju, L. (2021). Migration Transition in China, 1950-2015. *Chinese Political Science Review*, 7, 181–196. https://doi.org/10.1007/s41111-021-00193-2.

Wickramasinghe, A.A.I.N. and Wijitapure Wimalaratana (2016). International Migration and Migration Theories. *Social Affairs* Vol.1 No.5, 13–32.

Wiśniewski, R., Mazur, M., Śleszyński, P., & Szejgiec-Kolenda B. (2020). Impact of demographic changes in Poland on local development, Studies. *Prace Geograficzne,* 274, Warsaw: Committee for Spatial Economy and Regional Planning, Polish Academy of Sciences.

Zelinsky, W. (1971). The hypothesis of the mobility transition. *Geographical Review*, 61, 219-249.

Acknowledgements

Author contributions: author/authors has/have given an approval to the final version of the article. Author's total contribution to the manuscript: Ł.K.B (100%).

Funding: University of Bialystok

Appendix

Table 1. Selected demographics of Central and Eastern Europe 2004-2022

State	Fertility rate			Crude rate of natural change of population			Net migration rate per 1000 inhabitants plus statistical adjustment		
	2004	2014	2022	2004	2014	2022	2004	2014	2022
Bulgaria	1.33	1.62	1.65	-5.2	-5.8	-9.6	-2.1	-6.6	4.2
Czechia	1.23	1.53	1.64	-0.9	0.4	-1.8	1.3	2.1	30.9
Estonia	1.47	1.54	1.41	-2.7	-1.5	-4.2	-2.7	-0.5	29.5

State	Fertility rate			Crude rate of natural change of population			Net migration rate per 1000 inhabitants plus statistical adjustment		
	2004	2014	2022	2004	2014	2022	2004	2014	2022
Croatia	1.43	1.46	1.53	-2.2	-2.7	-6	-6.8	-4.3	11.7
Latvia	1.29	1.65	1.47	-5.1	-3.4	-7.9	-9.5	-3.5	25.5
Lithuania	1.27	1.57	1.27	-3.4	-3.7	-7.4	1.8	-0.1	3.8
Hungary	1.28	1.44	1.56	-3.7	-3.4	-4.9	-0.2	-0.3	0.2
Poland	1.23	1.32	1.29	-0.2	0	-3.9	-4.5	-1	5.6
Romania	1.33	1.56	1.71	-2	-2.8	-5	0.9	-0.2	6.9
Slovenia	1.25	1.58	1.55	-0.3	1.1	-2.3	-0.2	0.3	0.2
Slovakia	1.25	1.37	1.57	0.4	0.7	-1.3	3.4	-6.1	3

Source: Own preparation based on Eurostat (Eurostat, 2024b; Eurostat 2024g).

Table 2. Number of emigrants and immigrants in Central and Eastern Europe

State	Number of emigrants				Number of immigrants			
	2004	2008	2014	2022	2004	2008	2014	2022
Bulgaria	:	:	28 727	13 175	:	:	26 615	40 619
Czechia	34 818	51 478	28 468	31 764	53 453	108 267	29 897	347 429
Estonia	2 927	4 406	4 637	9 657	1 097	3 671	3 904	49 414
Croatia	6 812	10 638	20 858	46 287	18 383	16 883	10 638	57 972
Latvia	20 167	27 045	19 017	16 680	4 844	4 678	10 365	38 708
Lithuania	37 691	25 750	43 874	15 270	5 553	9 297	33 544	87 367
Hungary	3 820	9 591	42 213	58 408	24 298	37 652	54 581	94 148
Poland	18 877	30 140	268 299	228 006	9 495	15 275	222 275	275 515
Romania	:	302 796	172 871	202 311	:	138 929	136 035	293 024
Slovenia	8 269	12 109	14 336	20 956	10 171	30 693	13 846	35 613
Slovakia	1 586	1 705	3 644	4 468	4 460	8 765	5 357	5 463

Source: Own preparation based on Eurostat (Eurostat, 2024a).

Table 3. Selected socio-economic data of Central and Eastern Europe

State	Purchasing power standard (PPS) per inhabitant in percentage of the EU27 average		Total unemployment rate - percentage of population in the labour force (age class: from 15 to 74 years)		Persons at risk of poverty or social exclusion by age and sex (percentage of total population)	
	2014	2022	2014	2022	2015*	2022
Bulgaria	23	37	12,4	4,2	43,3	32,2
Czechia	57	74	6,1	2,2	13	11,8

State	Purchasing power standard (PPS) per inhabitant in percentage of the EU27 average		Total unemployment rate - percentage of population in the labour force (age class: from 15 to 74 years)		Persons at risk of poverty or social exclusion by age and sex (percentage of total population)	
	2014	2022	2014	2022	2015*	2022
Estonia	58	76	7,3	5,6	23,6	25,2
Croatia	39	48	17,3	6,8	24,4	19,9
Latvia	43	53	10,9	6,9	30	26
Lithuania	46	66	10,7	6	29,4	24,6
Hungary	41	49	7,5	3,6	30,6	18,4
Poland	40	49	9,2	2,9	22,5	15,9
Romania	28	41	8,6	5,6	44,5	34,4
Slovenia	68	75	9,7	4	17,7	13,3
Slovakia	53	56	13,1	6,1	17,3	16,5

* data regarding 2014 were unavailable
Source: Own preparation based on Eurostat (Eurostat, 2025a; Eurostat, 2025b; Eurostat 2025d).

Table 4. Residence permits for foreigners in Central and Eastern Europe

State	First residence permits per 1,000 inhabitants			Number of first residence permits		
	2008	2014	2022	2008	2014	2022
Bulgaria	0.52	1.22	2.38	3933	8795	15839
Czechia	5.91	3.37	5.04	61350	35458	53809
Estonia	2.9	2.45	6.25	3884	3222	8425
Croatia	:	0.79	14.87	:	3334	57330
Latvia	1.66	4.94	4.68	7706	9857	8790
Lithuania	3.54	2.47	11.72	5298	7252	31232
Hungary	3.73	2.15	7.12	37486	21188	68672
Poland	1.07	9.35	19.02	40896	355521	700264
Romania	0.94	0.52	2.22	19354	10294	42207
Slovenia	14.45	4.79	15.52	29215	9876	32781
Slovakia	1.49	1.02	5.05	8025	5510	27441

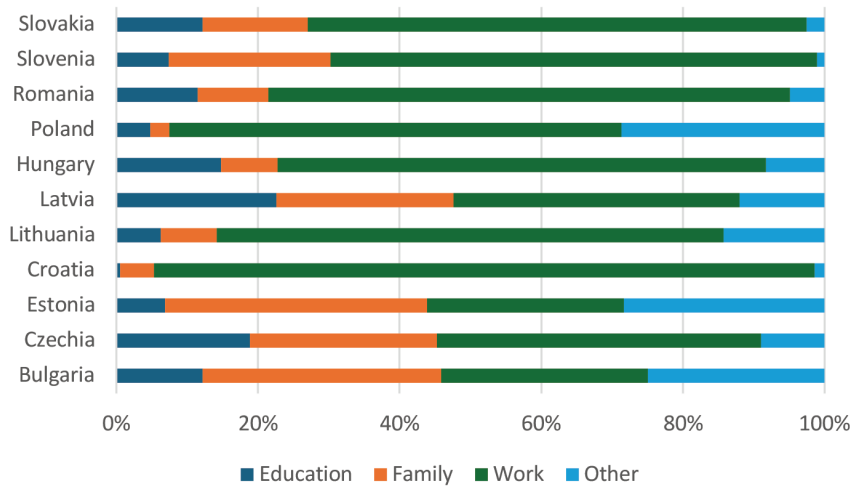
Source: Own preparation based on Eurostat (Eurostat, 2024c; Eurostat 2024d).

Table 5. Residence permits of foreigners by number and length of validity in Central and Eastern Europe in 2014 and 2022

State	Permits from 3 to 5 months		Permits from 6 to 11 months		Permits over 12 months	
	2014	2022	2014	2022	2014	2022
Bulgaria	876	290	4 434	7 606	3 485	7 943
Czechia	5 044	1841	3 573	5 201	26 841	46 767
Estonia	117	34	277	149	2 828	82 42
Croatia	276	13509	656	27 733	474	16 088
Latvia	327	308	8 743	3 731	787	4 751
Lithuania	163	262	922	1 073	6 167	29 897
Hungary	2 249	3073	6 086	10 745	12 853	54 854
Poland	105 372	59600	243 719	488 847	6 430	151 817
Romania	694	1409	2 090	4 924	7 510	35 874
Slovenia	1 062	2180	3 728	8 326	5 086	22 275
Slovakia	374	710	1 263	37 95	3 873	22 936

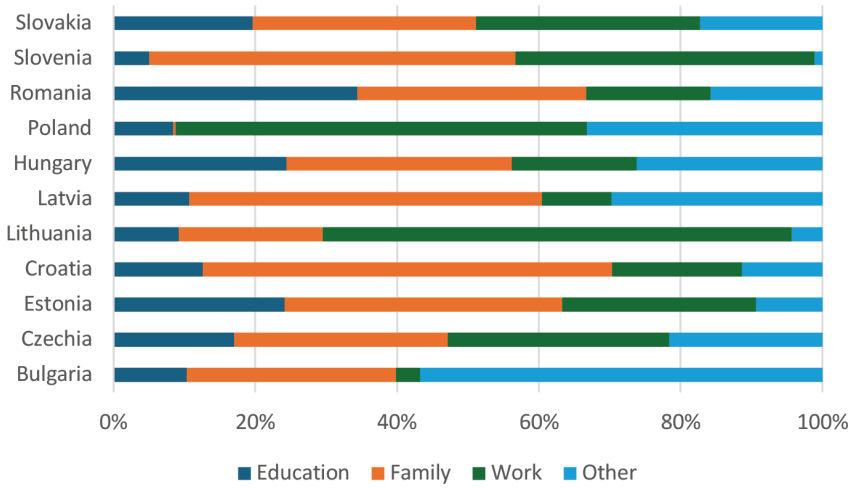
Source: Own preparation based on Eurostat (Eurostat, 2024c).

Chart 1. Reasons for first residence permit for foreigners in Central and Eastern Europe in 2022 (%)



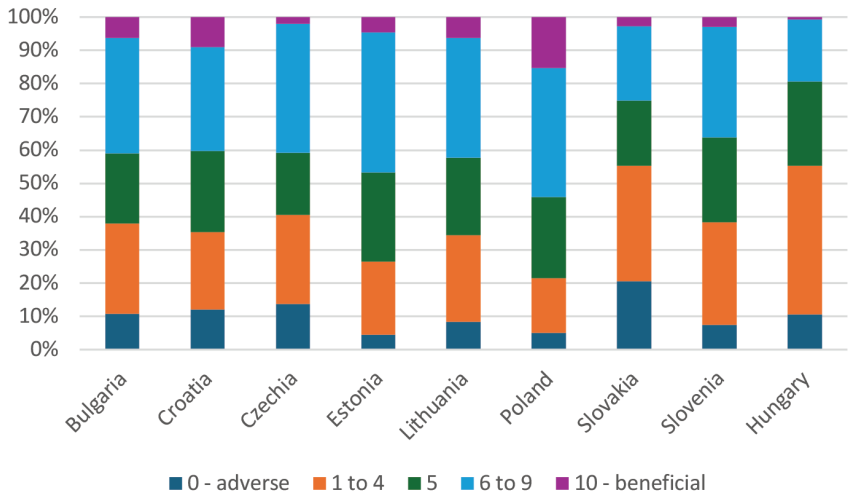
Source: Own preparation based on Eurostat (Eurostat, 2024e).

Chart 2. Reasons for first residence permit for foreigners in Central and Eastern Europe in 2014 (%)



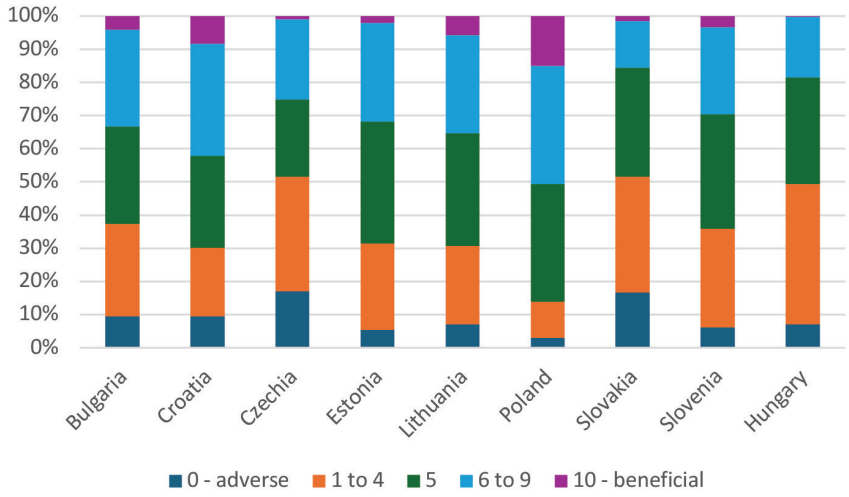
Source: Own preparation based on Eurostat (Eurostat, 2024e).

Chart 3. Is the fact that people from other countries are coming to live in the country generally beneficial or detrimental to the economy?



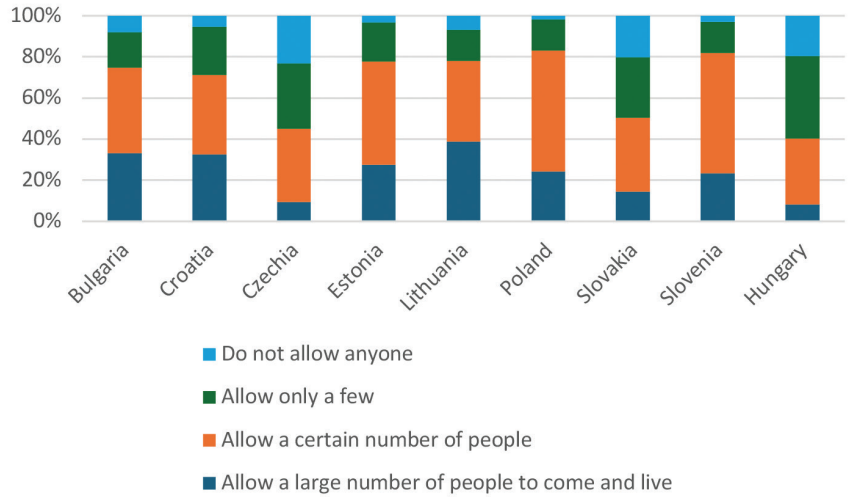
Source: Own preparation based on ESS (European Social Survey, 2020-2021).

Chart 4. As a result of people from other countries coming and living here, has the country in question become a worse or better place to live?



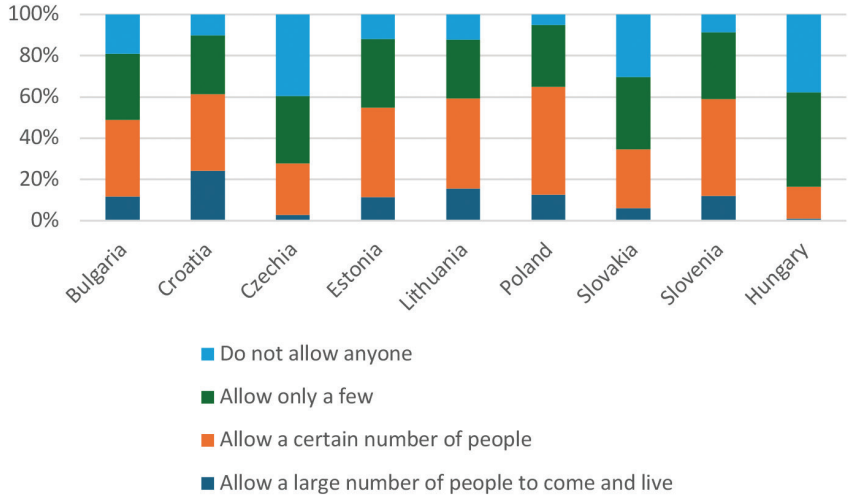
Source: Own preparation based on ESS (European Social Survey, 2020-2021).

Chart 5. To what extent should the state allow people of the same race or ethnic group as the majority of the population to come and live?



Source: Own preparation based on ESS (European Social Survey, 2020-2021).

Chart 6. To what extent should the state allow people of a different race or ethnic group than the majority of the population to come and live in the country?



Source: Own preparation based on ESS (European Social Survey, 2020-2021).

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 11.04.2025; accepted 30.08.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.16

THE IMPACT OF COMPETENCIES ON WAGES OF EMPLOYEES IN THE CONTEXT OF EMPLOYERS' EXPECTATIONS – POLAND IN THE LIGHT OF EU COUNTRIES

KAMILA TOPOLEWSKA

Bydgoszcz University of Science and Technology, Faculty of Management, Department of Economics and Marketing, ul. Al. prof. S. Kaliskiego 7, 85-790 Bydgoszcz, Poland
kamila.topolewska@pbs.edu.pl
ORCID: 0000-0003-1942-1115

ŁUKASZ TOPOLEWSKI

corresponding author
Nicolaus Copernicus University in Toruń, Faculty of Economic Sciences and Management, Department of Economics, ul. Gagarina 13a, 87-100 Poland
lukasz.topolewski@umk.pl
ORCID: 0000-0002-1548-4816

Abstract

Motivation: Competencies are an important feature from the perspective of both the employer and the job candidate. On the one hand, the employer is looking for candidates with specific competencies on the market and is willing to pay a specific salary for them. On the other hand, from the perspective of the job candidate, it is important to know which compe-

tencies are the best paid. In this way, the job candidate can direct their professional development in order to gain these competencies. Hence, research was undertaken to identify the best paid competencies.

Aim: The purpose of this article is to identify the competencies of employees that determine obtaining a salary at least at the level of the average salary in the economy.

Results: Based on individual data from Poles derived from the Human Capital Balance for 2021 (partially 2022), three logistic regression models were estimated: for the entire sample, for women, and for men. Significant variables for all models are age, education level, as well as willingness to work unusual hours required by the employer, willingness to travel frequently. It is worth considering which characteristics and competencies are specific to each model and positively influence the receipt of a high salary. Thus, in the case of the general model, gender, possession of a category B driver's license and the ability to use a computer, tablet and smartphone turn out to be important. In the case of women, the ability to use specialized computer programs, as well as to work with people of different nationalities, influences higher salaries. For men, the competency that gives them the opportunity for higher salaries is analyzing information and drawing conclusions.

Keywords: *competencies, wages, logit model, Poland*
JEL: *J24;E24; C53*

1. Introduction

As is well known, the human resource is one of the key ones in an organization. Using their knowledge, skills, experience or attitudes, employees can contribute to the achievement of the company's goals, thus often affecting its profit. Thus, it can be supposed that the more qualified employees, the greater the likelihood of success for the organization.. Therefore, it now seems important to shape the image of a good employer (employer branding), whose task is to attract potential employees and retain current ones. One of the key elements of this process is the appropriate formation of the organization's compensation policy.

Given that it is often wage factors that have a greater impact on employee motivation, and that the most important element of wage motivation is base pay (Mierzwa, 2023, p. 299), it is worth considering what factors determine its amount. Therefore, this article attempts to fill the research gap of determining the relationship between individual competencies and the amount of remuneration received.

The purpose of this article is to identify the competencies and individual features that determine obtaining a salary at least at the level of the average salary in the economy. The realization of such a goal can be beneficial to both sides of the labor market. From the point of view of employees or job candidates, the identification of highly valued competencies can indicate the directions of development for these individuals. In turn, from the point of

view of employers, it will be possible to verify whether the valuation of competencies in a given company is the same as the market approach.

The analysis of employee remuneration should begin by solving the definitional problems. One of them is the concept of wages. According to the definition of the Central Statistical Office, 'wages and salaries include monetary payments paid to employees or other individuals (i.e., gross wages and salaries), representing expenditures incurred by employers to pay for work performed, regardless of the source of their financing (from own or reimbursed funds) and regardless of the basis of the employment relationship or other legal relationship or legal action on the basis of which the work or service is performed' (Kamorska et al., 2020, p. 20).

This article assumes that the level of remuneration reflects the quality of human capital. The higher the quality of human capital, the higher the salary. Creating a relationship between these elements in an organization can give an important incentive for candidates and those already employed to increase their competencies (Bilian et al., 2017, p. 213). Of course, not all competencies are valued in the same way. It is value to emphasize, that competences can be defined 'as broader attributes that refer to an ability to use knowledge, skills social and/or methodological abilities in work or study situations and in professional and personal development. Competence is not limited to the cognitive area; it also encompasses functional/technical areas, interpersonal skills and values'(European Commision). Therefore, in the empirical part of this paper, they will be divided into three groups (Grzybowska, Łupicka, 2018, pp. 40–41):

- social (e.g., communication skills, ability to work in a group),
- technical (e.g., IT knowledge and skills, data and information processing),
- managerial (e.g., creativity, conflict resolution, decision-making).

2. Literature review

The literature review focus on employers' expectations of employees in selected European Union countries. The selection of countries base on data availability, and the analysis includes Poland, Romania, Latvia, and Spain. Particular attention was paid to the types of competencies expected. This will make it possible to determine what kinds of skills are in demand in national labour markets. In the case of Poland, these expectations will be linked to the subsequent model results to examine whether the desired competencies translate into higher wages. Polish employers' expectations of their employees can be determined on the example of a survey conducted among 32 companies in the SME sector in the Mazowieckie Voivodeship. The survey questionnaire used in the study was addressed to owners or top managers.

Based on the results, it can be concluded that from rank-and-file employees, employers mainly expected the ability to work with co-workers, a great deal of knowledge as a result of work experience and the ability to cooperate with superiors. Managers were also expected to have knowledge as a result of experience, the ability to work with co-workers, but also the ability to handle stressful situations, the ability to set goals, or knowledge of the industry (Dymek-Maciejewska, 2018, p. 16).

Another survey included 3,646 subjects, which identified competencies desirable from the perspective of the labor market. The implementation of this survey took place in 2021-2022. Based on the opinions of employers, the most important qualities include: responsibility for work, time management, ability to organize work, willingness to learn new things and communication skills. Among the qualities that were considered least important were: artistic ability, assembly and repair of machinery and equipment, performance of complex mathematical calculations and willingness to travel frequently. For managerial and specialized positions, employers also expected a college degree (Górniaket al., 2022, pp. 47, 50).

The next country discussed is Romania. One of the surveys is the one conducted in 2019 on a sample of 80 respondents (including CEOs, human resources specialists) involved in conducting recruitment and selection processes in their organizations. Based on its results, it can be concluded that among personal qualities, employers rated commitment to work and responsibility and ethical behavior highest. Referring to knowledge and skills, respondents valued to the highest degree a proactive attitude towards work, digital competence, communication skills, teamwork, or communication in a modern language (Staiculescuet al., 2021, pp. 191–192).

Another survey of employers' expectations in Romania was conducted in 2014 and included an analysis of job advertisements for one hundred managerial positions regardless of industry. Based on the results of the survey, it can be concluded that the most frequently sought qualities and competencies were: work experience, higher education, English language skills, communication skills, computer skills, planning and organizational skills. Among the competencies sought the least frequently were: power of persuasion, objectivity and decisiveness, ability to work with budgets, willingness to work for a company for a longer period of time, experience in working in a multicultural team (Matei, 2015, pp. 541–542).

In the case of Latvia, one study worth noting is the one in which the authors asked employers to rate the importance of particular skills, knowledge and attitudes of employees. Based on the results, it can be concluded that the most important things for employers are professional knowledge, knowledge of the Latvian language, purposefulness in action, attention to order and organization of work, ability to cooperate, and ability to plan and control tasks (Kantane, 2015, p. 227).

Another survey included 336 employers. They were asked to determine the importance of specific competencies. In their opinion, loyalty to the company, the ability to plan working time, the ability to work independently, or the ability to cooperate are important. Knowledge and skills, willingness to improve skills, creativity and initiative were found to be important factors, but to a much lesser extent (Sloka et al., 2015, p. 71).

According to Spanish employers selected as recruitment and selection professionals, key competencies include the ability to argue in an interview, communication skills, problem solving, project presentation, time management, learning skills, the ability to control one's emotions, the ability to work under pressure, commitment at work, leadership, among others (Cabreraet al., 2016, pp. 74–75).

It is also worth citing a survey targeting 806 employees in the Spanish branch of a multinational service company with about 6,000 employees. The aim of the survey was to determine what competencies the best employees (talents) possess and whether these competencies are gender-specific. The results of the study confirm that the best employees show initiative, are willing to continue learning and are able to think outside the box. For men, willingness to learn is given significant weight, while the other competencies are more important for women (De Haroet al., 2023, p. 227).

Comparing the expectations of employers in selected countries, it can be seen that by far the most common expectation of employers was for employees to have the ability to organize work (in all countries), as well as the willingness to learn, the ability to cooperate and communication skills (in three countries). Less frequently, employers expected expertise, experience, knowledge of the industry or taking responsibility for work (two countries). It can be concluded that the desired skills depend on the position to be filled. In the case of filling production positions, expertise is important, while in the case of managers, attention is directed toward social (soft) skills.

3. Methods

The data used to estimate the parameters of the models came from the Human Capital Survey conducted in 2021. According to the adopted methodology, the survey included 2,529 people from Poland. The sampling is stratified, proportional taking into account the sub-region of the CSO, the size of the locality and gender combined with age (Antosz, 2018, pp. 13-14).

Although the data contained a total of 2,529 observations, there were 1,611 working people. In addition, some people did not answer the questions, resulting in missing data. However, the analysis showed that these gaps were random in nature, so it was decided to remove some of the observations, bringing the final sample to 1159 people. The article uses a logit model that

belongs to the group of qualitative models. This model has the form (Walesiak, 2011, pp. 101–103):

$$\ln \frac{p_i}{1-p_i} = x'_i \beta \tag{1}$$

where:

$\ln \frac{p_i}{1-p_i}$ – the logarithm of the odds ratio of accepting and not accepting the value of 1 by the dependent variable;
x'_i – vector of independent variables;
β – vector of model parameters.

Using a logit model, the probability that the characteristics adopted for the study will contribute to a salary[1] at the level of the average salary in the national economy in 2021 was estimated (PLN 4083.44 net[2]) and higher (Sury M.,2025). The choice of this year was arbitrary. The measure itself, on the other hand, was adopted for the study due to its nature of viz. income comparability. This value can serve as a benchmark in the process of comparing a person's income with that of other working people. Its advantage is its universality over, for example, quartile values, which makes it a more intuitive measure in the aforementioned comparisons. Since much of the salary data was defined by ranges, it was assumed that the first range corresponding to the average salary is the range of 4-5 thousand zlotys net. The dependent variable is binary and takes the value of 0 or 1:

$$y = \begin{cases} 1, & a\ wage\ equal\ to\ or\ higher\ than\ the\ average\ wage\ in\ the\ economy \\ 0, & a\ wage\ lower\ than\ the\ average\ wage\ in\ the\ economy \end{cases}$$

Table 1 shows the explanatory variables used to estimate the logit model. They were divided into three categories: socio-demographic characteristics, the nature of the place of residence and characteristics of human capital. The first group distinguished between such characteristics as gender, age, marital status, disability and having children. The next category distinguished between groups of provinces divided into 6 communities. In the last group, education, foreign language skills, possession of a driver's license and additional competencies (technical, managerial and social) were distinguished.

Table 2 shows selected characteristics of the study samples used to estimate the three logit models. The first model covered the entire survey sample, while the next two models applied to women and men, respectively.

1 Salary is understood as the amount received "in hand' from all types of work performed.

2 Net income can vary depending on the person and his fiscal and personal situation.

Taking into account the following statistics, a respondent profile can be created for each model:

- model for the entire surveyed population – male, aged over 50, married, with a university education, living in the eastern region;
- model for women – married woman over 50, with a university education, residing in the eastern region;
- the model for men – a married resident of the eastern region, aged over 50, with a post-secondary and secondary vocational education.

4. Results

Using the explanatory variables presented in Table 1, a logit model was estimated for the entire research sample. In the next step, a model with significant independent variables was estimated. The stepwise (a posteriori) method was used for elimination. The significance level of the variables was assumed to be α=0.1. Further models were estimated in the same way for women and men, respectively, but in their case the variable characterizing gender was omitted.

From a cognitive value perspective, it is worth focusing on two elements – the marginal effect and the odds ratio. Marginal effects are interpreted as the impact of an independent variable on the probability that the dependent variable takes the value of 1. An example of such an interpretation, in the context of the model for the entire sample, is gender. Being a woman decreases the probability of earning a salary at the national average level by 29.9%.

Another measure is the odds ratio, which indicates how a one-unit change in an independent variable affects the odds ratio – that is, the ratio of the probability of success to the probability of failure. In the model for the entire sample, regarding competency k19 (willingness to take responsibility for completing tasks), possessing this skill increases the odds of receiving a salary at the national average level by 111.4%.

Table 3. shows the results of estimating models with significant independent variables. Based on the data in the table, it can be seen that the characteristics positively influencing the probability under study for the entire sample include: age 25 and over, possession of a category B or category D1/D driver's license, residence in the southern region, knowledge of foreign languages other than English and German, higher education, as well as competence in using a computer, tablet, smartphone, and willingness to take responsibility for the performance of tasks and coordinate the work of others. Willingness to travel frequently and willingness to work unusual hours required by the employer are also important. Analyzing the listed characteristics, one can see that they are often required for managerial positions,

which are associated with higher salaries. Among the characteristics that reduce the chance of a high salary should be distinguished: an established disability, basic vocational education, female gender, as well as the performance of simple calculus and artistic abilities. The first two characteristics mentioned may indicate that people with disabilities or those with vocational education are likely to be employed at lower rates, e.g., manufacturing positions, which are often lower paid. It is worth noting that a factor that reduces the chance of high pay is female gender. This may suggest a different problem cited in the literature, namely gender discrimination.

In the case of the model for women, qualities positively influencing the probability studied include: age 30 and over, knowledge of other foreign languages (except English and German), higher education, as well as the ability to use specialized computer programs, to cooperate with people of different nationalities. Also positively influenced by willingness to travel frequently and willingness to work unusual hours required by the employer. On the other hand, the probability studied is negatively affected by basic vocational education, the ability to assemble and repair machinery and technical equipment, and to perform simple calculus. In the case of the female population, one can see a certain correlation. Namely, characteristics that increase the probability of a high salary are usually required for managerial positions, while characteristics that decrease this probability may suggest lower positions in the hierarchy of the company.

The results of the estimation of the last model for men indicate that the factors that positively affect the studied probability are: age 25 or older, residence in the southern region, possession of a D1/D driver's license, higher education, ability to analyze information and draw conclusions, coordinate the work of others, willingness to take responsibility for the performance of tasks, as well as willingness to travel frequently and willingness to work unusual hours required by the employer. Characteristics that lower the probability studied include: basic vocational education, an established disability, as well as artistic ability and easy ability to relate to people. While disability or vocational education are unquestionable, the negative impact of social skills on achieving higher-than-average salaries is somewhat surprising. However, this may stem from the fact that individuals with highly developed social skills consciously choose professions that rely on interpersonal contacts, which are associated with lower salaries. Therefore, individuals with highly developed social skills may value interpersonal relationships more highly than high salaries. Considering the highest-paid industries, such as IT, finance, or engineering, technical skills should be emphasized, as they are more important than social skills. In the case of the male collective, similar trends can be observed as in the other groups. Namely, the traits that increase the likelihood of a high salary are related to managerial positions. A certain exception may be the possession of a cat D driver's license, since

this feature is related to the nature of the work, not the position in a particular company. As you can see, bus drivers in Poland are well compensated.

It is also worth referring to groups of competencies. Based on the results of all models, it is clear that employers pay particular attention to technical competencies. In the case of the general model, managerial competencies are more important than social competencies. Referring to the model for men, the amount of social competencies statistically significant is the same as the amount of managerial competencies. Interestingly, in the case of the model for women, completely statistically insignificant, from the point of view of the probability studied, turned out to be managerial competencies. Which means that employers focus mainly on technical and social competencies when offering them higher salaries. This may indicate a different problem raised in the literature, namely the lack of gender parity. Managerial positions are more often held by men than by women.

The verification of econometric models is also an important element. Table 4. and Figure 1. show selected measures for determining the fit of models to real data. One of the indicated measures is the likelihood ratio test, which provides information about the overall significance of the model. The null hypothesis in this test assumes that all parameters associated with the explanatory variables are equal to zero, while the alternative hypothesis states that at least one of the parameters differs from zero:

$$\begin{cases} H_0: \beta_0 = \beta_1 = \beta_2 = \ldots = \beta_j = 0 \\ H_1: \beta_0 \neq \beta_1 \neq \beta_2 \neq \ldots \neq \beta_j \neq 0 \end{cases}$$

The test statistic for the likelihood ratio test is given by:

$$LR = 2(\ln_{LUR} - \ln_{LR})$$

where:

L_{UR} – the likelihood function value for the full model,

L_R – the likelihood function value for the model consisting only of the intercept.

The above statistic follows a chi-squared (χ^2) distribution with k degrees of freedom.

One of the commonly considered measures of fit for econometric models is the McFadden R-square. This measure is based on the value of the likelihood function and is expressed by the formula:

$$R^2_{McFaddena} = 1 - \frac{\ln L_{UR}}{\ln L_R}$$

where:
L_{UR} – the likelihood function value for the full model,
L_R – the likelihood function value for the model consisting only of the intercept.

The values of this measure for a large amount of micro data are usually low (Stasiura, Konstanty, 2015, p. 139), which can also be seen from the estimated models.

Measures that reflect well the accuracy of the models are overall accuracy and the odds ratio. The former is calculated as the ratio of correctly predicted predictions to the total number of observations in the sample (Kufel, 2011, p. 147):

$$TA = \frac{n_{00}+n_{11}}{N} * 100, \quad (2)$$

where:
TA – total accuracy,
n_{00} –number of correctly predicted 'zeros',
n_{11}– number of correctly predicted 'ones',
N – total number of observations in the sample.
The odds ratio is calculated as follows (Śliwicki, Ręklewski, 2014, p. 83):

$$IRS = \frac{n_{11}*n_{00}}{n_{01}*n_{10}},$$

where:
IRS – odds ratio, n01 – number of incorrectly predicted 'zeros',
n10 – number of incorrectly predicted 'ones'.

Based on the data in Table 4, it can be seen that all models have high forecast accuracy. Due to the lack of balanced samples, the total accuracy was calculated taking into account the threshold point (c), which is calculated as the share of 'ones' in the total sample (Grabowski, 2019, p. 48). In the case of the general model, c = 0.379, in the women's model c = 0.255, and for men c = 0.509. When considering the accuracy of the predictions, it can be seen that for the general model and for men it is very similar. A lower result was recorded for the model for women, nevertheless, the model is still much more accurate than random classification (the value of overall accuracy is then 50.0) (Gruszczyński, 2012, p. 92).

The final element used to verify the model is the Receiver Operating Characteristic (ROC) curve. All the curves presented (Figure 1) show a good fit of the model to the data. The area under the ROC curve takes the value of 0.5 when the model has no predictive power and 1 when the prediction is excellent. For the general model and for men, the areas are 0.81, while for women they are 0.77.

5. Conclusion

Based on individual data from Poles derived from the Human Capital Balance for 2021 (partially 2022), three logistic regression models were estimated: for the entire sample, for women, and for men.

One result, for the model for the entire sample, is that women have a lower probability of earning higher wages than men. It confirms numerous studies in this regard (Blau, Khan, 2017, p. 853; Goraus et al., 2017, p. 142–144; Śliwicki, 2015, p. 27; Topolewska, 2023, p. 590). Similar conclusions were also reached by Auspurg et al. (2017, p. 204), concluded on the basis of their study of Germans that representatives of both sexes consider lower women to be fair. The authors argue that by endorsing the gender wage gap, the population leads to a self-fulfilling belief that is stable and long-term.

Another individual characteristic that significantly influences employees' wages is age. In all models, all variants of this variable were statistically significant (only in the model for women was the a2 variant not significant). Based on the results, it can be seen that in all cases increasing age will have a rather positive effect on the chances of receiving a higher salary. The effect of age on salary is also confirmed by a number of studies by other authors (Witkowska et al., 2019, p. 16; Kompa, Witkowska, 2018, p. 266).

An important individual characteristic, but one that also affects the shape of human capital, is an individual's education. The results of all models confirm that higher education increases the chances of higher earnings, while basic vocational education decreases these chances. A similar direction of influence of both or one variant of the indicated education can also be seen in the literature (Topolewska, 2023, p. 588; Kompa, Witkowska, 2018, p. 266; Śliwicki, Ryczkowski, 2014, p. 170).

Comparing employers' declarations of the competencies for which they are willing to pay higher wages to the obtained survey results, it is worth noting that the results are consistent and indicate a positive impact on the studied probability in the case of variables (Topolewska, 2023, p. 588; Górniaket al., 2022, pp. 47, 51):

- willingness to work unusual hours required by the employer (all models);
- willingness to travel frequently (all models);
- willingness to take responsibility for work (all-sample model and male model);
- computer literacy (model for the entire sample),;
- the ability to use computer programs (model for women);
- ability to work with people of different nationalities (model for women).

Competencies that negatively affect the probability studied, and this coincides with previous research, include artistic ability (all model and model for men) and the ability to assemble and repair machinery and equipment (model for women) (Topolewska, 2023, p. 588; Górniaket al., 2022, pp. 47, 51).

While the results for most of the other competencies are not in doubt, the decreasing likelihood of high pay for men with the ability to relate easily to people is something to wonder about. In most cases, employers value this skill and it is now a frequently recurring requirement for employees (Staiculescuet al., 2021, pp. 191–192; Matei, 2015, pp. 541–542; Sujováet al., 2021, p. 11; Asefer, Abidin, 2021, p. 45). Nevertheless, this result can be explained by the specifics of the professions. A good example is the profession of salesman. As a person responsible for customer service, he should be characterized by ease in establishing contacts, but the salary for this position itself deviates from that designated as the national average. Another example could be the IT profession, where salaries are considered high, while the need for networking is often limited in this case.

References

Antosz, P. (2018). *Metodologia badania: bilans kapitału ludzkiego 2016-2023*, PARP, Uniwersytet Jagielloński, Warszawa.

Asefer, A., &Abidin, Z. (2021). Soft Skills And Graduates Employability In The 21st Century From Employers' Perspectives: A Review Of Literature, *International Journal of Infrastructure Research and Management*, 9(2), 44–59.

Auspurg, K., Hinz, T., & Sauer C. (2017). Why Should Women Get Less? Evidence on the Gender Pay Gap from Multifactorial Survey Experiments, *American Sociological Review*, 82(1), 179–210.https://doi.org/10.1177/0003122416683393.

Bilian, Y., Mishchuk H., & Dzhyhar T. (2017). Human capital factors and remuneration: analysis of relations, modeling of influence, *Verslas: Teorijairpraktika*, vol. 18 (2), 208–214.https://doi.org/10.3846/btp.2017.022.

Blau, F.D., & Kahn L.M. (2017). The gender wage gap: Extent, trends, and explanations, *Journal of Economic Literature*, 55(3), 789-865. https://doi.org/10.1257/jel.20160995.

Cabrera N., López M.C., & Portillo C. (2016). Las competencias de los graduados y suevaluacióndesde la perspectiva de los empleadores*, EstudiosPedadódicos*, 43(3), https://dx.doi.org/10.4067/S0718-07052016000400004.

De Haro, J.M., García-Izquierdo, M., Castaño, A., & García-Izquierdo, A.L. (2023). Predictive Competences of High-potential Talent Employees, *Journal of Work and Organizational Psychology*, 39(3), 121–130. https://doi.org/10.5093/jwop2023a16.

Dymek-Maciejewska, M. (2018). The perfect employee? Non-formal competences – expectations and reality, *Journal of Modern Science*, 37(2), 11–21. https://doi.org/10.13166/jms/89884.

Goraus, K., Tyrowicz, J., & van der Velde, L. (2017). Which gender wage gap estimates to trust, A comparative analysis, *The review of income and wealth*, 63(1), 118–146. https://doi.org/10.1111/roiw.12209.

Górniak, J., Kocór, M., Prokopowicz, P., & Szczucka, A. (2022). *Bilans kapitału ludzkiego 2022/2021: raport z badania pracodawców: powrót do rzeczywistości: drugi rok pandemii oczami polskich firm*, PARP, Uniwersytet Jagielloński, Warszawa.

Grabowski W. (2019). *Modele wielopoziomowe. Wykorzystywanie danych regionalnych w badaniach mikroekonomicznych i socjologicznych*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź.

Gruszczyński, M. (2012). Tablica trafności oraz krzywa ROC. In M. Gruszczyński (Ed.), *Mikroekonometria. Modele i metody analizy danych indywidualnych*, Warszawa, Wolters Kluwer business.

Grzybowska, K., &Łupicka, A. (2018). Key Managerial Competencies for Industry 4.0 – Practitioners', Researchers' and Students' Opinions, *Logistics and Transport*, 39(3), 39–46. https://doi.org/10.26411/83-1734-2015-3-39-4-18.

European Commission, https://joint-research-centre.ec.europa.eu/projects-and-activities/skills-and-competences/defining-skill-and-competence_en.

Kamorska, E., Krystosiak, I., Strzelecka, H., Tuszyńska, E., Winiarz, A., Żelazny T. (2020). *Methodological report Wages and salaries in the national economy*, GUS, Warszawa.

Kantane, I., Sloka, B., Buligina, I., Tora, G., Busevica, R., Buligina, A., Dzelme, J., Tora, P. (2015). Expectations by Employers on Skills, Knowledge and Attitudes of Employees, *European Integration Studies*, 9(9), 224–234. https://doi.org/10.5755/j01.eis.0.9.12809.

Kompa, K.,&Witkowska, D. (2018). Factors affecting men's and women's earnings in Poland, *Economic Research-EkonomskaIstraživanja*, 31(1), 252–269. https://doi.org/10.1080/1331677X.2018.1426480.

Kufel, T. (2011). Ekonometria: rozwiązywanie problemów z wykorzystaniem programu GRETL, Wydawnictwo Naukowe PWN.

Matei, M. (2015). Romanian Employers Expectations And The Influence Of The Cultural Factor, *Annals of Faculty of Economics, University of Oradea, Faculty of Economics*, 1(2), 538–544.

Mierzwa, D. (2023). The role of salary and other non-wage factors in the employee motivation system, *Catholic Pedagogy*, 33a. https://doi.org/10.62266/PK.1898-3685.2023.33a.23.

Sloka, B., Kantāne, I., Buligina, I., Tora, G., Dzelme, J., Buševica, R., Buligina, A., Tora, P. (2015). Employers' Needs and Expectations for Qualified Em-

ployees (Case Study on the Opinions in One of the Regions in Latvia), *Economics and Business*, 27. 69–75. https://doi.org/10.1515/eb-2015-0011.

Staiculescu, C., Lacatus, M. L., &Livinti, R. (2021). Employers expectations and requirements. Case study: Employers of Schools of Economics and Business Graduates in Romania, *Proceedings of the International Conference on Business Excellence*, 15(1), 185–195. https://doi.org/10.2478/picbe-2021-0018.

Stasiura, E., &Konstanty, A. (2015). Modelowanie czynników społeczno-demograficznych wpływających na decyzje o wyjeździe za granicę.InK. Woźniak K. (Ed.) *Narzędzia analityczne w naukach ekonomicznych*, Miles.pl, Kraków.

Sujová, E., Cierna, H., Simanová, Ľ., Gejdoš, P., &Štefková, J. (2021). Soft Skills Integration into Business Processes Based on the Requirements of Employers–Approach for Sustainable Education, *Sustainability*, 13(24). https://doi.org/10.3390/su132413807.

Sury M., https://www.livecareer.pl/prawo-pracy/przecietne-wynagrodzenie, (02.02.2025).

Śliwicki, D. (2015), Różnice w wynagrodzeniach mężczyzn i kobiet w województwach, *Wiadomości Statystyczne. The Polish Statistician*, 10, 17–28.

Śliwicki, D., &Ręklewski, M. (2014), Application of the Logit Model to the Analysis of Economic Activity Factors of the Disabled, *OeconomiaCopernicana*, 5(3), 75–92. https://doi.org/10.12775/OeC.2014.020.

Śliwicki, D.,&Ryczkowski, M. (2014). Gender pay gap in the micro level – case of Poland, *Quantitative Methods in Economics*, 15, 159–173.

Topolewska, K. (2023). Competencies as determinant of remuneration, *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 194, 581–593. https://doi.org/10.29119/1641-3466.2024.194.34.

Walesiak, M. (2011). Modelowanie i prognozowanie zmiennych dwumianowych.InM. Walesiak (ed.), *Analiza danych jakościowych i symbolicznych z wykorzystaniem programu R* (99-111). Wydawnictwo C.H. Beck, Warszawa.

Witkowska, D, Matuszewska-Janica, A, & Mentel, G. (2019). Determinanty wynagrodzeń w wybranych państwach Unii Europejskiej, *Roczniki Kolegium Analiz Ekonomicznych,* 55, 9–24.

Acknowledgements

Author contributions: authors has given an approval to the final version of the article. Author's total contribution to the manuscript: K.T (80%); Ł.T (20%).

Appendix

Table 1. The set of explanatory variables used to estimate the parameters of the logit models

SOCIO-DEMOGRAPHIC CHARACTERISTICS			
gender (GENDER*)		Age	
1- woman	0-man**	A1**	18-24 years
marital status		A2*	25-30 years
MS1**	Single	A3*	31-40 years
MS2*	Married	A4*	41-50 years
MS3*	widow or widower	A5*	More than 50 years
MS4*	after divorce or during separation		
disability (DISA*)		having children (HCH*)	
1-yes	no**	1-yes	0-no**
NATURE OF RESIDENCE			
groups of voivodships			
NR* (voivodeships.: pomorskie, kujawsko-pomorskie, warmińsko-mazurskie)	northern region	SR* (voivodeships,: śląskie, małopolskie)	southern region
NWR* (voivodeships: zachodniopomorskie, wielkopolskie, lubuskie)	northwestern region	SWR* (voivodeships: dolnośląskie, opolskie)	southwestern region
CR** (voivodeships: mazowieckie, łódzkie, świętokrzyskie)	central region	ER* (voivodeships: podlaskie, lubelskie, podkarpacie)	eastern region
CHARACTERISTICS OF HUMAN CAPITAL			
Education		language skills	
GIM**	junior high school and below	knowledge of English (ENG*)	
GSE*	general secondary education	1 – yes	0 – no**
BV*	basic vocational	Knowledge of the German language (GER*)	
VTS*	vocational technical school/specialized high school	1– yes	0 – no**
		Knowledge of other foreign languages (ALGG*)	
HE*	higher education	1 – yes	0 – no**
Driving license***			
DL_B*	Category B	DL_C1E_CE*	Category C1E/CE
DL_C_C1*	Category C1/C	DL_D1E_DE*	Category D1E/DE
DL_D1_D*	Category D1/D	DL_T*	Category T

ADDITIONAL COMPETENCIES ****			
Technical competencies			
C1*	analyzing information and drawing conclusions	C8*	artistic ability
C2*	learning new things	C9*	fitness
C3*	use of computer, tablet, smartphone	C10*	administrative work and record keeping
C4*	operation of specialized computer programs	C11*	fluent in spoken and written Polish
C5*	operation of machinery, tools and technical equipment	C12*	performing simple calculus
C6*	assembly and repair of machinery and technical equipment	C13*	performing advanced mathematical calculations
C7*	willingness to work unusual hours as required by the employer		
Menegerial competencies			
C14*	time management and punctuality	C17*	resolving conflicts between people
C15*	independent organization of work	C18*	coordinating the work of others
C16*	ingenuity, creativity	C19*	readiness to take responsibility for the performance of tasks
Social competencies			
C20*	working with people of different nationalities	C23*	easily establish contacts with people
C21*	being communicative and conveying thoughts clearly	C24*	working in a group
C22*	dealing with stressful situations	C25*	willingness to travel frequently

*tag of variable in the model
** baseline variable
*** baseline variable no driver's license of any category
**** baseline variable, is the low and medium level of a given competence
Source: own preparation based on BKL data.

Table 2. Characteristics of the samples used to estimate logit models

		Total for the sample		**Model for women**		**Model for men**	
		in %	total	in %	total	in %	
Gender	Total	1159	100				
	Female	576	49,70	576	100		
	Male	583	50,30			583	100

		Total for the sample		Model for women		Model for men	
		in %	total	in %	total	in %	
Age	18-24	92	7,94	41	7,12	51	8,75
	25-30	160	13,81	87	15,10	73	12,52
	31-40	305	26,32	145	25,17	160	27,44
	41-50	270	23,30	145	25,17	125	21,44
	over 50	332	28,65	158	27,43	174	29,85
Marital status	Single	332	28,65	150	26,04	182	31,22
	Married	749	64,62	373	64,76	376	64,49
	Widower	19	1,64	13	2,26	6	1,03
	divorced, separated	59	5,09	40	6,94	19	3,26
Education	higher education	444	38,31	279	48,44	165	28,30
	vocational technical school/ specialized high school	297	25,63	118	20,49	179	30,70
	general secondary education	134	11,56	83	14,41	51	8,75
	basic vocational	230	19,84	78	13,54	152	26,07
	junior high school and below	54	4,66	18	3,13	36	6,17
Region of residence	Northern region	165	14,24	83	14,41	82	14,07
	Central region	224	19,33	107	18,58	117	20,07
	Northwestern region	172	14,84	85	14,76	87	14,92
	Southern region	220	18,98	114	19,79	106	18,18
	southwestern region	100	8,63	47	8,16	53	9,09
	eastern region	278	23,99	140	24,31	138	23,67

Source: own preparation based on BKL data.

Table 3. Parameter estimation results of estimated logit models with significant explanatory variables

	ALL				WOMEN				MEN			
	Coefficient	p-value	Marginal effect	Odds ratio	Coefficient	p-value	Marginal effect	Odds ratio	Coefficient	p-value	Marginal effect	Odds ratio
Const	-3,1044	***	-	-	-3,0741	***	-	-	-2,9510	***	-	-
A2	0,9972	***	0,2377	2,711	n.s.				1,0609	**	0,2511	2,889
A3	1,4408	***	0,3357	4,224	0,9904	***	0,1795	2,692	1,4348	***	0,3376	4,199
A4	1,4011	***	0,3287	4,060	0,9964	***	0,1807	2,709	1,3294	***	0,3120	3,779
A5	1,5554	***	0,3596	4,737	1,4021	***	0,2613	4,064	1,1673	***	0,2811	3,213
GENDER	-1,3878	***	-0,2991	0,250								

	ALL				WOMEN				MEN			
	Coefficient	p-value	Marginal effect	Odds ratio	Coefficient	p-value	Marginal effect	Odds ratio	Coefficient	p-value	Marginal effect	Odds ratio
C1	n.s.				n.s.				0,6289	**	0,1550	1,876
C3	0,4787	**	0,1030	1,614	n.s.				n.s.			
C4	n.s.				0,4403	*	0,0729	1,553	n.s.			
C6	n.s.				-0,9935	**	-0,1220	0,370	n.s.			
C7	0,5067	***	0,1110	1,660	0,6649	***	0,1072	1,944	0,4491	**	0,1116	1,567
C8	-0,5222	***	-0,1094	0,593	n.s.				-0,7588	***	-0,1834	0,468
C12	-0,3552	*	-0,0811	0,701	-0,4912	*	-0,0845	0,6119	n.s.			
C18	0,4170	***	0,0916	1,518	n.s.				0,4866	**	0,1209	1,627
C19	0,7485	***	0,1495	2,114	n.s.				0,9607	***	0,2283	2,614
C20	n.s.				0,5491	**	0,0869	1,732	n.s.			
C23	n.s.				n.s.				-0,4697	*	-0,1166	0,625
C25	0,5243	***	0,1181	1,689	0,6351	***	0,1086	1,887	0,5994	***	0,1487	1,821
BV	-1,3394	***	-0,2478	0,262	-1,7324	***	-0,1849	0,177	-1,2462	***	-0,2946	0,288
HE	0,8864	***	0,2004	2,426	1,1004	***	0,1763	3,005	0,9029	***	0,2205	2,467
ALGG	0,3579	*	0,0825	1,430	0,4922	*	0,0864	1,636	n.s.			
DISA	-1,1435	*	-0,1972	0,319	n.s.				-1,7062	*	-0,3471	0,182
DL_B	0,3955	*	0,0831	1,485	n.s.				n.s.			
DL_D1_D	1,1359	**	0,2750	3,114	n.s.				1,2564	**	0,2845	3,513
SR	0,5445	***	0,1263	1,724	n.s.				1,0299	***	0,2467	2,801

n.s. - statistically insignificant variable
significance level: *α=0.1, **α=0.05, *** α=0.01

Source: own preparation based on BKL data.

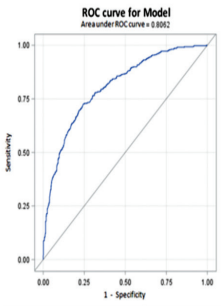
Table 4. Selected measures of model fit

Specification	General model	Model for women	Model for men
McFadden R-square	0,2249	0,1676	0,2304
Corrected R-square	0,1989	0,1279	0,1883
Likelihood ratio test	345,867	109,686	186,193
Log-likelihood	–596,0179	–272,3164	–311,0077
Accuracy (total)	71,8	64,1	71,9
Odds ratio	6,62	3,91	6,59

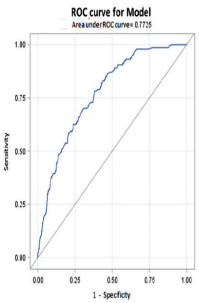
Source: own preparation based on BKL data.

Figure 1. ROC curves for models

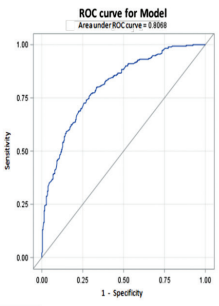
General model



Model for women



Model for men



Source: own preparation based on SAS.

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 19.04.2025; accepted 20.09.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.17

MEASURING FISCAL SUSTAINABILITY IN THE EU: A SYNTHETIC AND COMPARATIVE ASSESSMENT (2014, 2017, 2020, 2023)[1]

PAWEŁ KONOPKA

corresponding author
Department of Economy and Finance, Department of Quantitative Methods, University of Bialystok
✉ p.konopka@uwb.edu.pl
ORCID: 0000-0003-3822-5267

PATRYCJA ŁAPIŃSKA

Department of Economy and Finance, Department of Political Economy, University of Bialystok
✉ p.lapisnka@uwb.edu.pl
ORCID: 0000-0002-8539-8403

Abstract

Motivation: Fiscal sustainability constitutes a fundamental prerequisite for the long-term stability of public finances and the resilience of economies to external disturbances. Successive global and regional crises, including the global financial crisis, the sovereign debt crisis, the COVID-19 pandemic, as well as the energy and security shocks related to geopolitical developments, have exposed the vulnerability of fiscal systems within the European Union (EU). States characterized by a higher degree of fiscal sustainability were able to mitigate the adverse macroeconomic and social effects of such crises more effectively, whereas fiscally

[1] Financially supported by Minister of Science under the 'Regional Initiative of Excel-lence' (RID) programme.

weaker economies experienced prolonged instability and higher adjustment costs. Consequently, the assessment of fiscal sustainability acquires not only theoretical but also practical significance for shaping fiscal governance. While the subject has been widely discussed in the literature, existing studies frequently focus on single indicators or limited periods, which underscores the need for multidimensional and comparative analyses conducted within a longer time horizon.

Aim: The principal objective of this article is to identify the key determinants of fiscal sustainability and to evaluate its level across EU Member States in 2014, 2017, 2020, and 2023. By applying an integrated, synthetic measure, the study addresses the identified research gap, offering a comprehensive and temporally consistent framework for the comparative assessment of fiscal sustainability among EU economies.

Results: The Synthetic Measure of Fiscal Sustainability (SMFS) was constructed by employing the modified Hellwig method with Mahalanobis distance. The analysis incorporated five diagnostic variables: the public debt-to-GDP ratio, the budget balance-to-GDP ratio, the GDP growth rate, the current account balance, and EMU bond yields. Empirical data were derived from Eurostat. Hierarchical cluster analysis was subsequently applied to classify Member States into homogeneous groups according to their fiscal sustainability levels. The results indicate that Germany maintained the highest level of fiscal sustainability throughout the examined period, followed by the Netherlands and Malta. In contrast, Greece recorded the lowest SMFS values in 2014 and 2017, France in 2020, and Ireland in 2023. Overall, five distinct clusters of countries were identified, ranging from low to high sustainability. The findings demonstrate significant heterogeneity within the EU and underscore the necessity of designing fiscal frameworks that are both country-specific and consistent with the requirements of supranational fiscal governance.

Keywords: fiscal sustainability, multidimensionality, Hellwig method, Mahalanobis distance, hierarchical cluster analysis

JEL: E62, H50

1. Introduction

Successive economic downturns have directed economists' attention to the issue of fiscal sustainability. Countries characterized by high fiscal sustainability were more resilient to shocks and neutralized their adverse effects on the functioning of the economy more efficiently. In an era of overlapping economic and non-economic crises and the need to deal with their compounded effects, achieving and maintaining fiscal sustainability poses a major challenge. Therefore, it is crucial that the determinants of fiscal sustainability are identified.

In order to adopt the right fiscal policy strategy, it is also necessary to analyze the historical data and determine the current level of fiscal sustainability. Such considerations should serve as a prelude to assessing the legitimacy of the fiscal rules in place, the effectiveness of the policies implemented so far and the introduction of potential modifications.

2. Literature review

The sustained fiscal unsustainability of the state is associated with numerous negative consequences. Therefore, it is important to monitor the situation and, if necessary, adjust the fiscal (budget) policy pursued. The policy in question entails decisions made by the government on public spending and taxes [Begg et al., 2011, p. 77]. It is essential that these decisions meet the needs of the economy and follow the so-called '3T' principles for effective fiscal stimulus. The standard theory for fiscal stimulus specifies that fiscal policy is effective only if the instruments used are [Steel, Harris, 2020, p. 10]:

1. Timely,
2. Targeted,
3. Temporary.

Timeliness comes down to the quick implementation of fiscal policy instruments and the proper timing of their application, i.e. lasting no longer than necessary. Targeting means defining social groups in need of assistance and supporting only these specific groups. The last feature, temporariness, indicates the legitimacy of using fiscal policy instruments only until the economy improves (in the short term). Variable conditions may create the need to adapt these aspects to the current economic situation [Steel, Harris, 2020, p. 10].

Fiscal policy plays several key functions in the economy. One of them is the stabilization function. It primarily involves countering economic fluctuations, preventing crises, eliminating state dysfunctions and alleviating socio-economic tensions. Another function of fiscal policy is the optimal distribution of financial resources in the economy, which is called the allocative function. The redistributive function, in turn, involves the government making decisions on how and to what extent to reduce social, economic and spatial inequalities [Wójcicki, 2021, p. 27–28].

Fiscal sustainability is a multidimensional concept. The literature on the subject identifies a range of its determinants. Recognizing an economy as fiscally sustainable can, for example, come down to assessing the ratio of public sector net worth to GDP [Buiter, 1985]. It can also be analyzed in terms of the government's ability to finance its liabilities [Blanchard et al., 1990]. Another definition indicates that fiscal sustainability is achieved when the current and projected levels of budget deficit and public debt make the need for abrupt adjustments in fiscal policy possible to avoid [Alesina, Perotti, 1995]. Fiscal sustainability is also the authorities' efficiency in managing public spending and revenues in response to economic shocks, without unnecessarily causing social anxiety or economic crisis [Kopits, Symansky, 1998]. The literature on the subject also presents an approach in which fiscal sustainability is defined

by the absence of the need to finance government expenditure through debt and ensuring long-term budget balance [Schick, 2005].

To measure fiscal sustainability, among other things, the following are used: quantitative and qualitative measures or assessment of institutional behavior [Filipiak, Wyszkowska, 2022, p. 25–26], (see Table 1).

Fiscal sustainability has been the subject of many significant empirical studies over the years. For example, the fiscal sustainability of selected European Union countries was studied by Vanhorebeek and Van Rompuy (1995), Afonso (2005), Brady and Magazzino (2018), and Afonso and Coelho (2024). A comprehensive study on fiscal sustainability covering 173 countries was conducted by Afonso and Jalles (2019).

In addition to the classical approaches defining fiscal sustainability and its determinants, more recent studies have offered new insights and frameworks for assessing this multidimensional concept in the European Union. Afonso and Rault (2010) applied a panel data diagnostic to evaluate fiscal sustainability across EU Member States, confirming significant heterogeneity in fiscal performance and institutional constraints. Stoian, Obreja Brașoveanu and Brașoveanu (2018) proposed a framework to assess fiscal vulnerability based on market indicators such as sovereign credit risk, highlighting the importance of investors' perceptions in shaping debt sustainability. Collignon (2012) emphasized the role of fiscal policy rules in ensuring the long-term sustainability of public debt, arguing that compliance with well-designed rules is essential for convergence within the EU. Another perspective was provided by Bénassy-Quéré and Roussellet (2014), who extended the analysis to include the fiscal implications of systemic banking risks, thereby integrating financial stability concerns into the sustainability debate. Göndör (2019) examined comparative trends in EU countries with a focus on Romania, presenting long-term projections but stressing country-specific challenges. Earlier works such as Papadopoulos and Sidiropoulos (1999) concentrated on the Maastricht fiscal criteria as benchmarks of sustainability, yet these proved insufficient to capture broader fiscal resilience. Institutional aspects were also addressed by Kopits and Symansky (1998), who conceptualized fiscal rules as mechanisms disciplining government actions, and by Larch and Martins (2009), who analyzed fiscal policymaking in the EU and highlighted persistent enforcement challenges. Taken together, these studies confirm the complexity of fiscal sustainability but also reveal important gaps, as most focus on single indicators, specific countries, or institutional dimensions. The present study contributes to this body of literature by integrating multiple fiscal and macroeconomic variables into a synthetic measure and by applying a multidimensional comparative approach that allows for both temporal and cross-country assessment of fiscal sustainability in the European Union.

Fiscal rules in the form of indicators, benchmarks or procedures are helpful in maintaining fiscal sustainability. These rules impose a kind of frame-

work, limiting the fiscal policies implemented by the government. The literature identifies four main types of fiscal rules [Marchewka-Bartkowiak, 2010, p. 4–6]:

- debt rules (government debt to GDP),
- budget balance rules (e.g. 'golden budget rule'),
- spending rules (limits on public spending),
- revenue rules (limits on public revenues).

However, the effectiveness of fiscal rules depends on their right construction. The implementation of improperly structured fiscal regulations can result in a number of problems, such as the transfer of debt, creative accounting or fiscal illusions [Marchewka-Bartkowiak, 2010, p. 3].

The essential question in the discussion on fiscal rules and fiscal sustainability in the EU is whether fiscal rules in their current form are adequate. Researchers analyze data and assess the effectiveness of current EU fiscal law and consider replacing the existing fiscal rules with a more effective method of fiscal management [Gwóźdź, Kołodziej, 2024, p. 129].Some economists warn that the current fiscal framework could lead to pro-cyclical and thus destabilizing fiscal policies. Furthermore, they signal that the different economic and fiscal situations of individual EU member states should be taken into account [Postuła, Kawarska, Chmielewski, 2025, p. 9].

In each of the European Union's Member States there are fiscal rules, implemented both at the national and community-wide level. The latter act as a kind of instrument for disciplining and unifying national policies. In 2021, there were between 3 and 7 fiscal rules in the individual EU member states. [IMF, *Fiscal Rules…*, 2022]. Adherence to these principles certainly supports the long-term maintenance of fiscal sustainability, but nevertheless some of the restrictions in place are not respected. Additionally, it should be noted that, should serious economic shocks occur, the European Union allows a temporary waiver of certain preventive or corrective rules, as specified in the Stability and Growth Pact in the General Escape Clause [*The 'general…*, 2020].

Undoubtedly, long-term fiscal unsustainability leads to many negative consequences. Therefore, it is important to determine the state that the economy is in and, in the case of sustained instability, implement corrective mechanisms. The right fiscal policy decisions support the resilience of individual countries to economic slumps and limit the adverse effects of the crises that occur.

3. Methods

The Synthetic Measure of Fiscal Sustainability (SMFS) was constructed using the Hellwig method [Hellwig, 1968]. This method is one of the linear ordering techniques used in multidimensional comparative analysis. It involves

determining a synthetic index that allows for the assessment and ranking of objects (e.g., countries, regions, enterprises) according to their level of development relative to an established benchmark.

The foundation of the method is calculating the distance of each examined object from the benchmark, which serves as a reference point determined by the best values of individual diagnostic variables. The resulting index measures the proximity of the analyzed object to the pattern – the higher its value, the higher the overall evaluation of the analyzed object.

Hellwig method has found numerous applications, including in measuring sustainable development [Roszkowska et al., 2021], assessing municipal competitiveness [Adamowicz et al., 2012], analyzing sustainable development [Iwacewicz-Orłowska et al., 2016], measuring technical infrastructure development [Krakowiak-Bal, 2005], evaluating investment fund performance [Kopiński, 2014], identifying economic types of agriculture and rural areas [Wysocki, 2010] and studying corporate financing risk [Konopka, 2021].

According to the Hellwig method, the process of creating a synthetic measure consists of the following steps:

Step 1. Determination of variables and a finite set of assessed objects. Let:

$$X_i = [x_{i1}, x_{i2}, ..., x_{in}] - i\text{- object representation,} \tag{1}$$

where is a value of i– the object, with respect to j – the variable (i=1,2,…,m; j = 1,2,…,n);

where X_i is an object (in our case – a country).

Step 2. Definition of a set of weights for the variables (j = 1,2,…,n) whose sum equals one:

$$w_1 + w_2 + ... + w_n = 1 \tag{2}$$

Step 3. Building the ideal solution (pattern of development):

$$I = [x_1^+, x_2^+, ..., x^+_n] \tag{3}$$

where:

$$x_j^+ = \begin{cases} \max\limits_i x_{ij} \text{ for benefit variables} \\ \min\limits_i x_{ij} \text{ for cost variables} \end{cases} \tag{4}$$

Step 4. Normalization of variables. This step is critical and ensures that the variable values can be compared.

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j} \tag{5}$$

where:

$$\bar{x}_j = \frac{1}{m}\sum_{i=1}^{m} x_{ij} \tag{6}$$

and:

$$s_j = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(x_{ij} - \bar{x}_j)^2} \tag{7}$$

Step 5. Calculation of normalized weighted variable values. A normalized *i*- object with vector weights is expressed as:

$$\tilde{X}_i = [\tilde{x}_{i1,}\tilde{x}_{i2}, \ldots, \tilde{x}_{in}] \tag{8}$$

where:

$$\tilde{x}_{ij} = z_{ij} w_j \tag{9}$$

Step 6. Determination of the distance of normalized weighted objects from the ideal *I* by using classical Euclidean distance measure:

$$d_{i0}(X_i, I) = E(\tilde{X}_i, \tilde{I}) = \sqrt{\sum_{j=1}^{n}(\tilde{x}_{ij} - \tilde{x}_j^{+})^2} \tag{10}$$

Step 7. Calculating Hellwig's measure for the i - th object as follows:

$$H_i = 1 - \frac{d_{i0}}{d_0} \tag{11}$$

where:

$$d_0 = \bar{d} + 2S \text{ and } \bar{d} = \frac{1}{m}\sum_{i=1}^{m} d_{i0} \tag{12}$$

and:

$$S = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(d_{i0} - \bar{d})^2} \tag{13}$$

Step 8. Ranking of objects according to descending H_i.

As a rule, the values of the indicator H_i fall within the range [0,1]. However, in extreme cases, the value of the synthetic measure may exceed this range. This particularly occurs when a given object drastically differs from the others [Młodak, 2006, p. 126]. Hellwig method has served as a theoretical basis

for other methods based on the concept of a pattern, such as the TOPSIS method [Hwang, Yoon, 1981], [Bąk, 2016]. Hellwig method has numerous modifications that have emerged from research on various practical issues [Roszkowska et al., 2024]. The results of ordering (in addition to the values of the variables themselves) may be influenced by the method of variable normalization and the metric adopted to determine the distance between objects.

In this study, due to significant linear dependencies between variables, the Mahalanobis metric was used [Roszkowska et al., 2024], which allows for include the relationships between variables. The distance between objects measured using the Mahalanobis metric is as follows:

$$d_{i0}(X_i, I) = M(X_i, \bar{I}) = \sqrt{(Z_i - \bar{I})WC^{-1}W^T(Z_i - \bar{I})^T}$$

where C the covariance matrix, $Z = [z_{ij}]$, $W = diad(\sqrt{w_1}, \sqrt{w_2}, ..., \sqrt{w_n})$ is a diagonal matrix, where $w_1, w_2, ..., w_n = 1$ represents the weights assigned to the variables, $\bar{I}$ is the normalized pattern.

The evaluation scale, constructed on the basis of the modified Hellwig method with the application of the Mahalanobis distance, was selected owing to its capacity to aggregate multidimensional indicators into a single synthetic measure while simultaneously mitigating the issue of collinearity.

When the covariance matrix is an identity matrix, the Mahalanobis distance simplifies to the Euclidean distance. It should be emphasized that, in the approach applied in this study, unlike the classical Hellwig method, the weights of the selected variables are considered during the calculation of distances between objects measured using the Mahalanobis metric [Roszkowska et al., 2024]. Moreover, an equal weight level was adopted for all variables used in constructing the SMFS indicator. As an additional stage of the analysis, a hierarchical cluster analysis was conducted on the synthetic variables obtained through the application of the modified Hellwig method for the years under consideration. This procedure made it possible to classify Member States into five categories of fiscal sustainability, ranging from low to high. Unlike approaches based on arbitrarily imposed thresholds, the clustering was derived directly from the structure of the data, ensuring that the resulting typology reflects the empirical heterogeneity of fiscal sustainability across EU countries.

4. Results

The constructed Synthetic Measure of Fiscal Sustainability (SMFS, Table 3) includes determinants of fiscal stability such as the level of public debt relative to GDP, the budget deficit or surplus as a percentage of GDP, the GDP growth

rate, the current account balance, and EMU bond yields. The selection of years (2014, 2017, 2020, and 2023) was deliberate and aimed at capturing different phases in the fiscal position of EU Member States. The year 2014 reflects the post–sovereign debt crisis adjustment period, 2017 represents a phase of relative fiscal stability, 2020 corresponds to the pandemic crisis with the activation of the General Escape Clause of the Stability and Growth Pact, while 2023 offers the most recent data, reflecting the fiscal situation during the recovery process and in the context of new challenges such as rising energy and defense expenditures. This temporal perspective makes it possible to evaluate fiscal sustainability under both stable and extraordinary conditions, thereby providing a more comprehensive assessment of resilience.

The variables incorporated in the construction of the SMFS reflect the multidimensional character of fiscal sustainability and are widely recognized in the literature as essential indicators of long-term fiscal stability. The debt-to-GDP ratio serves as a fundamental measure of debt sustainability, while the budget balance expressed as a share of GDP captures the government's current fiscal position. The GDP growth rate indicates the economy's capacity to generate revenues and gradually reduce the relative debt burden, and the current account balance reflects the degree of external equilibrium and the extent to which countries rely on foreign financing. The inclusion of EMU bond yields is intended to capture sovereign financing costs and the market's perception of fiscal risk in the euro area. Although German government bonds are frequently employed as a proxy for the risk-free benchmark, the use of EMU bond yields provides a broader representation of financing conditions across the monetary union. By reflecting systemic market dynamics rather than the conditions of a single country, this measure ensures a higher degree of comparability of fiscal sustainability among EU Member States.

For variables V1 (current account balance), V3 (real GDP growth), and V4 (budget deficit/surplus), the higher the value of the variable, the higher the level of a country's fiscal stability. Conversely, the preference direction is reversed for variables V2 (EMU bond yield) and V5 (public debt level), meaning that the lower the value of the variable, the higher the level of fiscal stability of a given economy. The matrix of linear correlation coefficients among the variables was computed and is presented in Table 2.

In 2014, the yield on EMU bonds (V2) exhibited a significant negative correlation with the budget deficit/surplus (V4) at a level of -0.554, indicating that higher bond yields were associated with a larger deficit. Public debt (V5) showed a positive correlation with bond yields (V2) at a level of 0.490, suggesting that an increase in government debt could lead to higher bond yields. At the same time, public debt (V5) was negatively correlated with the budget deficit/surplus (V4) at a level of -0.510, indicating that a larger budget deficit contributed to an increase in government debt.

In 2017, public debt (V5) continued to show a positive correlation with bond yields (V2) at a level of 0.539, confirming previous relationships. The correlation between the budget deficit/surplus (V4) and public debt (V5) weakened, reaching -0.391, meaning that while a larger deficit still contributed to an increase in debt, its impact was smaller than in 2014.

In 2020, bond yields (V2) continued to exhibit a negative correlation with the budget deficit/surplus (V4) at a level of -0.471, which could be attributed to monetary policy measures such as quantitative easing. GDP growth (V3) was positively correlated with the budget deficit/surplus (V4) at a level of 0.539, suggesting that a stronger economy supported an improved fiscal position. At the same time, public debt (V5) showed a strong negative correlation with GDP (V3) at a level of -0.646, indicating that economic growth could contribute to reducing government debt.

In 2023, bond yields (V2) remained negatively correlated with the budget deficit/surplus (V4) at a level of -0.520, meaning that a larger deficit was associated with lower bond yields. The budget deficit/surplus (V4) displayed a strong negative correlation with public debt (V5) at a level of -0.633, confirming that a larger deficit led to an increase in government debt.

The analysis of these results fully justifies the application of the Mahalanobis metric. The research findings were used to assess the level of fiscal stability among individual European Union member states. The analysis was conducted for the years 2014, 2017, 2020, and 2023. The year 2023 was chosen for analysis as the last period for which all data were available, the year 2020 was chosen because it was the first year of the COVID-19 pandemic, and the years 2014 and 2017 were chosen for comparison purposes. The analysis was based on data available in the Eurostat database. Estonia was excluded from the study due to incomplete data.

The applied method enabled the ranking of countries from the most to the least fiscally stable, as well as the identification of factors contributing to an improvement or deterioration in ranking position. This comparison allows for the identification of problematic areas and the implementation of measures to improve the components responsible for adverse changes.

The study of fiscal stability among European Union member states in each of the analyzed years illustrated significant changes in the classification. A substantial decline in the SMFS index value, and consequently a notable drop in ranking, was observed for Ireland in 2023. This was primarily due to a decrease in real GDP of -5.5% year-over-year. In 2023, Hungary also experienced a weakening position in terms of fiscal stability. This was partly linked to an increase in EMU bond yields (in 2023, Hungary's EMU bond yield stood at 7.51%, while the average among EU member states was 3.72%).

Conversely, Denmark recorded a significant increase in the SMFS index value in 2023. The country's advancement in the 2023 ranking was associated with a relatively high surplus in the current account balance, a budget

surplus, and a relatively low public debt-to-GDP ratio of 33.6%. Croatia also improved its position in the ranking in 2023, recording real GDP growth of 3.3% year-over-year. Rankings are visualized in the charts 1 and 2.

In all the analyzed years, Germany exhibited the highest level of fiscal stability. The Netherlands and Malta also ranked highly. In 2014 and 2017, Greece had the lowest value of the Synthetic Measure of Fiscal Sustainability (SMFS), in 2020, it was France, and in 2023, Ireland. Table 3 presents the values of the SMFS determined for the years 2014, 2017, 2020, and 2023.

In the next step, an attempt was made to group EU member states based on their ranking positions derived from the $SMFS_{2014}$, $SMFS_{2017}$, $SMFS_{2020}$ and $SMFS_{2023}$ index values (see Chart 3), considering their level of fiscal stability in 2014, 2017, 2020, and 2023. For this purpose, hierarchical cluster analysis was used, employing Ward's method to determine the distance between groups and the Euclidean distance to calculate distances between objects.

Group 1 consists of Greece and France. These countries exhibited the lowest level of fiscal stability among the analyzed EU member states across all assessed periods. Group 2 includes seven countries: Finland, Italy, Austria, Belgium, Luxembourg, Hungary, and Ireland. The SMFS index values for 2014, 2017, 2020, and 2023 in Group 2 were slightly higher than in Group 1, yet fiscal stability remained relatively low.

Group 3 comprises 13 EU member states: Portugal, Croatia, Spain, the Czech Republic, Romania, Cyprus, Denmark, Latvia, Bulgaria, Slovakia, Slovenia, Poland, and Lithuania. This group demonstrated a moderate level of fiscal stability throughout the analyzed years.

Group 4 consists of Malta and the Netherlands, whose fiscal stability level, based on the calculations, can be described as relatively high throughout the studied period. Group 5 is a single-member group, containing only Germany. Compared to the other analyzed countries, Germany proved to be the most fiscally stable economy in the European Union.

The conducted analysis of fiscal stability levels among EU member states allowed for the identification of groups of countries with similar fiscal stability levels. Moreover, incorporating variables such as the level of public debt relative to GDP, the budget deficit/surplus as a percentage of GDP, GDP growth rate, current account balance, and EMU bond yields enabled the identification of factors contributing to a country's ranking position and the assessment of the overall impact of these components on ensuring fiscal stability in individual economies.

5. Conclusion

The persistence of state fiscal unsustainability is associated with many negative consequences. Therefore, it is important to monitor the situation and

pursue policies that support fiscal sustainability. Fiscal rules, which impose a kind of framework that limits the policies implemented by the government, are helpful in maintaining fiscal sustainability. These regulations can be established at two levels – the national and the EU one. The effectiveness of the fiscal rules used depends on their right construction and consistent compliance.

The right fiscal policy decisions support the resilience of individual countries to economic slumps and limit the adverse effects of the crises that occur. Nowadays, it is particularly important due to the multiplicity of simultaneously occurring economic and non-economic crises (polycrisis), the compounded consequences of which pose a major threat. Therefore, it is important to identify the determinants of fiscal sustainability and take actions aimed at achieving and maintaining it.

The fiscal sustainability of a country is determined, among other factors, by the level of public debt, budget deficit/surplus, GDP growth rate, current account balance or bond yields EMU. The above factors were taken into account when constructing the Synthetic Measure of Fiscal Sustainability (SMFS). The Hellwig method and the Mahalanobis metric were used to build the SMFS. The method used made it possible to determine the level of fiscal sustainability of individual European Union Member States in 2014, 2017, 2020 and 2023. The results of the survey indicate that by far the most fiscally stable country was Germany. The Netherlands and Malta also ranked high. Greece had the lowest value of SMFS in 2014 and 2017, France in 2020, and Ireland in 2023.

Furthermore, the analysis of individual components of the SMFS enabled the identification of the factors responsible for the position in the presented ranking moving upwards or downwards. This type of comparison makes it possible to identify problem areas and improve elements that cause adverse changes.

Additionally, based on the conducted research, 5 groups of European Union Member States were identified, ordered by the level of their fiscal sustainability. The least fiscally sustainable group 1. included Greece and France. Group 2., characterized by lower average sustainability, included 7 countries. Group 3., with an average level of fiscal sustainability, included 13 countries, whereas group 4., with a higher average level of fiscal sustainability, included 2 of them. In the case of one country, namely Germany, fiscal sustainability was defined as high.

Financially supported by Minister of Science under the 'Regional Initiative of Excellence' (RID) programme.

References

Adamowicz M., & Janulewicz P. (2012). Wykorzystanie metod wielowymiarowych w określeniu pozycji konkurencyjnej gminy na przykładzie województwa lubelskiego, *Metody Ilościowe w Badaniach Ekonomicznych*, 13(1), 17–28.

Afonso A. (2005). Fiscal Sustainability: The Unpleasant European Case. *FinanzArchiv/Public Finance Analysis,* 61(1), 19–44. https://doi.org/10.1628/0015221053722532.

Afonso A., & Coelho J. C. (2024). Fiscal sustainability, fiscal reactions, pitfalls and determinants. *Applied Economics*, *57*(26), 3560–3571. https://doi.org/10.1080/00036846.2024.2337808.

Afonso A., & Jalles J. T. (2019). Fiscal Reaction Functions Across the World. Quest of Statistical (In)significance. *FinanzArchiv/Public Finance Analysis*,75(3), 207–228. https://doi.org/10.1628/fa-2018-0023.

Afonso, A., & Rault, C. (2010). What do we really know about fiscal sustainability in the EU? A panel data diagnostic. *Review of World Economics, 145*(4), 731–755. https://doi.org/10.1007/s10290-009-0027-9.

Alesina A.,& Perotti R. (1995).Fiscal Expansions and Adjustments in OECD Countries, *Economic Policy*, Working Paper No. 5214.

Bąk A. (2016). Porządkowanie liniowe obiektów metodą Hellwiga i TOPSIS – analiza porównawcza, *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 426.

Begg D., Vernasca G., Fischer S.,& Dornbbusch R. (2011).Makroekonomia. Polskie Wydawnictwo Ekonomiczne, Warszawa.

Bénassy-Quéré, A., & Roussellet, G. (2014). Fiscal sustainability in the presence of systemic banks: The case of EU countries. *International Tax and Public Finance, 22*(1), 1–28. https://doi.org/10.1007/s10797-014-9293-0.

Blanchard O., Chouraqui J. C., Hagemann R.P., & Sartor N. (1990).The sustainability of fiscal policy: New answers to an old question. *OECD Economic Studies*, No. 15.

Brady, G.L., & Magazzino, C. (2018). Fiscal Sustainability in the EU. *Atlantic Economic Journal*,46(3), 297–311. https://doi.org/10.1007/s11293-018-9588-4.

Buiter W. H. (1985). A guide to public sector debt and deficits. *Economic Policy*, 1(1), 13–61.

Collignon, S. (2012). Fiscal policy rules and the sustainability of public debt in Europe. *International Economic Review, 53*(2), 539–567. https://doi.org/10.1111/j.1468-2354.2012.00690.x.

Filipiak B. Z.,& Wyszkowska D. (2022).Stabilność fiskalna w krajach UE. *Wiadomości Statystyczne. The Polish Statistician,* vol. 67, 8, 17–40, https://doi.org/10.5604/01.3001.0015.9703.

Göndör, M. (2019). Fiscal sustainability: Comparative trends in the European Union and challenges for Romania. *Curentul Juridic, 22*(4), 45–56. https://revcurentjur.ro/

Gwóźdź, T., & Kołodziej, D. (2024). Fiscal sustainability – a comparative approach. *RAIP*, 1(XXIV), 115–132. https://doi.org/10.5604/01.3001.0054.4679.

Hellwig Z. (1968). Zastosowanie metody taksonomicznej do typologicznego podziału kraju ze względu na poziom rozwoju oraz zasoby i strukturę wykwalifikowanych kadr, *Przegląd Statystyczny,* 4.

https://www.imf.org/external/datamapper/FiscalRules/matrix/matrix.html.

Hwang C.L., & Yoon K. (1981). *Multiple attribute decision making: Methods and applications*, Springer, https://doi.org/10.1007/978-3-642-48318-9.

IMF, *Fiscal Rules Dataset 1985–2021*, (2022), *IMF Fiscal Affairs Department*, Retrieved 14.01.2025 from.

Iwacewicz-Orłowska A., & Sokołowska D. (2016). Ocena realizacji koncepcji zrównoważonego rozwoju w podregionach województw Polski Wschodniej z wykorzystaniem metody wzorca rozwoju Hellwiga, *Optimum. Studia Ekonomiczne*, 1(79), 182–197, https://doi.org/10.15290/ose.2016.01.79.12.

Konopka P. (2021).*Metody wielokryterialnego podejmowania decyzji w badaniu ryzyka finansowania przedsiębiorstw*, Wydawnictwo Uniwersytetu w Białymstoku.

Kopiński A. (2014). Taksonomia i zastosowanie metody Hellwiga w ocenie efektywności funduszu inwestycyjnych, *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 330, 192–204.

Kopits G., & Symansky S. (1998). Fiscal Policy Rules. *IMF Occasional Paper No*. 162.

Kopits, M.G., & Symansky, M.S.A. (1998). *Fiscal policy rules*. International Monetary Fund.

Krakowiak-Bal A. (2005). Wykorzystanie wybranych miar syntetycznych do budowy miary rozwoju infrastruktury technicznej, *Infrastruktura i Ekologia Terenów Wiejskich*, 3, 71–82.

Larch, M., & Martins, J.N. (2009). *Fiscal policy making in the European Union: An assessment of current practice and challenges*. Routledge.

Marchewka-Bartkowiak K. (2010). Reguły fiskalne. *Analizy BAS*, nr 7(32).

Papadopoulos, A.P., & Sidiropoulos, M.G. (1999). The sustainability of fiscal policies in the European Union. *International Advances in Economic Research, 5*(1), 3–18. https://doi.org/10.1007/BF02295078

Postuła, M., Kawarska, A., & Chmielewski, W. (2025). The Reform of European Public Debt Regulations – an Opportunity and a Challenge for EU Member States. *Comparative Economic Research. Central and Eastern Europe*, *28*(2), 7–27. https://doi.org/10.18778/1508-2008.28.10.

Roszkowska E.,& Filipowicz-Chomko M. (2021). Measuring Sustainable Development Using an Extended Hellwig Method: A Case Study of Education, *Social Indicators Research*, 153, 299–322, https://doi.org/10.1007/s11205-020-02491-9.

Roszkowska E., & Filipowicz-Chomko M., & Łyczkowska-Hanćkowiak A., & Majewska E. (2024). Extended Hellwig's method utilizing entropy-based weights and Mahalanobis distance: applications in evaluating sustainable development in the education area. *Entropy*, 26(3), 197, https://doi.org/10.3390/e26030197.

Schick A. (2005). Sustainable Budget Policy: Concepts and Approaches. *OECD Journal on Budgeting*, 5(1).

Steel I., & Harris T. (2020). COVID-19 Economic Recovery: Fiscal Stimulus Choices for Lower-Income Countries. *Institute for Fiscal Studies*, London.

Stoian, A., Obreja Brașoveanu, L., & Brașoveanu, I.V. (2018). A framework to assess fiscal vulnerability: Empirical evidence for European Union countries. *Sustainability, 10*(7), 2268. https://doi.org/10.3390/su10072268.

The 'general escape clause' within the Stability and Growth Pact: Fiscal flexibility for severe economic shocks (2020).European Parliament, Retrieved 31.01.2025 from::https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)649351.

Vanhorebeek, F., and Van Rompuy, P. (1995). Solvency and Sustainability of Fiscal Policies in the EU. *De Economist,* 143(4), 457–473. https://doi.org/10.1007/BF01384910.

Wójcicki W. (2021). Zrozumieć finanse publiczne, Wydawnictwo Państwowej Szkoły wyższej im. Papieża Jana Pawła II w Białej Podlaskiej, Biała Podlaska.

Wysocki F. (2010). *Metody taksonomiczne w rozpoznawaniu typów ekonomicznych rolnictwa i obszarów wiejskich*, Wydawnictwo Uniwersytetu Przyrodniczego, Poznań.

Acknowledgements

Author contributions: (Patrycja Łupińska), P. Ł. (50%), (Paweł Konopka)author, P.K. (50%).

Funding: Financially supported by Minister of Science under the 'Regional Initiative of Excellence' (RID) programme. Application number E/7/1/RID/2024.

Appendix

Table 1. Measures used to assess fiscal sustainability

Quantitative measures	Qualitative measures	Assessment of institutional behavior
Budget deficit and government debt to GDP, annual budget revenues, credit default swap (CDS), current account balance	Subjective opinions on market trends, assessment of social preferences and habits, and surveys of public behavior and public sentiment	Evaluation of the adopted action strategies and decisions of the central and/or local authorities and the adopted direction of local and regional development

Source: own compilation based on: Filipiak, Wyszkowska, 2022, p. 25-26.

Table 2. Matrix of Linear Correlation Coefficients Between Variables

year	2014				
variable	V1	V2	V3	V4	V5
V1	1,000	-0,300	-0,037	0,372	0,004
V2	-0,300	1,000	-0,125	-0,554	0,490
V3	-0,037	-0,125	1,000	0,334	-0,257
V4	0,372	-0,554*	0,334	1,000	-0,510
V5	0,004	0,490*	-0,257	-0,510*	1,000
year	2017				
variable	V1	V2	V3	V4	V5
V1	1,000	-0,243	-0,156	0,169	-0,004
V2	-0,243	1,000	0,067	-0,251	0,539
V3	-0,156	0,067	1,000	0,234	-0,288
V4	0,169	-0,251	0,234	1,000	-0,391
V5	-0,004	0,539*	-0,288	-0,391*	1,000
year	2020				
variable	V1	V2	V3	V4	V5
V1	1,000	-0,221	-0,071	0,224	-0,057
V2	-0,221	1,000	-0,190	-0,471	0,140
V3	-0,071	-0,190	1,000	0,539	-0,646
V4	0,224	-0,471*	0,539*	1,000	-0,603
V5	-0,057	0,140	-0,646*	-0,603*	1,000
year	2023				
variable	V1	V2	V3	V4	V5
V1	1,000	-0,346	-0,229	0,380	-0,175
V2	-0,346	1,000	0,094	-0,520	0,062
V3	-0,229	0,094	1,000	-0,185	0,154

year	2023				
variable	V1	V2	V3	V4	V5
V4	0,380	-0,520*	-0,185	1,000	-0,633
V5	-0,175	0,062	0,154	-0,633*	1,000

*p<0,05
Source: Own elaboration.

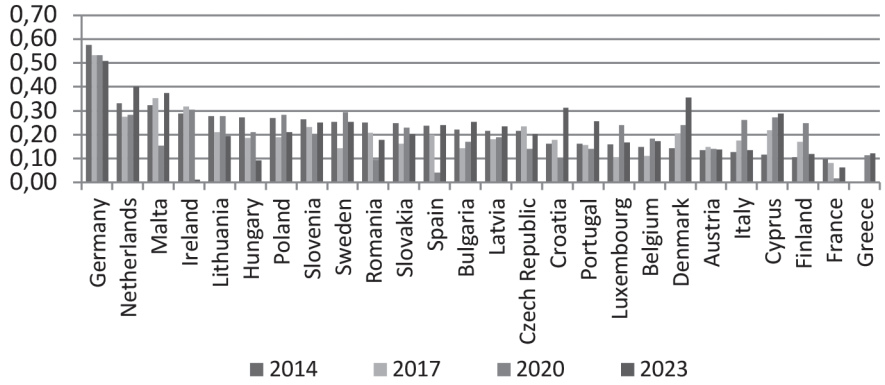
Table 3. Value of the SMFS index obtained using Hellwig's method with the Mahalanobis metric for the years 2014, 2017, 2020 and 2023

	Country	SMFS2014	Country	SMFS2017
1.	Germany	0,575	Germany	0,533
2.	Netherlands	0,331	Netherlands	0,352
3.	Malta	0,323	Malta	0,318
4.	Ireland	0,289	Ireland	0,275
5.	Lithuania	0,278	Lithuania	0,234
6.	Hungary	0,273	Hungary	0,232
7.	Poland	0,269	Poland	0,218
8.	Slovenia	0,263	Slovenia	0,210
9.	Sweden	0,252	Sweden	0,209
10.	Romania	0,251	Romania	0,205
11.	Slovakia	0,249	Slovakia	0,200
12.	Spain	0,238	Spain	0,190
13.	Bulgaria	0,222	Bulgaria	0,186
14.	Latvia	0,216	Latvia	0,180
15.	Czech Republic	0,215	Czech Republic	0,179
16.	Croatia	0,162	Croatia	0,175
17.	Portugal	0,161	Portugal	0,169
18.	Luxembourg	0,160	Luxembourg	0,161
19.	Belgium	0,147	Belgium	0,157
20.	Denmark	0,143	Denmark	0,149
21.	Austria	0,135	Austria	0,143
22.	Italy	0,128	Italy	0,143
23.	Cyprus	0,116	Cyprus	0,111
24.	Finland	0,107	Finland	0,104
25.	France	0,096	France	0,082
26.	Greece	0,003	Greece	0,001

	Country	SMFS2020	Country	SMFS2023
1.	Germany	0,533	Germany	0,510
2.	Netherlands	0,305	Netherlands	0,401
3.	Malta	0,295	Malta	0,374
4.	Ireland	0,282	Ireland	0,356
5.	Lithuania	0,282	Lithuania	0,312
6.	Hungary	0,277	Hungary	0,289
7.	Poland	0,272	Poland	0,257
8.	Slovenia	0,260	Slovenia	0,254
9.	Sweden	0,248	Sweden	0,254
10.	Romania	0,240	Romania	0,251
11.	Slovakia	0,239	Slovakia	0,239
12.	Spain	0,228	Spain	0,233
13.	Bulgaria	0,211	Bulgaria	0,211
14.	Latvia	0,200	Latvia	0,203
15.	Czech Republic	0,189	Czech Republic	0,202
16.	Croatia	0,184	Croatia	0,194
17.	Portugal	0,171	Portugal	0,179
18.	Luxembourg	0,154	Luxembourg	0,173
19.	Belgium	0,141	Belgium	0,167
20.	Denmark	0,140	Denmark	0,137
21.	Austria	0,139	Austria	0,135
22.	Italy	0,113	Italy	0,120
23.	Cyprus	0,103	Cyprus	0,119
24.	Finland	0,094	Finland	0,093
25.	France	0,042	France	0,062
26.	Greece	0,016	Greece	0,012

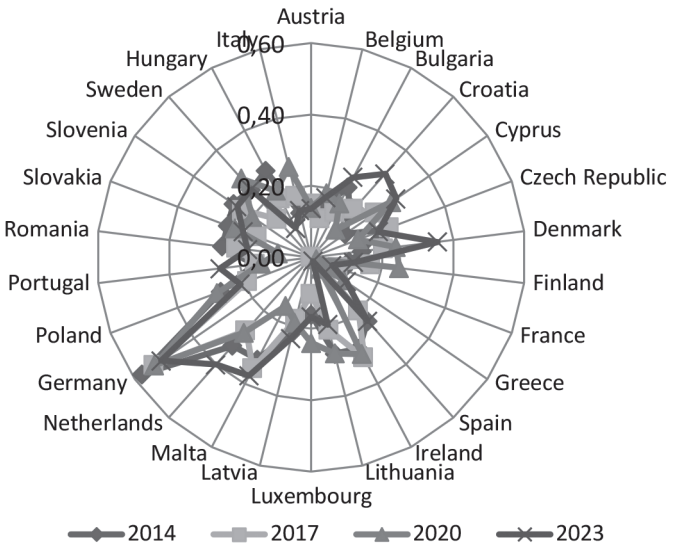
Source: Own elaboration.

Chart 1. Value of the SMFS index obtained using Hellwig's method with the Mahalanobis metric for the years 2014, 2017, 2020 and 2023



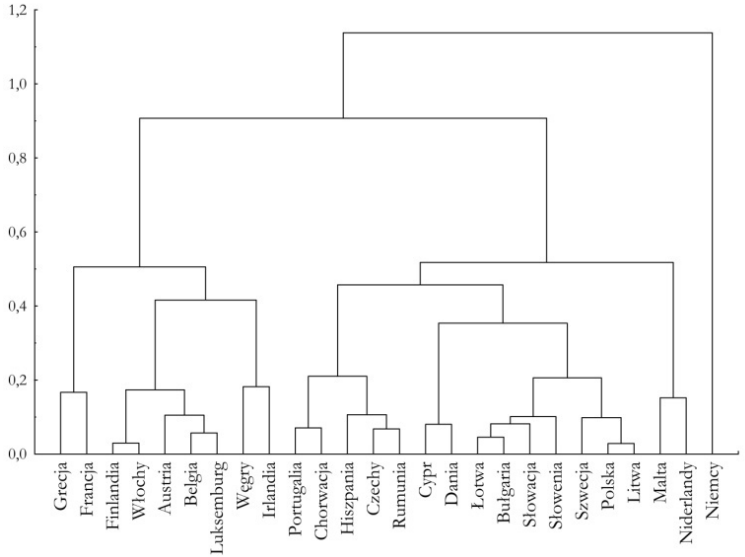
Source: Own elaboration.

Chart 2. Value of the SMFS index obtained using Hellwig's method with the Mahalanobis metric for the years2014, 2017, 2020 and 2023



Source: Own elaboration.

Chart 3. Hierarchical Cluster Analysis, Variables $SMFS_{2014}$, $SMFS_{2017}$, $SMFS_{2020}$, $SMFS_{2023}$



Source: Own calculations, cluster distances determined using Ward's method, observation distances calculated using the Euclidean metric.

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 28.04.2025; accepted 09.09.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.18

Analysis of the Determinants of Healthcare Expenditure Based on Panel Data from 2000–2020

PIOTR MALINOWSKI

University of Warsaw, Faculty of Economics Sciences, ul. Długa 44/50, 00-241, Warsaw, Poland
piotrmalinowski13@gmail.com
ORCID: https://orcid.org/0009-0002-9835-6621

Abstract

Motivation: The rising costs of healthcare, fueled by aging populations, increasing life expectancy, and expanding access to medical technologies, have intensified the need to understand the underlying drivers of healthcare expenditure. While previous studies often emphasize the income elasticity of healthcare spending, many fail to incorporate broader institutional and socio-demographic factors or rely on limited cross-sectional data from a small subset of countries.

Aim: This study aims to provide a comprehensive and updated analysis of the determinants of healthcare expenditures using panel data from 155 countries over the period 2000–2020. By including a wide range of economic, demographic, and institutional variables, and employing a robust two-way fixed effects model, the research seeks to uncover key factors shaping global health spending.

Results: The final significant variables influencing healthcare expenditure include GDP per capita, the share of public healthcare expenditure in GDP, the proportion of the population aged 65 and older, urbanization rates, the number of physicians per 1,000 inhabitants and out-of-pocket healthcare expenses. Additionally, a quadratic term for the logarithm of GDP per capita was introduced to account for the non-linear relationship between income and healthcare spending. The findings suggest that both economic and demographic factors are crucial in determining healthcare expenditures, offering insights for policymakers aiming to improve the efficiency of healthcare systems.

Keywords: Healthcare expenditures, Healthcare costs, Public spending, Institutional factors, Socio-demographic factors, Panel data, Fixed effects model
JEL: I13, I14, I15, I18

1. Introduction

In light of aging societies, the development of medical technologies, and the growing public expectations for the highest possible standard of healthcare provision, the topic of healthcare expenditure and its outcomes has gained significant importance and is increasingly featured in public discourse. Existing research on the determinants of healthcare expenditure places particular emphasis on the relationship between GDP per capita and the level of healthcare spending (Younsi et al., 2016, pp. 580–601; Xu et al., 2011, pp. 1–28; Leu, 1986, pp. 41–63). To estimate this relationship, researchers often use the income elasticity of GDP per capita with respect to aggregate healthcare expenditure. This focus on income elasticity analysis frequently leads to other potentially important variables being either overlooked or insufficiently examined. Yet institutional conditions in individual countries, the structure of public sector healthcare funding, or even individual consumer preferences regarding private healthcare spending may also play a crucial role.

Many existing studies are based on cross-sectional data or analyze small samples of countries, often limited to OECD members or developing economies (Gerdtham et al., 1992, pp. 63–84; Gbesemete & Gerdtham, 1992, pp. 303–308). Only a few studies to date have analyzed large samples using panel data and included a broader set of variables–something that appears increasingly insufficient in the context of the current public debate (Younsi et al., 2016, pp. 580–601; Xu et al., 2011, pp. 1–28).

The aim of this study is to conduct an in-depth analysis of the determinants of healthcare expenditure using panel data from 155 countries for the years 2000–2020, taking into account the differences arising from varying levels of development and institutional conditions. This paper constitutes a direct continuation and extension of the author's previous work (*Malinowski, 2024, pp.1-11*), which analyzed the determinants of healthcare spending using cross-sectional data from 2018. While that study confirmed the significance of key economic and demographic variables in explaining cross-country variation, the current analysis deepens the investigation by introducing a dynamic, panel-based approach that captures both temporal and regional heterogeneity. For this purpose, the most suitable econometric model will be estimated, based on a two-way fixed effects model with robust standard error matrices. The study will also justify the drawbacks of applying alternative approaches. In line with the methodological choices made

in Malinowski (2024), this study also incorporates the **squared logarithm of GDP per capita** to model the **non-linear relationship** between national income and healthcare spending - a specification that previously yielded strong explanatory power and continues to prove statistically valid in the extended panel framework.

2. Literature on the Determinants of Healthcare Expenditure

To obtain the correct form of the estimated model, the selection of independent variables remains crucial. Due to significant discrepancies in the literature regarding the proposed explanatory variables, a detailed review of the most highly regarded academic articles has been conducted. The literature review is divided into two stages. In the first stage, cross-sectional studies are analyzed, as they often cover larger samples of countries for a single point in time or focus on specific groups of countries with potentially similar individual effects. In the second stage, panel data studies are examined, which, although often considering fewer variables, include multiple time periods, allowing for the observation of temporal effects. This division enables the clear identification of independent variables specific to each study and facilitates the selection of those to be used in this paper.

Gbesemete and Gerdtham analyzed healthcare expenditure in Africa using a cross-sectional study of 30 countries. They found that 78.3% of the variance in healthcare expenditure could be explained by the combined variability of GDP per capita, the percentage of births attended by medical personnel, and international aid received (Gbesemete & Gerdtham, 1992, pp. 303–308). This study is particularly relevant when selecting variables for low-income countries, most of which are African nations.

On the opposite end of the spectrum is the study by Gerdtham et al., who conducted a cross-sectional analysis of 19 OECD countries (Gbesemete & Gerdtham, 1992, pp. 303–308). In addition to the commonly analyzed relationship between GDP per capita and healthcare expenditure, this study focuses on the share of public financing in healthcare spending and its implications. This issue is also addressed by other authors. Leu argues that an increase in the public share of healthcare financing raises total expenditure, linking it to the decrease in the cost of medical services for individual consumers (Leu, 1986, pp. 41–63). Culyer draws similar conclusions, adding that an increase in the number of entities financing healthcare services (insurance companies) also raises expenditure (Culyer, 1989, pp. 21–32), attributing this to the difficulty in centralized budget control. In later works, Gerdtham et al. conclude that providing services mainly through the public sector reduces total healthcare expenditure (Gerdtham et al., 1998, pp. 113–134). To incorporate these insights, Gerdtham et al. include several additional variables in

their model: the share of total public expenditure allocated to healthcare, the percentage spent on hospital care, a dummy variable indicating the presence of copayments in ambulatory care, and another dummy variable for state-funded hospitals (Gerdtham et al., 1992, pp. 63–84).

Gerdtham et al. also introduce a simplified measure of supply-induced demand, as analyzed by Leu and Thornton & Rice (Leu, 1986, pp. 41–63; Gerdtham et al., 1992, pp. 63–84; Thornton & Rice, 2008, pp. 2873–2889). This lies at the intersection of microeconomic perspectives–viewing healthcare spending through household budgets and income-maximizing medical service providers–and the macroeconomic approach taken in this paper, which considers healthcare expenditure from a national perspective. As a proxy for supply-induced demand, they use the number of physicians per 1,000 inhabitants, unlike Leu, who used the percentage of hospital beds provided by the public sector relative to total beds in both public and private sectors (Leu, 1986, pp. 41–63; Gerdtham et al., 1992, pp. 63–84) Statistically significant variables included GDP per capita, the share of public financing, urbanization, and the dummy variable for copayments in ambulatory care. In contrast, the number of physicians per 1,000 inhabitants and the percentage of the population over 65 were statistically insignificant.

The authors understood urbanization, similarly to Leu, as a proxy for healthcare facility accessibility and the associated costs for consumers, which tend to be lower in urban centers (Leu, 1986, pp. 41–63). Their obtained negative correlation, consistent with Thornton & Rice, supports this interpretation (Leu, 1986, pp. 41–63; Thornton & Rice, 2008, pp. 2873–2889). However, it contradicts studies that interpret urbanization as a proxy for environmental pollution. It's also important to consider that the effect of urbanization may differ across country groups. In high-income countries, high urbanization likely facilitates better access to healthcare and lower costs, as mentioned above. In contrast, in low-income countries, following Gugler and Flanagan's argumentation, healthcare expenditure may increase (Gugler & Flanagan, 1978, pp. 26–46), due to the formation of cities with poor sanitation, high pollution from early industrialization, and low housing standards, which can promote the spread of epidemics.

Thornton and Rice conducted an intranational analysis of 50 U.S. states (Thornton & Rice, 2008, pp. 2873–2889). This unique study focuses on internal variation and the alignment of supply and demand in the medical market. Its exceptional perspective highlights additional aspects worth considering in our model. Uniquely, the study identifies education as a key determinant of healthcare expenditure. This finding is critical from a cost-benefit analysis standpoint. According to the study, increasing education levels reduces healthcare spending. It's worth noting that more years of formal education also enhance economic efficiency in other areas, including productivity/

However, the impact of education on healthcare expenditure is somewhat ambiguous. On one hand, longer education improves health habits and thus public health, indirectly reducing spending. On the other hand, from an individual perspective, increased awareness of health issues may raise spending. GDP per capita was also significant, but its elasticity was only 0.37, explained by the intranational scope of the analysis. Unlike Gbesemete and Gerdtham, the age structure of the population, expressed as the percentage over 65, was statistically significant (Gbesemete & Gerdtham, 1992, pp. 303–308). These are the three key takeaways from the study. Given its uniqueness, education should be considered a potentially important factor in healthcare spending. However, in this paper, we will omit education itself and instead focus on population health indicators–such as alcohol consumption, smoking, and the percentage of overweight individuals–which are likely outcomes of formal education. Therefore, the focus will be on analyzing these variables.

Regarding panel data, the two most important studies are by Xu et al. and Younsi et al., both of which attempt a comprehensive analysis of healthcare expenditure determinants over longer time spans (Younsi et al., 2016, pp. 580–601; Xu et al., 2011, pp. 1–28). These studies largely replicate the estimations of previously discussed variables, which will not be repeated here. Instead, we will focus on the innovations introduced.

Younsi et al. introduce an additional variable: out-of-pocket expenditure, referring to healthcare costs borne directly by households, such as physician copayments (earlier captured by Gerdtham et al.'s dummy variable), payments in primary care, and drug purchases (Younsi et al., 2016, pp. 580––601; Gerdtham et al., 1992, pp. 63–84). This innovative approach allows for a more comprehensive view of consumer expenditure, complementing government-funded healthcare spending. Younsi et al. include it as a percentage of total healthcare spending (Younsi et al., 2016, pp. 580–601). A key insight from this study–absent in earlier works–is that healthcare expenditure grows more slowly over time than GDP per capita. Xu et al. reach similar conclusions (Xu et al., 2011, pp. 1–28).

In addition to traditional econometric approaches, recent studies have applied methods such as fuzzy-set Qualitative Comparative Analysis (fsQCA) to examine complex interactions between determinants of healthcare spending. For instance, Nie et al. identified multiple configurations of institutional and demographic factors that jointly explain variations in health expenditures among OECD countries, emphasizing the importance of multi-causal analysis. (Nie et al, 2025, pp. 1–18)

3. Data and Methodology

In selecting the variables for the model, the author relied on the existing literature discussed above, giving priority to those factors that consistently demonstrated the highest statistical significance in previous empirical studies or appeared to be the most relevant from a theoretical perspective. This approach ensured that the final set of explanatory variables reflected both well-established determinants of healthcare expenditure and variables with strong potential explanatory power. This leads to a baseline model consisting of 12 explanatory variables and one dependent variable, defined as follows (Equation 1). This model structure was originally developed by the author in a previous study (Malinowski, 2024, pp. 1-11), which employed cross-sectional data from 153 countries for the year 2018. Through a series of modifications to the model's functional form, that study achieved a cross-sectional specification explaining 96.5% of the variation in healthcare expenditure. It is therefore justified to begin with the functional form proposed by these authors, while applying the necessary modifications required for a panel model framework, such as the inclusion of adding country-specific effect (Equation 1) and year-specific effect (Equation 2).

$$\begin{aligned}\mathbf{CHE_{it}} = {} & \boldsymbol{\beta_0} + \boldsymbol{\beta_{1i}}\mathbf{lnGDP_{it}} + \boldsymbol{\beta_{2i}}\mathbf{GHE_{it}} + \boldsymbol{\beta_{3i}}\mathbf{AGE65_{it}} + \boldsymbol{\beta_{4i}}\mathbf{URB_{it}} + \boldsymbol{\beta_{5i}}\mathbf{lnPHY_{it}} \\ & + \boldsymbol{\beta_{6i}}\mathbf{lnLEB_{it}} + \boldsymbol{\beta_{7i}}\mathbf{lnIMR_{it}} + \boldsymbol{\beta_{8i}}\mathbf{OOP} + \boldsymbol{\beta_{9i}}\mathbf{BMI_{it}} + \boldsymbol{\beta_{10i}}\mathbf{lnALC_{it}} \\ & + \boldsymbol{\beta_{11i}}\mathbf{CIG_{it}} + \boldsymbol{\beta_{12i}}\mathbf{ODA_{it}} + \mathbf{v_i} + \boldsymbol{\varepsilon_{it}}\end{aligned} \quad (1)$$

where:
i – 1, ... , N – country;
t – 1, ... , N – time period;
v_i – country-specific effect;
ε_{it} – random error term;
CHE – Current health expenditure per capita, expressed in current international dollars, adjusted by purchasing power parity (PPP);
GDP – Gross Domestic Product per capita in current international dollars (PPP-adjusted);
GHE – Domestic general government health expenditure as a percentage of GDP;
AGE65 – Population aged 65 and over as a percentage of the total population. Based on the de facto population definition, including all residents regardless of legal status or citizenship;
URB – Urban population as a percentage of the total population, according to definitions from national statistical offices;

PHY – Number of physicians per 1,000 people, including general practitioners and specialists;
LEB – Life expectancy at birth, defined as the number of years a newborn is expected to live if prevailing mortality patterns remain constant;
IMR – Infant mortality rate, defined as the number of infants dying before age 1 per 1,000 live births in a given year;
OOP – Out-of-pocket expenditure as a percentage of total healthcare expenditure. Includes expenses such as medication purchases, doctor visits, and additional tests, borne directly by households;
BMI – Percentage of adults aged 18 and older with a body mass index (BMI) of 25 kg/m^2 or higher;
ALC – Total alcohol consumption per capita (age 15+), measured in liters of pure alcohol per calendar year, including both recorded and unrecorded alcohol, adjusted for tourist consumption;
CIG – Percentage of the population aged 15 and older currently using any tobacco product (smoked and/or smokeless), either daily or occasionally;
ODA – Official development assistance received by the country, expressed in constant 2022 US dollars. Percentage-based or PPP-adjusted international dollar data were not available, although they would have been more appropriate for this analysis;

These definitions are consistent with those employed in earlier studies, including Malinowski (2024), enabling comparability and continuity in analysis.

All data were retrieved from the World Bank database, except for BMI, sourced from the World Health Organization (WHO), and ODA, sourced from the Organization for Economic Co-operation and Development (OECD). The variable definitions are the official ones provided by the World Bank, WHO (BMI), and OECD (ODA). Throughout this paper, healthcare expenditure refers to aggregated per capita healthcare spending expressed in current international dollars, PPP-adjusted (Malinowski, 2024, pp. 1–11).

International dollars are a World Bank-defined monetary unit representing the amount of goods and services that a U.S. dollar would buy in the United States. The term 'current' refers to the purchasing power of the unit at the most recent estimation, which, for the dataset used, is the year 2022 (Malinowski, 2024, pp. 1–11).

The choice of variables and model functional form was based on the related literature cited above. It is worth noting that data for alcohol consumption (ALC) and tobacco use (CIG) were reported in five-year intervals. To address the loss of a significant number of observations due to the gaps between reporting periods, linear interpolation and extrapolation were applied to fill the missing values. A similar approach was applied to the PHY variable (physicians per 1,000 inhabitants), where some isolated data points were missing despite expected annual reporting. These adjustments should not affect the

precision of coefficient estimates for these variables but may improve the estimation precision for the remaining variables.

It should also be emphasized that the term *country* refers not to the political sovereignty of a geographic region, but rather to the independent reporting of the variables of interest. Therefore, some dependent territories are listed as separate entities, and their data are not included in the 'dominant' country's dataset. The complete map of countries included in the analysis is presented in Chart 1.

In this study, a 5% significance level is used as the threshold for statistical significance. Additionally, variables potentially significant at the 10% level are marked in the output tables. However, this is merely an auxiliary guide for further model interpretation and is not used as a definitive criterion for statistical significance.

3.1. Descriptive statistics

Table 1. presents the basic descriptive statistics for the variables analyzed. Based on the table, significant differences in healthcare expenditure levels across countries can be observed. The average healthcare expenditure across the entire sample amounted to $1,162.28. The highest healthcare expenditure per capita was recorded in the United States in 2020, reaching $11,702.41, while the lowest was observed in the Democratic Republic of the Congo in 2000, amounting to $6.72.

When analyzing the share of healthcare expenditure in GDP over time, a very slight upward trend can be noted Chart 2. In the analyzed dataset, healthcare expenditure grew faster than GDP per capita; the slope coefficient of the trend line for the logarithmised values was 0.0495 for lnCHE and 0.043 for lnGDP, respectively. Thus, the findings here contrast with those of Younsi et al., who argued that healthcare expenditure grows more slowly than GDP per capita (Younsi et al., 2016, pp. 580–601).

Public healthcare expenditure represents a subgroup of total healthcare spending. The average share of public healthcare expenditure in GDP across the analyzed countries was 3.38%. It ranged from 0.06% to 22.25% of GDP. Chart 3. shows how this share evolved over time. From a temporal perspective, we can observe a steady, slight increase in the share of public healthcare expenditure throughout the years.

A key variable for the following analysis, as well as for estimating income elasticity, is GDP per capita, which averaged $16,531.37 across the countries analyzed. The highest GDP per capita was observed in Qatar in 2012 at $163,219.49, while the lowest was recorded in the Democratic Republic of the Congo in 2001 at $420.27.

The number of observations remained stable across most variables. However, significant gaps were noted for the ALC and CIG variables, resulting from their reporting at five-year intervals, as discussed earlier.

3.2. Choice of Functional Form of the Model

A key step in the analysis is the selection of the most suitable panel data model that best estimates the parameters of interest. The model selection process is based on estimating successive model variants. A logarithmic transformation was applied to all variables not expressed as percentages, marked by the prefix 'ln' in the model specification. Although many authors apply logarithmic transformations to all variables, diagnostic testing in this study indicated that such an approach would not improve the estimation quality or functional form (Younsi et al., 2016, pp. 580–601; Xu et al., 2011, pp. 1–28). It was therefore more appropriate to retain percentage variables in their original form.

The correlation between independent variables used in the model is relatively high. The estimated values are shown in Chart 4. However, considering the nature of the variables, a certain degree of correlation between them is unavoidable. An attempt was made to remove the most highly correlated variables–lnIMR, AGE65, and lnPHY–but doing so did not affect the results of functional form or heteroskedasticity tests. As such, the decision was made to retain these variables.

The estimation began with a Pooled OLS model. The parameter estimates are presented in a comparative table (Table 2.). The Breusch-Pagan LM test was used to examine the significance of individual effects across countries and whether the model reduces to a simple pooled regression. This hypothesis was rejected based on a p-value of 0.000, indicating non-zero individual effects and invalidating the use of a simple Pooled OLS model.

Panel cointegration techniques have also been employed in regional studies to model long-run equilibrium relationships between expenditure and macroeconomic indicators, highlighting the suitability of panel-based specifications (Samadi & Homaie Rad, 2013, pp. 63-68).

The focus then shifted to the Fixed Effects (FE) and Random Effects (RE) estimators. Theoretical considerations point to the Fixed Effects model being more appropriate, for two main reasons. First, the dataset includes the entire population rather than a random sample, favoring FE. Second, it is likely that country-specific effects are correlated with the explanatory variables. To finalize model selection, a Hausman test was performed, yielding a p-value of 0.000 (Hausman, 1978, pp. 1251–1271). This led to the rejection of the null hypothesis of no correlation between individual effects and explanatory variables, thus confirming the use of the Fixed Effects model. Estimates for both FE and RE models are shown in Table 2.

However, the FE model does not account for year-specific effects. To address this, a Two-Way Fixed Effects model was estimated, adding a time effect term resulting in the following equation:

$$\begin{aligned} CHE_{it} = {} & \beta_0 + \beta_{1i}\ln GDP_{it} + \beta_{2i}GHE_{it} + \beta_{3i}AGE65_{it} + \beta_{4i}URB_{it} + \beta_{5i}\ln PHY_{it} \\ & + \beta_{6i}\ln LEB_{it} + \beta_{7i}\ln IMR_{it} + \beta_{8i}OOP + \beta_{9i}BMI_{it} + \beta_{10i}\ln ALC_{it} \\ & + \beta_{11i}CIG_{it} + \beta_{12i}ODA_{it} + v_i + \gamma_t + \varepsilon_{it}, \end{aligned} \quad (2)$$

where:

γ_t – year-specific effect.

Most of the time fixed effects in the Two-Way Fixed Effects model were statistically significant. Omitting them could bias the estimates of other variables. Younsi et al. and Xu et al. also included a time variable to obtain valid estimators, although they did not explicitly refer to it as a Two-Way Fixed Effects model (Younsi et al., 2016, pp. 580–601; Xu et al., 2011, pp. 1–28). Furuoka et al. explicitly used this model and found it to be the best fitting one (Furuoka et al., 2017, pp. 12–25).

To verify the functional form, the RESET test was performed in both fitted and regressor versions. The fitted version returned an F-statistic of 24.0 and p-value of 0.000, leading to the rejection of the null hypothesis of correct functional form. The regressor version gave an F-statistic of 2.58 with a p-value of 0.0762, suggesting no grounds for rejecting the null. These conflicting results imply that more weight should be given to the fitted version of the RESET test, while the regressor version is considered supplementary.

Based on the statistical significance of interactions, squared and cubic terms in the regressor version, the model was extended by adding the square of lnGDP, denoted as intlnGDPxlnGDP, as previously done by Malinowski (2024). Reapplying the RESET fitted test to this new specification yielded an F-statistic of 2.90 and p-value of 0.0553–indicating no reason to reject the null hypothesis. Thus, this extended model now has the correct functional form:

$$\begin{aligned} CHE_{it} = {} & \beta_0 + \beta_{1i}\ln GDP_{it} + \beta_{2i}GHE_{it} + \beta_{3i}AGE65_{it} + \beta_{4i}URB_{it} \\ & + \beta_{5i}\ln PHY_{it} + \beta_{6i}\ln LEB_{it} + \beta_{7i}\ln IMR_{it} \\ & + \beta_{8i}OOP + \beta_{9i}BMI_{it} + \beta_{10i}\ln ALC_{it} \\ & + \beta_{11i}CIG_{it} \\ & + \beta_{12i}ODA_{it} + \beta_{13i}intlnGDPXlnGDP_{it} + v_i + \gamma_t \\ & + \varepsilon_{it} \end{aligned} \quad (3)$$

To test for heteroskedasticity, the modified Wald test was used, yielding a p-value of 0.000, indicating heteroskedasticity. The Wooldridge test for first-order autocorrelation returned an F-statistic of 100.596 and p-value of

0.000, confirming the presence of autocorrelation. Given the short time dimension and large number of entities in the panel dataset, cross-sectional dependence was not tested, as it would not affect subsequent steps.

To address heteroskedasticity and autocorrelation, the model was re-estimated using robust standard error matrices. This specification was considered the best model in this study and is referred to henceforth as the 'best model' or the 'Two-Way Fixed Effects model with correct functional form and robust standard errors.' The parameter estimates for the correct functional form using robust errors are shown in Table 3., alongside estimates from other model variants (Table 2.). With this revised specification and robust standard errors, the following variables were statistically significant: lnGDP, GHE, AGE65, URB, lnPHY, OOP, and intlnGDPxlnGDP.

To assess the impact of interpolation and extrapolation of lnPHY, lnALC, and CIG, the best model was re-estimated using only the raw data (without interpolation), resulting in just 468 observations from 142 countries. In contrast, the interpolated dataset contained 3,182 observations across 155 countries. Year-specific effects remained significant regardless of data completion. Most coefficient estimates were of similar magnitude, with differences deemed qualitatively minor. Therefore, interpolation did not appear to distort the results, while allowing for a greater number of observations, enhancing the credibility of the findings. Data imputation was also employed by other authors (Xu et al., 2011, pp. 1–28).

4. Model Estimation and Results

The parameter estimates are presented in Table 3., and their analysis provides key findings for this study. The variables that proved to be statistically significant include: GDP per capita (lnGDP), public health expenditure as a share of GDP (GHE), population age structure (AGE65), urbanization level (URB), number of physicians per 1,000 inhabitants (lnPHY), out-of-pocket expenditure share (OOP), and the square of the logarithm of GDP per capita (intlnGDPXlnGDP).

The obtained income elasticity is 1.711. However, it is not appropriate to directly compare this elasticity with values reported in other studies, as it cannot be interpreted independently of the squared logarithmic term introduced here, which is not present in other works. The square of the logarithm of income (intlnGDPXlnGDP) is negatively correlated with healthcare expenditure and has a complex interpretation.

An attempt was made to use the logarithm of GDP squared instead, which would have been easier to interpret. However, this approach was unsuccessful due to a negative RESET test result for that model. Therefore, the square of the logarithm of GDP per capita was used in this study, as it is

necessary to achieve a correct functional form. This allows for the estimation of non-constant income elasticity between GDP per capita and healthcare expenditure (Wooldridge, 2013, p. 198). In other words, the level of income elasticity in the model depends on the specific value of GDP per capita–or more precisely, on the logarithm of that value. This relationship is captured in Equation (4). The income elasticity would be defined solely by the parameter if were equal to zero.

$$\%\Delta \mathbf{CHE} \approx [\boldsymbol{\beta_1} + \mathbf{2}\boldsymbol{\beta_{13}}\mathbf{lnGDP}]\%\Delta \mathbf{GDP} \tag{4}$$

Public health expenditure as a share of GDP is positively correlated with healthcare expenditure. This aligns with the arguments of Leu and Culyer (Leu, 1986, pp. 41–63); (Culyer, 1989, pp. 21–32), but contradicts the findings of Gerdtham et al., who observed a negative correlation (Gerdtham et al., 1992, pp. 63–84). This finding is also supported by recent evidence from the European Union, where institutional quality and fiscal capacity have been shown to significantly influence public healthcare spending (Piscopo et al., 2024, pp. 1-19). The results support the concept that subsidizing medical services by the government reduces their effective price for consumers, increasing demand. As government funding increases, the market equilibrium shifts toward higher consumption of healthcare services, ultimately raising total expenditure.

However, the positive correlation of out-of-pocket expenditure with total healthcare spending appears contradictory to the above. Though close to zero, this may indicate the existence of unknown factors influencing how the distribution of healthcare costs between the state and households affects total expenditure. This relationship has been further explored in recent empirical work on low- and middle-income countries, such as India, where household-level data confirms the burden of direct payments and their uneven distribution across regions and income groups (Sofi & Yasmin, 2024). It may be worthwhile to more deeply analyze insurance system structures in different countries to determine whether they impact the estimated values.

Urbanization turned out to be negatively correlated with healthcare spending (Thornton & Rice, 2008, pp. 2873–2889). Thus, it can be treated as a proxy for the cost of access to healthcare facilities. Somewhat contradicting this is the positive correlation found for the number of physicians per 1,000 inhabitants. Initially, these variables were expected to complement one another and show similar directional relationships with income.

A justification for the positive correlation of the physician variable may lie in the supply-induced demand hypothesis. The underlying intuition is that physicians, as producers of medical services, may tend to maintain their in-

come levels regardless of the physician-to-population ratio (Eastaugh, 1992, pp. 410–424); (Frech, 1996, pp. 84–101).

The share of the population over 65 years was also statistically significant and positively correlated with healthcare spending, in line with initial expectations. Surprisingly, all lifestyle-related variables (obesity, smoking, alcohol consumption) turned out to be statistically insignificant. This contradicts both the well-known negative health impacts of those behaviors and some prior research findings (Thornton & Rice, 2008, pp. 2873–2889).

The analyzed model appears to be the best specification and should serve as a reference point for inferring the determinants that influence healthcare expenditure. However, it is essential to view any study through the lens of its limitations. Data availability varies greatly across years, necessitating interpolations and approximations. Moreover, many studies use different estimations for comparable qualitative variables. Debates continue over using age brackets such as under 15 or over 65 as proxies for population age structure, and over the cut-off thresholds used to define obesity. These small differences–though individually minor–are numerous and can significantly impact final results, particularly in terms of statistical significance.

Therefore, all estimates should be treated as guidelines regarding the importance of specific determinants in shaping healthcare expenditure, and should be taken into account when designing health policies in individual countries.

5. Conclusion

The aim of this study was to identify the most important determinants of healthcare expenditure. Using panel data from 155 countries over the period 2000–2020, a series of econometric models was estimated. This enabled the selection of the Fixed Effects model with both country and year effects, along with robust standard error matrices, as the best tool for modeling healthcare spending. Introducing the square of the logarithm of GDP per capita proved crucial for achieving the correct functional form of the model. The final model demonstrated a high level of fit across the countries analyzed.

This work constitutes a further step in the investigation of healthcare expenditure determinants and contributes new insights - particularly concerning the role of income. By applying a Fixed Effects model with year-specific effects and robust error matrices, and by introducing the square of the logarithm of GDP per capita, the study enables the estimation of non-constant income elasticity with respect to healthcare spending.

The findings show that income elasticity of healthcare expenditure varies greatly depending on the type of data and variables used.

The findings of this study are largely consistent with the literature reviewed. GDP per capita and public health expenditure as a share of GDP were con-

firmed as key determinants, in line with Leu, Culyer, and Younsi et al., while the quadratic GDP term highlighted a non-linear relationship noted only in some prior works (Leu, 1986, pp. 41–63); (Culyer, 1989, pp. 21–32);(Younsi et al., 2016, pp. 580–601). The positive effect of population ageing supports earlier results (Thornton & Rice, 2008, pp. 2873–2889). However, lifestyle-related variables proved insignificant, and the negative link between urbanization and health spending contrasts with studies associating urbanization with higher costs, suggesting instead that greater urban access may reduce expenditure.

The obtained results provide important institutional guidelines for actions aimed at improving the efficiency of healthcare expenditure and enhancing access to medical services. They also form a solid foundation for further, more detailed analyses and for discussion on healthcare financing strategies and the diversity of health system models. Future research should explore the effectiveness of different health system models, particularly by comparing public and private systems, in order to identify the most efficient approaches to healthcare financing and organization. It is especially important to gain a better understanding of how specific health policies impact access to and quality of healthcare services, and what mechanisms can most effectively allocate resources within the healthcare sector.

References

Culyer, A. (1989). Cost containment in Europe. In Health Care Financing Review: Annual supplement (pp. 21–32). U.S. Department of Health and Human Services.

Eastaugh, S.R. (1992). Health economics, efficiency, quality, and equity. Auburn House.

Frech, H.E. (1996). Competition and monopoly in medical care. The AEI Press.

Furuoka, F., Lim, B., Kok, E., Hoque, M.Z., & Munir, Q. (2017). What are the determinants of health care expenditure? Empirical results from Asian countries. Sunway Academic Journal, 8, 12–25. https://doi.org/10.2139/ssrn.2967109

Gbesemete, K.P., & Gerdtham, U.G. (1992). Determinants of health care expenditure in Africa: A cross-sectional study. World Development, 20(2), 303-308. https://doi.org/10.1016/0305-750X(92)90108-8.

Gerdtham, U.G., Søgaard, J., Andersson, F., & Jönsson, B. (1992). An econometric analysis of health care expenditure: A cross-section study of the OECD countries. Journal of Health Economics, 11(1), 63–84. https://doi.org/10.1016/0167-6296(92)90025-V.

Gerdtham, U.-G., Jönsson, B., MacFarlan, M., & Oxley, H. (1998). The determinants of health expenditure in the OECD countries: A pooled

data analysis. In Developments in Health Economics and Public Policy, 6 (pp. 113–134). Springer.
Gugler, J., & Flanagan, W.G. (1978). Urbanization and social change in West Africa. Cambridge University Press.
Hausman, J.A. (1978). Specification tests in econometrics. Econometrica, 46(6), 1251–1271. https://doi.org/10.2307/1913827.
Malinowski, P. (2024). Determinants of healthcare expenditure: A cross-sectional analysis at the country level. Journal of Education, Health and Sport, 70, 55541, 1–11. https://doi.org/10.12775/JEHS.2024.70.55541.
Nie, S., Liu, D., & Chen, S. (2025). Complex interactions in healthcare expenditure through the years: A panel data analysis using fsQCA in OECD countries with policy implications. PLOS ONE, 20(5), e0324497, 1-18. https://doi.org/10.1371/journal.pone.0324497.
Leu, R.E. (1986). Public and private health services: complementarities and conflicts. In A.J. Culyer & B. Jönsson (Eds.), Basil Blackwell (pp. 41–63). Oxford.
Piscopo, J., Groot, W., & Pavlova, M. (2024). Determinants of public health expenditure in the EU. PLOS ONE, 19(3), e0299359, 1–19. https://doi.org/10.1371/journal.pone.0299359.
Samadi, A. & Homaie Rad, E. (2013). Determinants of Healthcare Expenditure in Economic Cooperation Organization (ECO) Countries: Evidence from Panel Cointegration Tests. *International Journal of Health Policy and Management, 1*(1), 63-68. https://doi.org/10.15171/ijhpm.2013.10
Sofi, S.A., & Yasmin, E. (2024). Out-of-Pocket Health Expenditure and Associated Factors: Insights From National Health Accounts (NHA) Using Panel Data Analysis. *A journal of medical care organization, provision and financing, 61,* 469580241309903. https://doi.org/10.1177/00469580241309903.
Thornton, J.A., & Rice, J.L. (2008). Determinants of healthcare spending: A state level analysis. Applied Economics, 40(22), 2873–2889. https://doi.org/10.1080/00036840600993973.
Wooldridge, J. M. (2013). Introductory econometrics: A modern approach (5th ed.). South-Western Pub.
Xu, K., Saksena, P., & Holly, A. (2011). The determinants of health expenditure: A country-level panel data analysis(No. 26). World Health Organization. Retrieved from https://apps.who.int/iris/handle/10665/44700.
Younsi, M., Chakroun, M., & Nafla, A. (2016). Robust analysis of the determinants of healthcare expenditure growth. The International Journal of Health Planning and Management, 31(4), 580–601. https://doi.org/10.1002/hpm.2358.

Acknowledgements

Author contributions: author/authors has/have given an approval to the final version of the article. Author's total contribution to the manuscript: P. Malinowski (100%).

Funding: This research received no external funding.

Supplementary information: author/authors acknowledge following people and institution for help with the preparation of the article: University of Warsaw, Faculty of Economics Sciences.

Note: The present publication builds upon and significantly expands the previous research conducted by Malinowski (2024), offering a more comprehensive and detailed analysis of the determinants of healthcare expenditure.

Appendix

Table 1. Descriptive statistics for the entire dataset

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Number of observations	Mean	Standard deviation	Min	Max	IQR
CHE	3,219.00	1,162.27	1,521.23	6.72	11,702.41	1,360.29
GDP	3,231.00	16,531.37	19,183.74	420.27	163,219.49	20,704.04
GHE	3,221.00	3.38	2.39	0.06	22.25	3.25
AGE65	3,255.00	8.10	5.79	0.86	29.58	9.74
URB	3,255.00	55.86	22.99	8.25	100.00	37.36
PHY	2,043.00	2.02	1.48	0.01	7.55	2.70
LEB	3,255.00	69.90	9.00	41.96	84.56	12.89
IMR	3,255.00	27.13	25.26	1.70	138.60	35.90
OOP	3,219.00	33.52	19.51	0.08	86.07	29.58
ALC	771.00	5.78	4.25	0.00	19.05	7.48
CIG	1,085.00	23.70	11.32	3.50	68.50	17.20
ODA	3,255.00	512.24	1,039.76	-866.95	27,361.74	601.07
BMI	3,255.00	44.32	18.45	4.33	89.90	28.37

Source: Own elaboration based on data from the World Bank, the World Health Organization, and the Organization for Economic Co-operation and Development.

Table 2. Comparative summary of estimator values using the following models: Pooled OLS, Fixed Effects, Two-way Fixed Effects, and Two-way Fixed Effects with correct functional form and robust standard errors (Two-way Fixed Effects Robust)

	(1)	(2)	(3)	(4)
VARIABLES	PooledOLS	Fixed Effects	Two-way Fixed Effects	Two-way Fixed Effects Robust
lnGDP	0.941***	0.951***	0.896***	1.711***
	(0.015)	(0.017)	(0.018)	(0.287)

	(1)	(2)	(3)	(4)
VARIABLES	PooledOLS	Fixed Effects	Two-way Fixed Effects	Two-way Fixed Effects Robust
GHE	0.147***	0.144***	0.142***	0.143***
	(0.004)	(0.004)	(0.004)	(0.014)
AGE65	0.007***	0.011***	0.006*	0.021**
	(0.003)	(0.003)	(0.003)	(0.009)
URB	-0.004***	-0.007***	-0.009***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.003)
lnPHY	0.025***	0.032***	0.040***	0.031**
	(0.007)	(0.007)	(0.007)	(0.015)
lnLEB	0.495***	0.657***	0.443***	0.142
	(0.091)	(0.096)	(0.102)	(0.274)
lnIMR	-0.009	-0.029	-0.008	-0.024
	(0.020)	(0.022)	(0.021)	(0.049)
OOP	0.004***	0.003***	0.003***	0.004**
	(0.000)	(0.000)	(0.000)	(0.002)
BMI	-0.002**	-0.002	0.001	0.003
	(0.001)	(0.001)	(0.001)	(0.005)
lnALC	0.034***	0.041***	0.048***	0.034
	(0.009)	(0.011)	(0.011)	(0.039)
CIG	-0.001*	0.001	0.003***	0.004
	(0.001)	(0.001)	(0.001)	(0.003)
ODA	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
intlnGDPXlnGDP				-0.047***
				(0.015)
Constant	-4.779***	-5.390***	-4.185***	-6.534***
	(0.447)	(0.480)	(0.508)	(1.865)
Number of observations	3,182	3,182	3,182	3,182
Number of countries	155	155	155	155
Country FE	NO	YES	YES	YES
Year FE	NO	NO	YES	YES

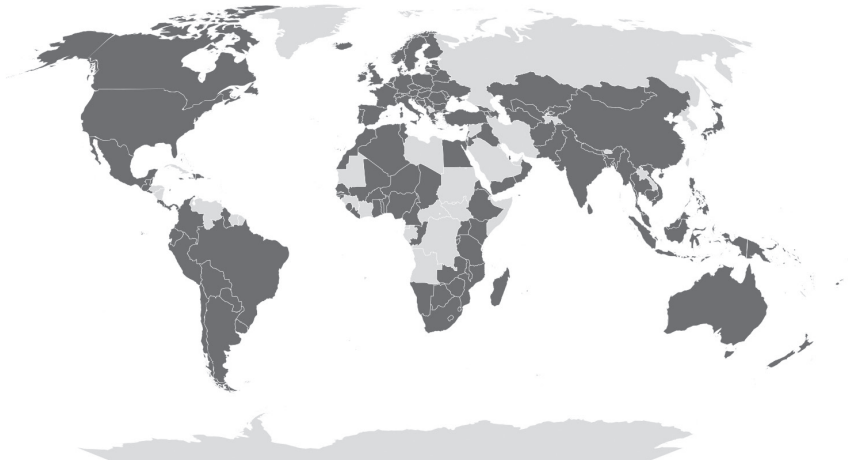
Additional information: For clarity, individual year effects have been omitted from the table.
Legend: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are reported in parentheses according to the model used.
Source: Own elaboration based on data from the World Bank, the World Health Organization, and the organization for Economic Co-operation and Development.

Table 3. Estimation of the Two-way Fixed Effects model with correct functional form and robust standard errors

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Coefficients	Robust standard error	t	p > | t |	95% Confidence Interval
lnGDP	1.711***	(0.287)	5.969	0.000	1.145 - 2.278
GHE	0.143***	(0.014)	10.273	0.000	0.116 - 0.171
AGE65	0.021**	(0.009)	2.361	0.019	0.003 - 0.038
URB	-0.010***	(0.003)	-3.116	0.002	-0.017 - -0.004
lnPHY	0.031**	(0.015)	2.009	0.046	0.001 - 0.061
lnLEB	0.142	(0.274)	0.518	0.605	-0.400 - 0.684
lnIMR	-0.024	(0.049)	-0.485	0.629	-0.120 - 0.072
OOP	0.004**	(0.002)	2.174	0.031	0.000 - 0.007
BMI	0.003	(0.005)	0.564	0.573	-0.007 - 0.012
lnALC	0.034	(0.039)	0.885	0.377	-0.042 - 0.111
CIG	0.004	(0.003)	1.388	0.167	-0.002 - 0.010
ODA	-0.000	(0.000)	-0.683	0.496	-0.000 - 0.000
intlnGDPXlnGDP	-0.047***	(0.015)	-3.103	0.002	-0.076 - -0.017
Constant	-6.534***	(1.865)	-3.504	0.001	-10.218 - -2.850
Number of observations	3,182				
Number of countries	155				
Country FE	YES				
Year FE	YES				

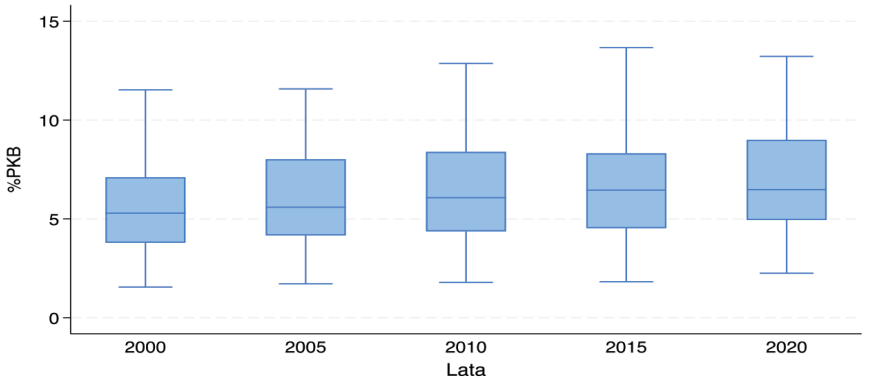
Additional information: For clarity, individual year effects have been omitted from the table.
Legend: *** p<0.01, ** p<0.05, * p<0.1.
Source: Own elaboration based on data from the World Bank, the World Health Organization, and the Organization for Economic Co-operation and Development.

Chart 1. Map of countries included in analysis



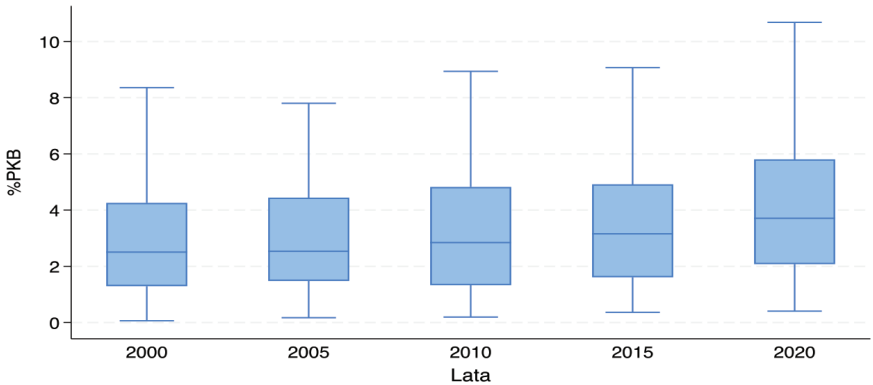
Additional information: The countries included in the analysis are marked in dark gray.
Source: Own elaboration based on World Bank data.

Chart 2. Share of healthcare expenditure in GDP for the aggregated group of all analyzed countries over the years



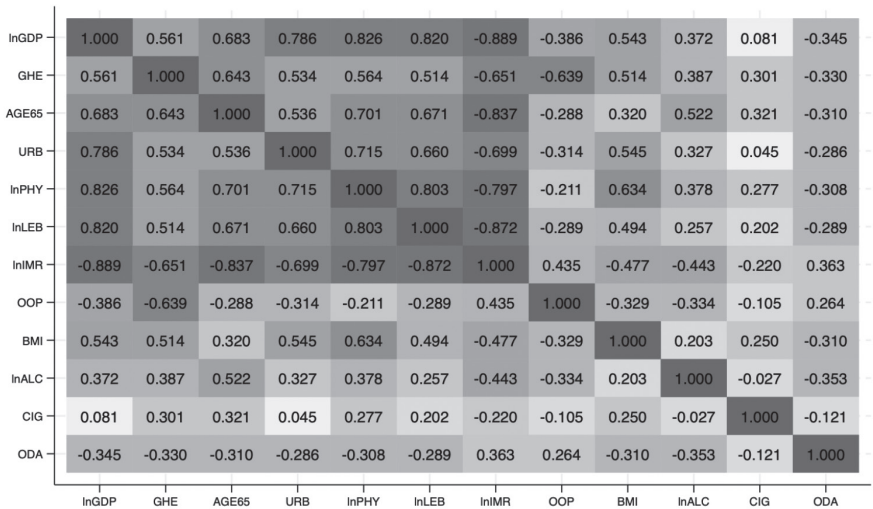
Additional information: Outliers are not included in the chart.
Source: Own elaboration based on data from the World Bank.

Chart 3. Share of public healthcare expenditure in GDP for the aggregated group of all analyzed countries over the years



Additional information: Outliers are not included in the chart.
Source: Own elaboration based on data from the World Bank.

Chart 4. Correlation matrix of independent variables



Source: Own elaboration based on data from the World Bank, the World Health Organization, and the Organization for Economic Co-operation and Development.

EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 24, Issue 3, 2025
p-ISSN 1898-2255, e-ISSN 2392-1625
www.apcz.umk.pl/EiP

Original article
received 06.06.2025; accepted 21.07.2025; published 30.09.2025
doi: 10.12775/ EiP.2025.19

Housing Security of Seniors in Poland Compared to the European Union – Living Conditions, Financial Burdens, and Housing Satisfaction

ANNA MURAWSKA

corresponding author
Department of Economics and Marketing, Faculty of Management, Bydgoszcz University of Science and Technology, Kaliskiego 7, 85-796 Bydgoszcz, Poland
✉ anna.murawska@pbs.edu.pl
ORCID: orcid.org/0000-0002-3944-7657

ADRIANNA GUZOWSKA

Department of Management Engineering, Faculty of Management, Bydgoszcz University of Science and Technology, Kaliskiego 7, 85-796 Bydgoszcz, Poland
✉ adrianna.guzowska@pbs.edu.pl
ORCID: orcid.org/0000-0001-5446-1329

Abstract

Motivation: For every single person, a place of residence is a part of their everyday life and a guarantee of their sense of security. Housing conditions have a significant influence on the overall quality of life. The sense of housing security is crucial, in particular for the elderly. The issue seems to be particularly relevant given demographic aging, as well as the demographic trends that shape both the current and future housing resources for seniors. **Aim:** The aim of this article is to evaluate the housing security of seniors aged 65 and over in Poland compared to the European Union, with particular emphasis on living conditions,

financial burden and housing satisfaction. Method: 9 variables and 27 objects/EU(27) countries were used for assessment. The study covered the years 2013 and 2023, and the data was taken from Eurostat databases. The analysis was based on descriptive statistics, and gaps were calculated taking into account places of residence and age groups.
Results: Housing conditions for seniors in Poland are improving, yet structural problems remain serious. Seniors in Poland continue to incur high housing expenses, and this applies most to those living alone. The high satisfaction level of seniors may conceal real difficulties and does not necessarily reflect issues such as poor technical condition of premises, rising maintenance costs, and the lack of housing adapted to the needs of an aging population.

Keywords: *security, housing, senior, age above 65, living conditions, costs, rent, satisfaction*
JEL: *I31, R21, J14*

1. Introduction

Europeans live longer than ever before, and the age profile of the society is rapidly changing (EC, 2024, 2025; Ritchie et al., 2023; Ritchie & Roser, 2019). Aging of the population means that the proportion of working-age people in the UE is decreasing, while the number of the elderly is increasing (Kocot, 2011; Papież, 2007). This pattern will continue over two decades when the process of the post-war baby boom generation going into retirement will come to an end (EC, 2024). These changes will probably have profound implications not only for individuals, but also for governments, companies, and civil society – impacting health and social care systems, labour markets, public finances, and pension entitlements etc. (Crove et al., 2022; Maier, 2016; Polakowski, 2012). According to the forecast, the population of the elderly (people aged 65 and over) in the EU(27) will clearly rise from 90.5 million at the beginning of 2019 to 129.8 million in 2025. In 2019, people aged 55 and older made up just over one-third (33.6%) of the entire EU(27) population. The share is expected to reach 40.6% by 2025, and increase in each of the EU Member States (EC, 2024).

In 2022, the share of elderly people aged 60 and over in the population of Polish residents reached 25.9%, and the number of seniors amounted to 9.8 million. The old-age dependency ratio in Poland (i.e. the number of people aged 65 and over per 100 people aged 15-64) increased to 29.9. According to the demographic forecast, a steady grow of the number of seniors is expected to continue through 2060. By that year, the population of the elderly in Poland is to each 11.9 million, i.e. by 21.0% more than in 2022, representing 38.3% of the entire population (GUS, 2023).

Given the above data, the research on the housing, financial, environmental or health situation is extremely important, in particular with regard

to seniors[1]. Low income and substandard housing conditions result in a decline in the quality of life (Chu et al., 2022; Dewilde, 2022; Oleńczuk-Paszel & Sompolska-Rzechuła, 2025), however, these problems most acutely affect the youngest and oldest members of the population (Engel et al., 2016; Zhou et al., 2022). Special attention should be paid to living conditions and housing fees, which constitute a substantial burden, especially on one-person senior households.

The issue of 'housing and quality of life' should now be assessed with a multidisciplinary approach, due to the complexity and broadness of its components (Lawrence, 2004). Moreover, in order to guarantee good health standards, political and administrative decisions need to be channelled for improvement of the overall neighbourhood and building conditions (Feng et al., 2018; Padeiro et al., 2022; Wu et al., 2022) while having a clear and up-to-date regulatory system, since this is a key factor in ensuring public health protection and social justice.

The article attempts to assess the housing security of seniors aged 65 and over in Poland compared to the European Union, with particular emphasis on living conditions, financial burdens and housing satisfaction. The article indicates how living and financial conditions influence seniors' satisfaction with their apartments, and identifies the key challenges Poland needs to encounter in the context of an aging society and the ever-growing housing maintenance expenses. As part of this aim, the hypothesis was developed that housing conditions of people over 65 in Poland are improving, however, seniors still bear high housing expenses, and the high level of housing satisfaction may conceal real difficulties and does not necessarily reflect issues such as poor technical condition of premises and maintenance costs.

The issues of life quality and the security dimensions are frequently addressed in the literature and strategic documents, yet not to the extent they deserve due to their importance for state social policy and strategic decision-making aimed at equalising life standards and quality. The article tries to point out the gap in housing security dimensions (housing conditions and economic aspects) between people aged 18-64 and those over 65 in Poland and in the European Union as a whole, and the subjective assessment of housing satisfaction by seniors. The study may help identify which aspects of housing security of seniors in Poland are at a low level and require improvement.

[1] 'Senior' is a general term defining an elderly person, usually over 60 or 65, although the age limit may differ, depending on the context (GUS, 2025). In Poland, there is no clear, legally valid definition of 'senior', and the age limit may differ across institutions, programmes, and acts.

2. Literature review

Stable and safe living conditions are fundamental to overall well-being and essential for the proper functioning of both the household and the individual (Gutkowska, 2003; Murawska, 2009) and housing security and material well-being are to interrelated concepts. The former refers to the stability and safety of one's living situation, the latter concerns the fulfilment of basic life needs (United Nations, 2025). Housing is a fundamental human right, not only to shelter, but also to 'adequate housing' in terms of legal security of possession, availability of services, materials, facilities and infrastructure, affordability, habitability, accessibility, location, and cultural adequacy (United Nations, 2009). Therefore, housing as a 'home' does not only mean a physical shelter, but also a foundation for social, psychological and cultural well-being. Housing is one of the core values of the quality of the living environment, providing citizens with a sense of economic stability and security, while motivating them to productive work (Kolesnikova, 2022).

The literature identifies various indicators related to housing resources and neighbourhood conditions that influence the quality of life and health. They are divided into four broad categories: first, what is considered is health issues that may result in the lack of a stable home (housing instability); second, financial burdens resulting from high housing costs (affordability); third, health issues related to indoor housing conditions (housing safety and quality); finally, the impact of the neighbourhood on health, including environmental and social characteristics of the place of residence (neighbourhood) (Green et al., 2021).

The World Health Organisation (WHO) defines a healthy home as one that 'supports the state of complete physical, mental, and social well-being' (WHO, 2018). Poor housing conditions and exposure to environmental hazards at home are risk factors for adverse health condition (Mitro et al., 2016; Rolfe et al., 2020; WHO, 2018). Exposures to these hazards are caused by the combined impact of both internal and external sources, building design and conditions, the presence and performance of ventilation systems, and resident activity patterns, including the use of consumer products and devices emitting environmental pollutants (Adamkiewicz et al., 2011, 2014). Furthermore, the living space features (e.g. thermal comfort, natural lighting, occupancy) and access to basic resources (e.g. heating, plumbing, cooking appliances) also contribute to residents' health, well-being, and life quality (D'Alessandro et al., 2020; D'Alessandro & Appolloni, 2020; Kabisch et al., 2022; WHO, 2018).

Housing conditions and their improvement are among the key factors that influence the quality of life and health (Acolin & Reina, 2022; Mansour

et al., 2022; Prochorskaite & Maliene, 2013; Rodgers et al., 2018) in particular for the elderly (Feng et al., 2018; Howden-Chapman et al., 2023). Substandard housing conditions and dangerous exposure to environmental factors within premises result in significant morbidity and mortality. Housing indices incorporating multiple dimensions of healthy housing are important for monitoring conditions and identifying households at risk (Chu et al., 2022).

Severe housing deprivation in European Union countries have been studied by Hick, Pomati, and Stephens (Hick et al., 2022). The authors focused primarily on the EU measure of severe housing deprivation and overcrowding issues, as well as poor housing conditions. Howden-Champan and others have come to a conclusion that housing standards are unevenly developed, implemented and monitored around the globe, despite reliable research showing that modernising existing homes and building new high-quality ones can reduce disease (Howden-Chapman et al., 2023). Prochorskaite & Maliene underline that health and well-being require greater consideration in current sustainable housing policy and investments (Prochorskaite & Maliene, 2013). In addition to housing indices, equally important are economic indicators, which reveal the scale of costs incurred for using a flat, housing-related expenses, housing cost burdens, and outstanding rent fees and payments for other media (Acolin & Reina, 2022; Kutty, 2005; McConnell, 2013).

Many authors addressed in their research the issue of housing security of seniors, which proves the multitude of research approaches and interpretive perspectives on this topic, as well as the importance of the phenomenon itself. The housing conditions of seniors have most often been analysed in the context of their relation to well-being (Bieszk-Stolorz & Dmytrów, 2023; Jazayeri et al., 2023), problems with housing accessibility and safety (Fenelon & Mawhorter, 2020), residential environment and surroundings (Bojanowska, 2021; Niezabitowski, 2018), fulfilment of housing needs of dependant elderly people (Bugajska & Iwański, 2018), or expenses resulting from to housing-related costs (Jenkins Morales & Robert, 2021).

Housing security of seniors is a key component of their health, well-being, and life quality. A home is not only a shelter, but also a human right that should guarantee stability, availability of services, and protection against environmental threats. Poor housing conditions can lead to a deterioration of physical and mental health, especially among the elderly. Therefore, studying indicators that show housing conditions, improving housing quality, and implementing a housing policy that addresses the needs of seniors are fundamental to their safety and dignified ageing.

3. Methods

The empirical data used in the article comes from the EU-SILC (European Union Statistics on Income and Living Conditions) survey, conducted by the Statistical Office of the European Union (Eurostat, 2025a). The analysis covered two time points: the years 2013 and 2023, based on a representative sample of EU residents. The EU-SILC survey in 2023 included a total of 531,418 households from 27 countries. Abbreviations of the EU(27) member states were used in the descriptive and graphical analysis of the results: Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France FR), Germany (DE), Greece (GR), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES), and Sweden (SE). The largest groups were evaluated in Germany (n = 36,563), Italy (n = 29,424), Spain (n = 27,227), and Poland (n = 17,999). The lowest values concerned the following countries: Ireland (n = 4,191), Cyprus (n = 4,281), and Malta (n = 4,515). This result ranks Poland among the countries with relatively high sample implementation effectiveness, exceeding the weighted average for the EU(27) (74.3%) (Eurostat, 2025b).

The analysis takes into consideration two age groups: 18-64 and 65 and over. Particular attention was paid to housing security of the elderly (≥65) and one- and two-person households, in which at least one person belongs to that age group. The age categories and types of households analysed in the study, along with the levels of housing satisfaction level and types of financial burdens, are shown in Table 1. For the purpose of the study, a database was established to cover nine indicators developed with Microsoft Excel and Statistica 13.3 (Table 2). In the selection of variables, the highest availability of complete and up-t0-date data for all EU(27) member states were taken into account. The indicators used in the study cover both living and economic aspects. The living ones included the overcrowding rate, the percentage of people living in dwellings with poor technical condition (e.g. leaking roof, dampness, rot), severe housing deprivation, and the average number of rooms per person. The economic indicators considered housing cost overburden, the share of housing expenses and rent in disposable income, total housing costs expressed in PPS, and the financial burden of housing expenses.

Basic descriptive statistics were applied, such as: arithmetic mean, coefficient of variation (Vs), range (R), and distance measure (D). A Shapiro-Wilk test for normality was also carried out, and skewness (A) and kurtosis (K) were calculated. The coefficient of variation Vs > 10% was considered indicative of statistically significant variability between countries (Table 3). The range (R) was applied

in the analysis as a measure of variability, which allowed for the comparison of changes over time (2013–2023), and the assessment of differences between age groups (b–c) and types of households (d–e, f–g). Negative values of the change indicator over time (2013–2023) represent an improvement compared to 2013 for a variable being a destimulant (and the opposite for a stimulant). Analogically, negative values of differences between age groups indicate unfavourable conditions for the elderly (for destimulants), and the other way round for stimulants. Due to limited availability of data on housing satisfaction, the analysis was conducted only for the population aged 65 years and over. Hausing satisfaction was assessed using a categorical scale with four levels: 'very low', 'low', 'good', and 'very good'. For the purpose of international comparison, the responses 'very good' and 'good' were combined into a high satisfaction category, while the responses 'low' and 'very low' were grouped into a low satisfaction category.

4. Results and discussion

4.1. Selected housing indicators against the background of the EU(27)

The statistical analysis of housing condition indicators among the elderly (65+) reveals significant regional and structural disparities within the broader context of the EU(27). Living indicators, including overcrowding (X_{01C}), technical issues (X_{02c}), and the severe housing deprivation rate (X_{03C}), indicate relatively low average values, but with strong deviations in some countries, in particular in Central and Eastern Europe. Here, characteristic are positive skewness and high kurtosis ranges, which suggest there are countries where the housing situation of seniors is way worse than in others.

Particularly alarming is data concerning financial burden. Indicators X_{05c}, $X_{06e/g}$ and X_{09e_HVY}/X_{09g_BUR} clearly show that many seniors in the EU(27) – and especially in Poland – perceive housing maintenance expenses as a significant financial burden (X_{09e_HVY}), ranking the country among those with the hardest situation in this regard.

On the other hand, the analysis of subjective housing satisfaction variables reveals an advantage of positive responses – more than 90% of seniors define their housing conditions as 'good' or 'very good'. In a few countries, however – particularly Romania, Cyprus, and Estonia - the share of 'very low' (Y_{c_vlow}) responses is reaching disturbing levels. The discrepancy between objective and subjective indicators may suggest internalized standards, adaptive expectations from the elderly, or local cultural differences in the perception of life standards.

4.2. Living conditions in an intergenerational and temporal perspective – analysis of indicators – X_{01}-X_{04}

Table 4 presents a comparison of living conditions by age group and region based on selected indicators (X_{01}-X_{03}) in 2013 and 2023. From 2013 to 2023, the overcrowding rate for housing premises (X_{01}) among the population aged ≥65 decreased both in Poland (from 27.7% to 23.3%, a decrease by 4.4 percentage points (p.p.)) and in the EU(27) (from 7.3% to 6.7%, a decrease by 0.6 p.p.). Despite this positive trend, the scale of overcrowding among Polish seniors in 2023 was three times higher than the EU(27) average. At the same time, in both analysed areas, the elderly remained in a relatively better housing situation than the working-age population (18-64). In 2023, this difference was 11.1 p.p. in Poland and 11.2 p.p. in the EU(27).

In 2023, 5.2% of people aged ≥65 in Poland lived in dwellings with leaking roofs, dampness, or rot (X_{02}), which represents a decrease from 8.8% in 2013 (-3.6 p.p.). Among the 18–64 age group, this indicator amounted to 5.4%, i.e. only slightly higher – the difference between the age groups was negligent (0.2 p.p.), indicating an almost equal hazard level. The situation was a bit different in the EU(27) – seniors (12.1%) continued to live in worse conditions than their peers in Poland, and the gap compared to younger people (16.0%) was greater by 3.9 p.p. Against the backdrop of EU countries, the improvement for people aged ≥65 was slower (–1.4 p.p.) than in Poland. Poland recorded a clear improvement of housing conditions over the decade – in particular for younger people (-4.7 p.p.), but also for seniors. In 2023, both generations experienced a similar level of technical issues.

In 2023, 3.2% of people aged ≥65 experienced severe housing deprivation (X_{03}), whereas in 2013 it was 7.0% – an improvement by 3.8 p.p. In the younger group (18–64), a decline was even greater – from 9.9% to 4.7% (-5.2 p.p.), and the gap between the groups was 1.5 p.p. in favour of seniors. Against the backdrop of EU(27) countries, the indicator for the elderly was lower than in Poland – amounting to 1.4% (down from 2.3%), and for younger individuals – 4.2%. The intergenerational gap in the EU(27) was clearer (2.8 p.p.), though the values were lower than in Poland. Although housing conditions in Poland improved for both groups, the elderly were still slightly more exposed to deprivation than in the EU(27), despite a significant progress over the past decade.

The analysed values of the indicator of the average number of rooms per person by household type (X_{04}) are shown in Table 5. In 2023, people aged ≥65 living alone in Poland had 2.4 rooms per person on average – the same as individuals aged 18–64. Over the decade, this space increased slightly (from 2.2) by 0.2 rooms. Against the backdrop of EU(27) countries, seniors living alone had a bit more of space (3.3 rooms), though compared to 2013, the increase was

minimal (0.1). The gap between younger and older people living alone was a bit higher in the EU(27) (-0.5 in favour of seniors), whereas in Poland, no intergenerational differences were recorded in 2023. Similar proportions remained in two-person households. In Poland, both younger and older couples had 1.5 rooms per person, and in the EU(27) – 1.9 and 2.0, accordingly. Changes over the decade in the average number of rooms per person by household type were minimal – increases of 0.1 rooms or no changes at all.

4.3. Economic aspects of housing security in an intergenerational and temporal perspective – analysis of indicators X_{05}-X_{09}

Table 6 presents a comparison of economic conditions by age group and region based on selected indicators (X_{05}-X_{07}) in 2013 and 2023. In Poland in 2023, 7.5% of the elderly (≥65) were overburdened by housing costs (X_{05}). This figure is lower than that of a decade prior, representing a decrease of 2.5 p.p. In the 18-64 age group the decrease was larger (-4.4 p.p.) and the indicator stood at 5.9%. Seniors were therefore more burdened than younger people – by 1.6 p.p. Against the backdrop of EU(27) countries, the cost overburden was higher: 9.8% among seniors and 8.9% among younger people. Improvement was also observed – by 1.6 p.p. and 2.9 p.p. respectively – and the generational gap was smaller (0.9 p.p.). Although seniors in Poland experienced housing cost overburden less frequently than their peers in the EU(27), their situation remained less favourable than that of younger Poles (18–64). Although seniors in Poland experienced housing cost overburden less frequently than their peers in the EU(27), their situation remained less favourable than that of younger Poles (18–64).

Between 2013 and 2023, the share of rent related to the occupied dwelling in disposable income (indicator X_{06}) increased in Poland in one-person households for both the elderly (≥65) and younger people (18-64) – by 2.6 and 5.4 p.p., respectively. The intergenerational difference in 2023 was 11.5 p.p. to the disadvantage of younger households. Against the backdrop of EU(27), in the same category, a slight decrease in the share of rent was observed – by 2.1 p.p. in the 18-64 group and by 0.8 p.p. in the ≥65 group. The difference between these groups in 2023 was minimal at 0.3 p.p. In two-person households in Poland, the share of rent in disposable income fell in both groups: by 7.6 p.p. among younger people and by 4.1 p.p. among the elderly. The intergroup difference in 2023 was 4.2 p.p. to the disadvantage of younger people. In the EU(27), decreases were also recorded – by 2.5 p.p. (18–64) and by 0.3 p.p. (≥65) – with a small intergroup difference of 0.4 p.p. Indicator X_{06} shows that in Poland it is younger households – both one- and two-person – that bear relatively higher rent burdens than the elderly, and that the dynamics of change in the last decade was much more pronounced than against the background of the EU(27).

Between 2013 and 2023, the share of housing costs in disposable income (X_{07}) decreased in all groups under analysis except for one-person households of the elderly in Poland, where it increased by 1.3 p.p.. Among one-person households aged 18-64 in Poland, a decrease of 6.4 p.p. was noted. However, in 2023 seniors were more burdened by housing costs relative to in disposable household income than younger people (a difference of -2.2 p.p.), particularly in one-person households. In the EU(27) younger people incurred higher housing costs relative to in disposable household income (a difference of 3.5 p.p.), although for both groups the indicators fell compared to 2013. In two-person households, decreases housing cost burden were recorded in all groups. In the EU(27): -3.6 p.p. (18-64) and -2.1 p.p. (65+), with younger people being more burdened in 2023 (a difference of 1.8 p.p.). In Poland, the decreases were larger: -5.6 p.p. and -2.0 p.p., and the difference between the groups was small (-0.7 p.p.). Indicator X_{07} shows that generational differences in housing cost burdens are more pronounced in one-person households. Against the backdrop of EU(27), younger people were relatively more burdened; in Poland, it was the elderly.

In the analysed period, the value of indicator X_{08}, measuring total housing costs in purchasing power standard (PPS), increased in all household groups (Table 7). In one-person households in Poland, total housing costs in PPS for people aged 18-64 increased by 106.6, reaching 356.9 PPS in 2023. Among the elderly (≥65), the increase was 93.0 and the indicator reached 298.0 PPS. The intergenerational range in 2023 was 58.9 to the disadvantage of younger households. In the EU(27), an increase was also noted – by 65.6 for the 18–64 group and by 47.5 for the elderly. The indicator value in 2023 was 460.7 and 361.3, respectively. The intergenerational range in one-person households in the EU(27) was considerably wider than in Poland, amounting to 99.4 PPS**.** In two-person households in Poland with persons aged 18–64, the x_{08} indicator increased by 108.6 was recorded, reaching 433.6 PPS, whereas the elderly experienced an increase of 97.0 (value of 372.3 PPS in 2023). The range in 2023 was 61.3 to the disadvantage of younger people. In the EU(27), the values of indicator X_{08} increased by 68.5 (to 553.5 PPS) for younger households and by 33.6 (to 412.9 PPS) for older households, respectively. The intergenerational difference was as much as 140.6 to the disadvantage of younger people. This indicator pointed to two key trends: in Poland, the pace of cost (expressed in PPS) increase was higher, whereas in the EU(27), the gap between younger and older households deepened, especially among two-person households.

Chart 1 shows the differences between age groups in one-person households regarding the financial burden of housing costs. In Poland, the elderly (≥65) report a heavy housing cost burden (HVY) far more often than the younger – by 17.3 p.p. to their disadvantage. In the category of moderate burden (BUR) in Poland, it is younger people who more frequently report this level of burden – the difference is 14.6 p.p. to the disadvantage of younger

people. The indicator of no housing cost burden (NOT) shows that in Poland the elderly more often declare no burden – a difference of 2.7 p.p., similar to the EU(27), where the difference is smaller at 1.0 p.p.. Chart 2 shows the differences between age groups in two-person households regarding the financial burden of housing costs. In Poland, significant differences also exist: in the HVY category, the elderly more often experience a heavy burden (a difference of 10.1 p.p.). In the BUR category, younger people in Poland more often report a moderate burden – a difference of 8.8 p.p. to their disadvantage, while in the EU(27), no difference between age groups was noted. Regarding no perceived costs (NOT), the elderly both in Poland (1.3 p.p.) and in the EU(27) (0.1 p.p.) more often declare no burden than younger people. In summary, the data indicate that in Poland older households – especially one-person households – are more exposed to heavy housing cost burdens, while younger households more often experience a moderate burden. In the EU(27), the differences between age groups are much smaller.

4.4. Housing satisfaction among the elderly against the background of EU(27) Countries

Poland ranked among the leading countries against the background of the EU (27) in terms of high housing satisfaction in the analysed age group. For the purposes of the analysis, a stacked bar chart (Chart 3) was prepared, presenting the percentage share of the elderly (≥65) declaring high (sum of 'vgood' and 'good' responses) and low (sum of 'low' and 'vlow' responses) levels of satisfaction with housing conditions in individual against the background of individual EU(27) countries. A total of 95.7% of the elderly in Poland rated their housing conditions positively, which placed Poland fourth among the 27 Member States. At the same time, only 4.3% of surveyed elderly people in Poland expressed dissatisfaction with their housing conditions. These results indicate a distinctly higher level of housing satisfaction among older adults in Poland than the EU(27) average, which was 92.5% for high and 7.5% for low satisfaction, respectively.

The highest level of housing satisfaction was recorded in Belgium (95.9%), Sweden (95.8%) and Slovenia (95.8%), while Poland was immediately behind them and ahead of countries such as Cyprus, Finland, Italy and Portugal. At the opposite end was Hungary, where only 80.2% of respondents expressed high satisfaction with their housing and as many as 19.7% indicated a low level of satisfaction. Poland's high ranking may be the result of widespread home ownership among older generations, relatively stable housing conditions and favourable socio-cultural conditions conducive to a positive assessment of the housing situation (Nowak, 2023).

4.5. Discussion of results

An analysis of housing conditions for people aged 65+, conducted against the background of the EU(27), revealed significant differences between countries. Although average overcrowding (7.3%) and deprivation (1.6%) rates among older adults were low, their distributions indicate serious problems in selected countries. Despite a high overall level of satisfaction with housing conditions among seniors (over 90% positive ratings), very low satisfaction also occurred sporadically. Research by Fernández-Portero et al. confirms that the quality and form of housing have a significant impact on the subjective sense of well-being of the elderly in Europe. These data suggest the need for targeted housing policy for the elderly, especially in regions most at risk of housing exclusion (Fernández-Portero et al., 2017).

A distinct improvement in the housing conditions of the elderly was noted in Poland – both in terms of a decrease in the overcrowding indicator and a reduction in the proportion of seniors living in dwellings in poor technical condition or experiencing severe housing deprivation. In 2023, the overcrowding rate was still more than three times the EU average, indicating persistent structural problems in the housing sector. Similar research was conducted by Hick et al., 2022, who analysed the issue of housing deprivation against the background of the EU. The authors point out that rates of overcrowding and poor technical conditions of dwellings are particularly high in Central and Eastern Europe, which also includes Poland.

Despite economic challenges, the level of housing satisfaction among Polish seniors is very high – almost 96% of persons over 65 rate their housing conditions positively. This may stem from a strong attachment to the place of residence, long-term occupancy of one dwelling and widespread home ownership (Gorczyca & Grabiński, 2018; Nowak, 2023). This situation indicates that current financial support mechanisms are insufficient and inadequately tailored to the needs of older adults. However, it should be noted that high satisfaction may mask real difficulties – the elderly, attached to their place of residence, are often reluctant to consider moving even in the case of deteriorating technical conditions or rising maintenance costs (Groeger, 2024; Muszyński, 2022).

It is also important to note the limitations of the study – data availability for some indicators was limited, which hindered a full assessment of the dynamics of change and comparisons. Moreover, the analysis did not include qualitative aspects of the housing environment, such as the availability of care services, architectural barriers or social integration, which are crucial for the seniors' quality of life.

5. Conclusion

The article assessed the level of housing security for people aged 65 and over in Poland against the backdrop of other European Union countries, with particular emphasis on living conditions, financial aspects and housing satisfaction. In pursuit of this aim, the stated hypothesis was confirmed. The housing conditions of people over 65 in Poland are improving; however, seniors still bear high housing costs, and high housing satisfaction may conceal real difficulties faced by seniors and does not reflect issues such as inadequate technical condition of dwellings and excessive maintenance costs.

The analysis showed that, despite a decline in overcrowding and an improvement in housing conditions among senior households, Poland still performs worse than the EU(27) average in terms of overcrowding and severe housing deprivation. In Poland, seniors, especially those living alone, are more exposed to high housing cost burdens than younger people, which is confirmed by higher values of the housing cost overburden rate and the share of housing expenditure in disposable income – in contrast to the more balanced situation observed in other EU(27) countries. Conversely, seniors are relatively less likely than younger age groups (18–64) to incur high rental costs, and their total housing expenditure expressed in purchasing power standard (PPS) is lower. However, the high level of declared housing satisfaction may mask real difficulties, such as deteriorating technical condition of dwellings, lack of architectural adaptations and insufficient institutional support.

These conclusions have important practical implications – they point to the need to develop housing policy targeted at the elderly, encompassing both financial support and modernisation of existing housing stock. It is necessary to take measures aimed at developing housing infrastructure adapted to the needs of an ageing society. This includes both the modernisation of existing dwellings and the planning of spaces that support independence and social integration. In Poland, seniors can benefit from various forms of housing support, such as sheltered housing and local projects adapting municipal apartments to their needs. Additionally, there are initiatives providing subsidies for renovations that improve the safety and accessibility of dwellings (Ministerstwo Rodziny, Pracy i Polityki Społecznej, 2025). Some programs also offer preferential loans and credits for the modernization and adaptation of housing for older adults. It is worth noting, however, that these programs are typically designed for older people with health problems or limited independence, who require additional support and care. However, there is a lack of a nationwide, comprehensive housing policy specifically targeted at this group. However, such forms of housing are still relatively

limited in scale and availability. From a scientific perspective, these results underline the importance of further, in-depth qualitative research on the subjective sense of housing security and the factors influencing satisfaction with living conditions in later life.

References

Acolin, A., & Reina, V. (2022). Housing cost burden and life satisfaction. *Journal of housing and the built environment : HBE*, *37*(4), 1789–1815. https://doi.org/10.1007/s10901-021-09921-1.

Adamkiewicz, G., Spengler, J.D., Harley, A.E., Stoddard, A., Yang, M., Alvarez-Reeves, M., & Sorensen, G. (2014). Environmental Conditions in Low-Income Urban Housing: Clustering and Associations With Self-Reported Health. *American Journal of Public Health*, *104*(9), 1650–1656. https://doi.org/10.2105/AJPH.2013.301253.

Adamkiewicz, G., Zota, A.R., Fabian, M.P., Chahine, T., Julien, R., Spengler, J.D., & Levy, J.I. (2011). Moving Environmental Justice Indoors: Understanding Structural Influences on Residential Exposure Patterns in Low-Income Communities. *American Journal of Public Health*, *101*(S1), S238––S245. https://doi.org/10.2105/AJPH.2011.300119.

Bieszk-Stolorz, B., & Dmytrów, K. (2023). The Well-Being-Related Living Conditions of Elderly People in the European Union–Selected Aspects. *Sustainability*, *15*(24), https://doi.org/10.3390/su152416823.

Bojanowska, E. (2021). Środowisko i miejsce zamieszkania w życiu osób starszych. *Polityka Społeczna*, *11–12*, 10–16. https://doi.org/10.5604/01.3001.0015.5996

Bugajska, B., & Iwański, R. (2018). Zaspokojenie potrzeb mieszkaniowych niesamodzielnych osób starszych – w poszukiwaniu optymalnych rozwiązań. *Exlibris Biblioteka Gerontologii Społecznej*, *1-2 (15)*, 12–25. https://doi.org/10.24917/24500232.15.1.

Chu, M.T., Fenelon, A., Rodriguez, J., Zota, A.R., & Adamkiewicz, G. (2022). Development of a multidimensional housing and environmental quality index (HEQI): Application to the American Housing Survey. *Environmental Health*, *21*(1), 56. https://doi.org/10.1186/s12940-022-00866-8.

Crove, D., Haas, J., Millot, V., Rawdanowicz, Ł., & Turban, S. (2022). *Population ageing and government revenue: Expected trends and policy considerations to boost revenue* (Papers No. 1737). OECD Economics Department Working. Retrieved form https://www.oecd.org/en/publications/population-ageing-and-government-revenue_9ce9e8e3-en.html (22.05.2025).

D'Alessandro, D., & Appolloni, L. (2020). Housing and health. An overview. W *Annali Di Igiene Medicina Preventiva E Di Comunità* (1, pp. 17–26). Roma. Retrieved form https://iris.uniroma1.it/handle/11573/1455941 (25.02.2025).

D'Alessandro, D., Gola, M., Appolloni, L., Dettori, M., Fara, G.M., Rebecchi, A., Settimo, G., & Capolongo, S. (2020). COVID-19 and Living space challenge. Well-being and Public Health recommendations for a healthy, safe, and sustainable housing. *Acta Bio Medica : Atenei Parmensis*, *91*(9-S), 61–75. https://doi.org/10.23750/abm.v91i9-S.10115.

Dewilde, C. (2022). How housing affects the association between low income and living conditions-deprivation across Europe. *Socio-Economic Review*, *20*(1), 373–400. https://doi.org/10.1093/ser/mwab003.

EC. (2024). *Ageing Europe–Statistics on population developments*. Retrieved form https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing_Europe_-_statistics_on_population_developments (21.05.2025).

EC. (2025). *Population structure and ageing*. Retrieved form https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Population_structure_and_ageing (21.05.2025).

Engel, L., Chudyk, A.M., Ashe, M.C., McKay, H.A., Whitehurst, D.G.T., & Bryan, S. (2016). Older adults' quality of life – Exploring the role of the built environment and social cohesion in community-dwelling seniors on low income. *Social Science & Medicine*, *164*, 1–11. https://doi.org/10.1016/j.socscimed.2016.07.008.

Eurostat. (2025a). Retrieved form https://ec.europa.eu/eurostat/data/database (13.03-15.05.2025).

Eurostat. (2025b). *Income and living conditions (ilc)*. Retrieved form https://ec.europa.eu/eurostat/cache/metadata/en/ilc_sieusilc.htm (13.05.2025).

Fenelon, A., & Mawhorter, S. (2020). Housing Affordability and Security Issues Facing Older Adults in the United States. *The Public Policy and Aging Report*, *31*(1), 30–32. https://doi.org/10.1093/ppar/praa038.

Feng, I.-M., Chen, J.-H., Zhu, B.-W., & Xiong, L. (2018). Assessment of and Improvement Strategies for the Housing of Healthy Elderly: Improving Quality of Life. *Sustainability*, *10*(3). https://doi.org/10.3390/su10030722.

Fernández-Portero, C., Alarcón, D., & Barrios Padura, Á. (2017). Dwelling conditions and life satisfaction of older people through residential satisfaction. *Journal of Environmental Psychology*, *49*, 1–7. https://doi.org/10.1016/j.jenvp.2016.11.003.

Gorczyca, K., & Grabiński, T. (2018). *Ageing in place: Residential satisfaction in Polish housing-estate communities*. Ageing and Society, 38(12), 2410-2434. https://doi.org/10.1017/S0144686X17000630.

Green, K.-A., Bovell-Ammon, A., & Sandel, M. (2021). Housing and Neighborhoods as Root Causes of Child Poverty. *Academic Pediatrics*, *21*(8), S194–S199. https://doi.org/10.1016/j.acap.2021.08.018.

Groeger, L. (2024). Senior housing policy in Poland: Determinants and desiderata. *European Spatial Research and Policy*, *31*(2), 187-212. https://doi.org/10.18778/1231-1952.31.2.07.

GUS. (2023). *Sytuacja osób starszych w Polsce w 2022 roku*. stat.gov.pl. Retrieved form https://stat.gov.pl/obszary-tematyczne/osoby-starsze/osoby-starsze/sytuacja-osob-starszych-w-polsce-w-2022-roku,2,5.html (21.05.2025).

GUS. (2025). *Główny Urząd Statystyczny / Metainformacje / Słownik pojęć / Pojęcia stosowane w statystyce publicznej*. Retrieved form https://stat.gov.pl/metainformacje/slownik-pojec/pojecia-stosowane-w-statystyce-publicznej/3928,pojecie.html (22.05.2025).

Gutkowska, K. (2003). *Diagnoza funkcjonowania wiejskich gospodarstw domowych na przełomie wieków*. Warszawa: Wydawnictwo SGGW.

Hick, R., Pomati, M., & Stephens, M. (2022). Severe Housing Deprivation in the European Union: A Joint Analysis of Measurement and Theory. *Social Indicators Research*, *164*(3), 1271–1295. https://doi.org/10.1007/s11205-022-02987-6.

Howden-Chapman, P., Bennett, J., Edwards, R., Jacobs, D., Nathan, K., & Ormandy, D. (2023). Review of the Impact of Housing Quality on Inequalities in Health and Well-Being. *Annual Review of Public Health*, *44*(Volume 44), 233–254. https://doi.org/10.1146/annurev-publhealth-071521-111836.

Jazayeri, E., Kazemipour, S., Hosseini, S. R., & Radfar, M. (2023). Quality of life in the elderly: A community study. *Caspian Journal of Internal Medicine*, *14*(3), 534–542. https://doi.org/10.22088/cjim.14.3.543.

Jenkins Morales, M., & Robert, S.A. (2021). Housing Cost Burden and Health Decline Among Low- and Moderate-Income Older Renters. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *77*(4), 815–826. https://doi.org/10.1093/geronb/gbab184.

Kabisch, S., Poessneck ,Janine, Soeding, Max, & and Schlink, U. (2022). Measuring residential satisfaction over time: Results from a unique long-term study of a large housing estate. *Housing Studies*, *37*(10), 1858–1876. https://doi.org/10.1080/02673037.2020.1867083.

Kocot, E. (2011). Przemiany demograficzne – świat, Europa, Polska. Wpływ zmian demograficznych na rynek pracy i sektor ochrony zdrowia. *Zdrowie Publiczne i Zarządzanie*, *2011* (Tom 9, Numer 1), 5–24.

Kolesnikova, I. (2022). Housing security as an indicator of the living environment. *Nierówności Społeczne a Wzrost Gospodarczy*, *69*. https://doi.org/10.15584/nsawg.2022.1.6.

Kutty, N.K. (2005). A new measure of housing affordability: Estimates and analytical results. *Housing Policy Debate*, *16*(1), 113–142. https://doi.org/10.1080/10511482.2005.9521536.

Lawrence, R.J. (2004). Housing and health: From interdisciplinary principles to transdisciplinary research and practice. *Futures*, *36*(4), 487–502. https://doi.org/10.1016/j.futures.2003.10.001.

Maier, M. (2016). Skutki starzenia się społeczeństwa dla rynku pracy w Polsce–Wybrane aspekty. *Marketing i Rynek*, *nr 3 (CD)*, 511–520.

Malik, K., & Mikołajczak, E. (2019). Senior Housing Universal Design as a Development Factor of Sustainable-Oriented Economy. *Sustainability*, *11*(24). https://doi.org/10.3390/su11247093.

Mansour, A., Bentley, R., Baker, E., Li, A., Martino, E., Clair, A., Daniel, L., Mishra, S.R., Howard, N.J., Phibbs, P., Jacobs, D.E., Beer, A., Blakely, T., & Howden-Chapman, P. (2022). Housing and health: An updated glossary. *J Epidemiol Community Health*, *76*(9), 833–838. https://doi.org/10.1136/jech-2022-219085.

McConnell, E.D. (2013). Who has housing affordability problems? Disparities in Housing Cost burden by Race, Nativity and Legal Status in Los Angeles. *Race and social problems*, *5*(3), 173–190. https://doi.org/10.1007/s12552-013-9086-x.

Ministerstwo Rodziny, Pracy i Polityki Społecznej. (2025). Mieszkanie chronione. https://www.gov.pl/web/rodzina/mieszkanie-chronione.

Mitro, S.D., Dodson, R.E., Singla, V., Adamkiewicz, G., Elmi, A.F., Tilly, M.K., & Zota, A.R. (2016). Consumer Product Chemicals in Indoor Dust: A Quantitative Meta-analysis of U.S. Studies. *Environmental Science & Technology*, *50*(19), 10661–10672. https://doi.org/10.1021/acs.est.6b02023.

Murawska, A. (2009). Ocena warunków mieszkaniowych w gospodarstwach domowych w Polsce. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu*, *11*(4), 213–218.

Muszyński, M. (2022). The image of old age emerging from place personalization in older adults' dwellings. *Journal of Aging Studies*, *63*, 101075. https://doi.org/10.1016/j.jaging.2022.101075.

Niezabitowski, M. (2018). Kilka uwag o problemach środowiska zamieszkania na tle potrzeb osób starszych dotyczących tej sfery. *EXLIBRIS Biblioteka Gerontologii Społecznej*, *1-2 (15) /2018 Gdzie mieszka starość Przestrzeń – architektura – mieszkanie*, 26–42. https://doi.org/10.24917/24500232.15.2.

Nowak, K. (2023). Differentia specifica mieszkalnictwa w Polsce na arenie międzynarodowej. *Wiadomości Statystyczne. The Polish Statistician*, *68*(2), 16–38. https://doi.org/10.59139/ws.2023.02.2.

Oleńczuk-Paszel, A., & Sompolska-Rzechuła, A. (2025). Housing Conditions and the Quality of Life of the Populations of the European Union Countries. *Sustainability*, *17*(4), Article 4. https://doi.org/10.3390/su17041550.

Padeiro, M., de São José, J., Amado, C., Sousa, L., Roma Oliveira, C., Esteves, A., & McGarrigle, J. (2022). Neighborhood Attributes and Well-Being Among Older Adults in Urban Areas: A Mixed-Methods Systematic Review. *Research on Aging*, *44*(5–6), 351–368. https://doi.org/10.1177/0164027521999980.

Papież, M. (2007). Wpływ procesu starzenia się ludności na zmiany zachodzące na rynku pracy na przykładzie wybranych krajów Unii Europejskiej w latach 1998-2004. *Zeszyty Naukowe / Akademia Ekonomiczna w Krakowie, nr 740*, 51–73.

Polakowski, M. (2012). Społeczne i ekonomiczne konsekwencje starzenia się społeczeństw a główne kierunki reform systemów emerytalnych w Europie. *Studia BAS, 2(30)*, 169–199.

Prochorskaite, A., & Maliene, V. (2013). Health, well-being and sustainable housing. *International Journal of Strategic Property Management*, *17*(1), 44–57. https://doi.org/10.3846/1648715X.2012.762949.

Ritchie, H., Rodés-Guirao, L., Mathieu, E., Gerber, M., Ortiz-Ospina, E., Hasell, J., & Roser, M. (2023). Population Growth. *Our World in Data*. Retrieved form https://ourworldindata.org/population-growth (21.05.2025).

Ritchie, H., & Roser, M. (2019). Age Structure. *Our World in Data*. Retrieved form https://ourworldindata.org/age-structure (21.05.2025).

Rodgers, S.E., Bailey, R., Johnson, R., Poortinga, W., Smith, R., Berridge, D., Anderson, P., Phillips, C., Lannon, S., Jones, N., Dunstan, F.D., Morgan, J., Evans, S.Y., Every, P., & Lyons, R.A. (2018). Health impact, and economic value, of meeting housing quality standards: A retrospective longitudinal data linkage study. *Public Health Research*, *6*(8). https://doi.org/10.3310/phr06080.

Rolfe, S., Garnham, L., Godwin, J., Anderson, I., Seaman, P., & Donaldson, C. (2020). Housing as a social determinant of health and wellbeing: Developing an empirically-informed realist theoretical framework. *BMC Public Health*, *20*(1), 1138. https://doi.org/10.1186/s12889-020-09224-0.

United Nations. (2009). *The Right to Adequate Housing. Fact Sheet n. 21/Rev. 1.* Office of the United Nations High Commissioner for Human Rights. Retrieved form https://doi.org/10.1163/9789004502758_044 (28.02.2025).

United Nations. (2025). *The human right to adequate housing*. OHCHR. Retrieved form https://www.ohchr.org/en/special-procedures/sr-housing/human-right-adequate-housing (22.05.2025).

WHO. (2018). *WHO Housing and health guidelines*. World Health Organization. World Health Organization Housing and Health Guidelines. Retrieved form https://iris.who.int/bitstream/handle/10665/276001/9789241550376-eng.pdf (26.02.2025).

Wu, S., Fu, Y., & Yang, Z. (2022). Housing condition, health status, and age-friendly housing modification in Europe: The last resort? *Building and Environment*, *215*, 108956. https://doi.org/10.1016/j.buildenv.2022.108956.

Zalega, T. (2016). Incomes and Savings of Polish Seniors in View of Research Outcomes. *Problemy Zarzadzania*, *14*(59), 135–155.

Zhou, Z., Ma, Y., Du, W., Zhou, K., & Qi, S. (2022). Housing Conditions and Adolescents' Socioemotional Well-being: An Empirical Examination from China. *Applied Research in Quality of Life*, *17*(5), 2721–2741. https://doi.org/10.1007/s11482-021-09998-4.

Acknowledgements

Author contributions: author has given an approval to the final version of the article. A.M (50%), A.G. (50%)

Funding: this research was fully funded by the Faculty of Management, Bydgoszcz University of Science and Technology

Appendix

Table 1. Explanation of abbreviations and symbols used in the analysis of housing security in the EU(27) countries in 2013 and 2023

Symbol/ Code	Description
X	Variable describing housing security
Y	Variable describing satisfaction level
a	Total age group
b	From 18 to 64 years
c	65 years or over
d	One adult younger than 65 years
e	One adult 65 years or over
f	Two adults younger than 65 years
g	Two adults, at least one aged 65 years or over
HVY	Households with heavy financial burden due to housing costs
BUR	Households with financial burden due to housing costs
NOT	Households without financial burden due to housing costs
Vgood	Very good satisfaction
Good	Good satisfaction
Low	Low satisfaction
Vlow	Very low satisfaction

Source: Own work based on (Eurostat, 2025a).

Table 2. Indicators of Housing Security – Living Conditions and Economic Aspects

Variable symbol	Variable description
X_{01}	Overcrowding rate by age group in %
X_{02}	Total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor, by age (in %)
X_{03}	Severe housing deprivation rate in %
X_{04}	Average number of rooms per person by type of household – average

Variable symbol	Variable description
X_{05}	Housing cost overburden rate by age group in %
X_{06}	Share of rent related to occupied dwelling in disposable household income, by type of household in %
X_{07}	Share of housing costs in disposable household income, by type of household in %
X_{08}	Total housing costs in purchasing power standard – PPS
X_{09}	Financial burden of the total housing cost in %

Source: Own work based on *Eurostat* (2025a).

Table 3. Statistical characteristics of variables describing the EU(27) countries for the age group 65 years and over (data for 2023)

Variable	S/D	Mean	Min	Max	R	Vs	A	K	SW – W
X_{01c}	D	7.3	0.3 (CY)	26.0 (LV)	25.7	96.4	1.2	0.8	0.9
X_{02c}	D	11.1	2.4 (SE)	30.2 (CY)	27.8	61.4	1.4	1.9	0.9
X_{03c}	D	1.6	0.0 (MT, NL)	7 (LV)	7.0	99.2	2.0	5.4	0.8
X_{04e}	S	3.4	2.1 (LV)	5.1 (IE, LU, MT)	3.0	25.7	0.8	-0.5	0.9
X_{04g}	S	2.1	1.4 (LV, RO)	3.1 (IE)	1.7	23.0	0.5	-0.7	0.9
X_{05c}	D	8.9	1.6 (IE)	27.2 (GR)	25.6	63.4	1.4	2.7	0.9
X_{06e}	D	28.0	10.7 (LV)	40.6 (SE)	29.9	28.9	-0.2	-0.8	1.0
X_{06g}	D	21.7	4.3 (LV)	54.1 (EE)	49.8	41.1	1.7	6.9	0.8
X_{07e}	D	27.7	12.3 (MT)	45.2 (GR)	32.9	29.4	0.1	-0.3	1.0
X_{07g}	D	17.1	10 (MT)	30.7 (GR)	20.7	28.1	0.7	0.8	0.9
X_{08e}	D	309.0	114.7 (MT)	620.6 (NL)	505.9	48.8	0.7	-0.7	0.9
X_{08g}	D	351.9	169.7 (MT)	647.2 (DE)	477.5	39.7	0.7	-0.7	0.9
X_{09e_HVY}	D	29.1	5.8 (SE)	68.5 (PL)	62.7	55.1	0.7	0.2	1.0
X_{09e_BUR}	D	44.9	22.1 (SE)	64.7 (CZ)	42.6	28.6	-0.2	-0.9	1.0
X_{09e_NOT}	D	26.1	2 (IT)	72.1 (SE)	70.1	75.6	1.0	0.3	0.9
X_{09g_HVY}	D	22.6	2.8 (SE)	58.5 (PL)	55.7	62.4	0.9	0.4	0.9
X_{09g_BUR}	D	48.9	19.6 (SE)	74.5 (CZ)	54.9	30.2	-0.6	-0.3	0.9
X_{09g_NOT}	D	28.5	2.3 (IT)	77.6 (SE)	75.3	76.6	1.0	0.2	0.9
Y_{c_vgood}	S	32.2	8 (BG)	71.9 (SE)	63.9	55.4	0.5	-0.9	0.9
Y_{c_good}	S	60.3	23.9 (SE)	84.9 (BG)	61.0	29.2	-0.5	-0.9	0.9
Y_{c_low}	D	4.6	1.5 (DK, LU)	11.8 (HU)	10.3	52.6	1.1	1.7	0.9
Y_{c_vlow}	D	2.8	0.3 (RO)	12.9 (DK)	12.6	102.5	2.2	5.5	0.7

Notes: S – stimulant; D – destimulant; mean – EU(27) average value; min – minimum value for the country; max – maximum value for the country; Vs – coefficient of variation in %; R – range (max–min); A – asymmetry; K – kurtosis; SW–W – Shapiro–Wilk test result;
Source: Own work based on Eurostat (2025a).

Table 4. Range between age groups and range of change over time for indicators X01–X03 (EU(27) and PL, 2013–2023)

Variable symbol	Region	Age group	2013	2023	Range 2023–2013 [%]	Range 2023 (b–c) [%]
X_{01}	EU(27)	18–64	19.6	17.9	-1.7	11.2
	EU(27)	≥65	7.3	6.7	-0.6	
	PL	18–64	45.0	34.4	-10.6	11.1
	PL	≥65	27.7	23.3	-4.4	
X_{02}	EU(27)	18–64	15.8	16.0	0.2	3.9
	EU(27)	≥65	13.5	12.1	-1.4	
	PL	18–64	10.1	5.4	-4.7	0.2
	PL	≥65	8.8	5.2	-3.6	
X_{03}	EU(27)	18–64	5.7	4.2	-1.5	2.8
	EU(27)	≥65	2.3	1.4	-0.9	
	PL	18–64	9.9	4.7	-5.2	1.5
	PL	≥65	7.0	3.2	-3.8	

Source: Own work based on Eurostat (2025a).

Table 5. Range between age groups and range of change over time for indicator X_{04} (EU(27) and PL, 2013–2023)

Variable symbol	Region	Age group	2013	2023	Range 2023–2013 [average]	Range 2023 (d–e or f–g) [average]
X_{04} (1-person household)	EU(27)	18–64	2.8	2.8	0.0	-0.5
	EU(27)	≥65	3.2	3.3	0.1	
	PL	18–64	2.2	2.4	0.2	0.0
	PL	≥65	2.2	2.4	0.2	
X_{04} (2-person household)	EU(27)	18–64	1.9	1.9	0.0	-0.1
	EU(27)	≥65	2.0	2.0	0.0	
	PL	18–64	1.4	1.5	0.1	0.0
	PL	≥65	1.4	1.5	0.1	

Source: Own work based on Eurostat (2025a).

Table 6. Range between age groups and range of change over time for indicators X_{05}–X_{07} (EU(27) and PL, 2013–2023)

Variable symbol	Region	Age group	2013	2023	Range 2023–2013 [%]	Range 2023 (b–c or d–e or f–g) [%]
X_{05}	EU(27)	18–64	11.8	8.9	-2.9	-0.9
	EU(27)	≥65	11.4	9.8	-1.6	
	PL	18–64	10.3	5.9	-4.4	-1.6
	PL	≥65	10.0	7.5	-2.5	

Variable symbol	Region	Age group	2013	2023	Range 2023–2013 [%]	Range 2023 (b–c or d–e or f–g) [%]
X_{06} (1-person household)	EU(27)	18–64	32.1	30.0	-2.1	0.3
	EU(27)	≥65	30.5	29.7	-0.8	
	PL	18–64	31.1	36.5	5.4	11.5
	PL	≥65	22.4	25.0	2.6	
X_{06} (2-person household)	EU(27)	18–64	22.6	20.1	-2.5	-0.4
	EU(27)	≥65	20.8	20.5	-0.3	
	PL	18–64	26.7	19.1	-7.6	4.2
	PL	≥65	19.0	14.9	-4.1	
X_{07} (1-person household)	EU(27)	18–64	35.3	32.2	-3.1	3.5
	EU(27)	≥65	29.4	28.7	-0.7	
	PL	18–64	36.9	30.5	-6.4	-2.2
	PL	≥65	31.4	32.7	1.3	
X_{07} (2-person household)	EU(27)	18–64	22.9	19.3	-3.6	1.8
	EU(27)	≥65	19.6	17.5	-2.1	
	PL	18–64	25.4	19.8	-5.6	-0.7
	PL	≥65	22.5	20.5	-2.0	

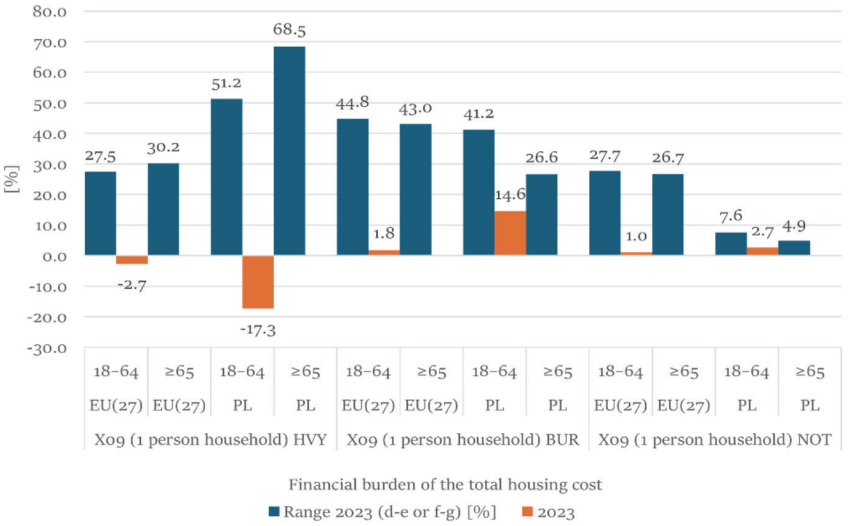
Source: Own work based on Eurostat (2025a).

Table 7. Range between age groups and range of change over time for indicator X_{08} (EU(27) and PL, 2013–2023)

Variable symbol	Region	Age group	2013	2023	Range 2023–2013 [PPS]	Range 2023 (d–e or f–g) [PPS]
X_{08} (1-person household)	EU(27)	18–64	395.1	460.7	65.6	99.4
	EU(27)	≥65	313.8	361.3	47.5	
	PL	18–64	250.3	356.9	106.6	58.9
	PL	≥65	205.0	298.0	93.0	
X_{08} (2-person household)	EU(27)	18–64	485.0	553.5	68.5	140.6
	EU(27)	≥65	379.3	412.9	33.6	
	PL	18–64	325.0	433.6	108.6	61.3
	PL	≥65	275.3	372.3	97.0	

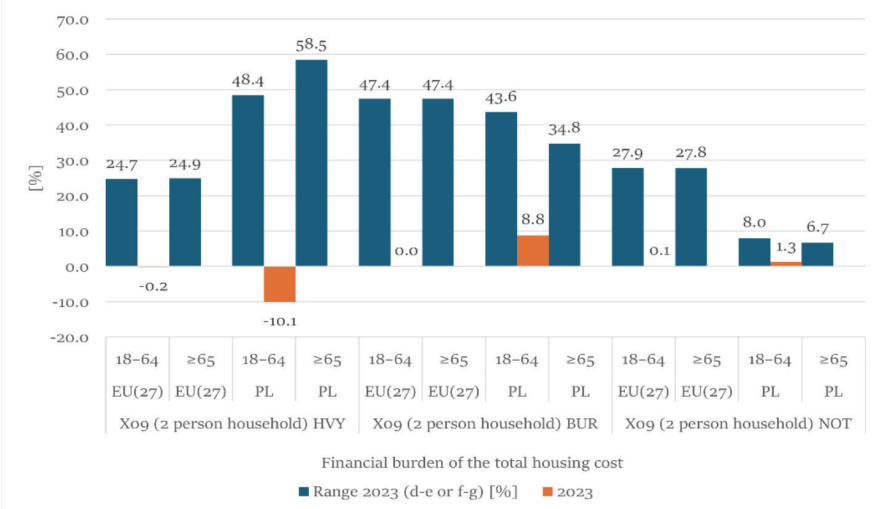
Source: Own work based on Eurostat (2025a).

Chart 1. Differences between age groups in one-person households for the financial burden of housing costs indicator (X_{09}) in 2023 (EU(27) and Poland)



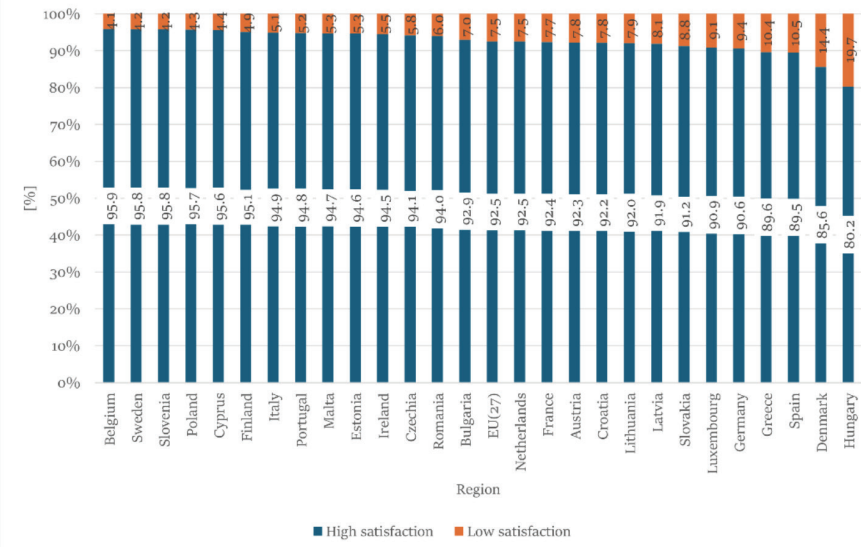
Source: Own work based on Eurostat (2025a).

Chart 2. Differences between age groups in two-person households for the financial burden of housing costs indicator (X_{09}) in 2023 (EU(27) and Poland)



Source: Own work based on Eurostat (2025a).

Chart 3. Level of housing satisfaction among people aged 65+ against the background of the EU(27)



Source: Own work based on Eurostat (2025a).