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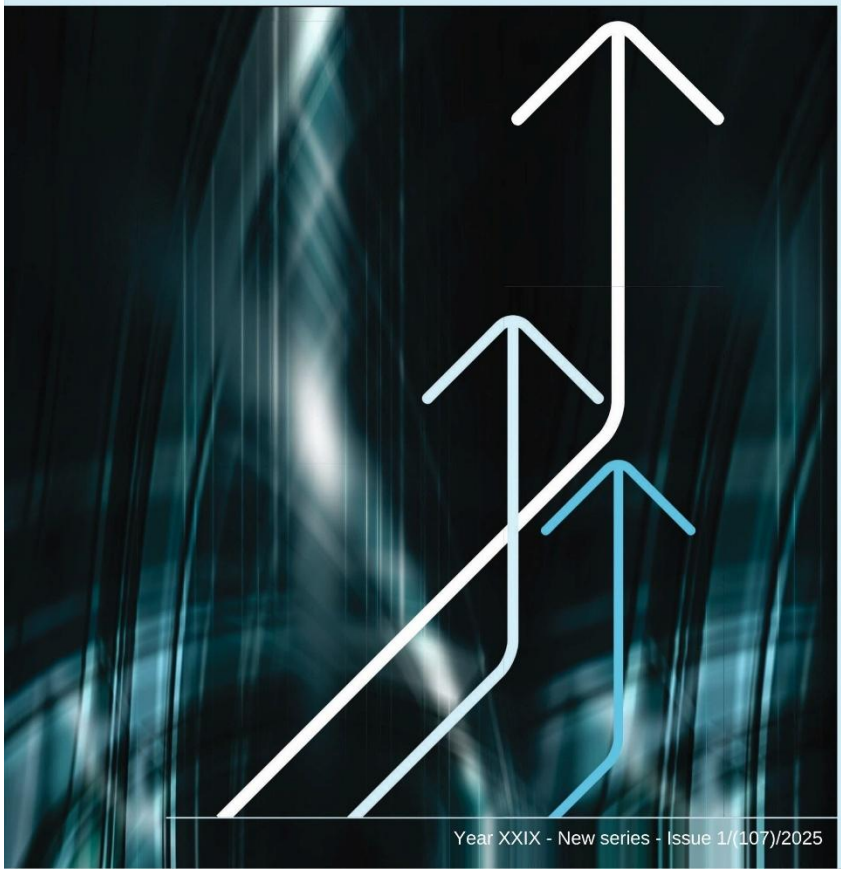

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“VICTOR SLĂVESCU” CENTRE FOR FINANCIAL
AND MONETARY RESEARCH

FINANCIAL STUDIES

ROMANIAN ACADEMY
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Contents

EXPLORING PATTERNS OF ECONOMIC SECURITY AND SUSTAINABILITY ACROSS DEMOGRAPHIC GROUPS

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Abstract

This study analyses income dynamics and economic vulnerability in the Republic of Moldova between 2019 and 2023, using data on income and expenditures from the Household Budget Survey conducted by the National Bureau of Statistics. The findings reveal significant socio-demographic disparities, with self-employed agricultural workers, pensioners, and low-education households being the most vulnerable. Urban areas demonstrated faster income growth than rural regions, exacerbating regional inequalities. Age and education also emerged as critical factors influencing economic security, with older adults and individuals with limited education facing higher risks of financial exclusion. The results underline the necessity of targeted policies to enhance educational access, reduce labour market insecurity, and address regional disparities to foster economic resilience and social inclusion.

Keywords: income, social groups, vulnerability, financial inclusion

JEL Classification: D31, R20, E21, O15

1. Introduction

Material and financial security are essential for individual and collective well-being, encompassing both objective measures and subjective perceptions. While material security offers a critical framework for assessing vulnerabilities among social groups, its analysis is complicated by the interplay of these objective and subjective factors. Income stands out as a key objective indicator for evaluating material security.

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This study examines income distribution across population groups, aiming to identify those most vulnerable to economic and financial exclusion. As a vital measure of material and financial security, income distribution reveals patterns of inequality that are crucial for addressing socioeconomic disparities.

At the macro level, indicators such as Gross Domestic Product (GDP) offer a broad view of national economic health and resource availability. While useful for assessing economic trends and policy outcomes, macro indicators often fail to capture the nuanced realities of inequality within specific population subgroups. Their limitations make them insufficient for identifying vulnerable households or addressing deeply rooted disparities. By contrast, the micro-level analysis focuses on household and individual income distribution, providing a more detailed perspective on inequality and economic opportunity. This approach highlights how age, education, employment status, and place of residence influence income levels. The micro-level analysis offers valuable insights into the socioeconomic conditions perpetuating inequality and exclusion by identifying groups whose income falls below the thresholds necessary for resilience and inclusion.

2. Literature review

To better understand the dynamics of income and exclusion, this study builds on existing theoretical and empirical research, as outlined below. The existing research has identified interdependencies between financial and social exclusion (Lewis & AV Lewis, 2014; Németh, Zsótér, & Béres, 2020; Fernández-Olit, Martín Martín, & Porras González, 2020). Hungarian researcher Dorjnyambuu examined the causal relationship between financial and social exclusion in Eastern and Central Europe, identifying the interdependence between these two phenomena (Dorjnyambuu, 2023). Furthermore, income influences the adoption of digital financial practices, as lower income levels often hinder access to such services. Other research has underlined that household income is a determining factor in adopting and promoting certain digital financial practices (Vik, Kamerāde, & Dayson, 2024). A significant aspect emphasised by foreign researchers is the correlation between financial vulnerability, income, and other socio-demographic characteristics (Buleca, Šubová, & Maličká, 2022). For instance, the education level of individuals is one

of the critical characteristics (Daud, Marzuki, Ahmad, & Kefeli, 2019; Németh, Zsótér, & Béres, 2020; Šubová, Mura, & Buleca, 2021), which impacts income levels on the one hand and indicates or creates risks related to the knowledge required for promoting financial inclusion on the other. In addition to education, the literature highlights other factors, such as unemployment or periods of joblessness (Rhine & Greene, 2013; Lee & Sabri, 2017; Hamid, Loke, & Chin, 2023). Another critical aspect highlighted in studies on financial exclusion is the relationship between the risk of exclusion and individuals' residential environment. Researchers have noted a gap and a higher risk of financial exclusion in rural areas compared to urban areas (Yusof, Rokis, & Jusoh, 2015; Németh, Zsótér, & Béres, 2020).

Research in this field provides a broad and diverse theoretical and empirical framework regarding the correlations between financial exclusion, income, and socio-demographic characteristics. Thus, this study will be guided by the theoretical parameters identified at a general level and outline the population's risk profiles based on income at the national level.

3. Data and methods

This study utilised statistical indicators from the National Bureau of Statistics (NBS) to analyse income and expenditure patterns between 2019 and 2023. The analysis was based on the availability of comparable data, with the primary source being the Household Budget Survey (HBS). The HBS is a nationally representative survey covering 12,612 households annually, with data collected monthly using a two-stage sampling process. In 2019, significant methodological improvements were introduced to enhance accuracy and representativeness, including recalibrating the sample to reflect current population dynamics and transitioning from a panel design to sampling new households annually. These updates align with international standards and improve data robustness (BNS, 2024).

Due to the 2019 methodological changes, data from earlier periods were excluded from the analysis as they were incompatible for comparison. The 2019–2023 data were extrapolated to the total population based on socio-demographic characteristics, such as age, education, and labour market status.

The research focused on disaggregated income and expenditure indicators, enabling a dynamic analysis of these metrics

and their ratio across socio-demographic factors, including household head characteristics and area of residence. This approach highlighted key trends and variations within the population.

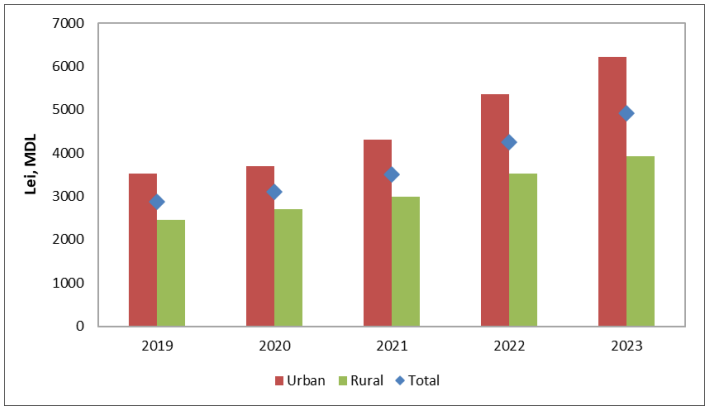
While the HBS provides reliable data, it is subject to limitations, including non-response rates in sensitive areas like income reporting and potential sampling errors. However, the NBS mitigates these issues through continuous methodological refinements, such as the 2019 recalibration. Despite these challenges, the HBS remains a vital tool for understanding income and expenditure trends in socio-demographic contexts.

4. Main results

In recent years, population income in the Republic of Moldova has shown a notable increase, with urban areas experiencing a more pronounced increase compared to rural regions (Figure 1).By 2023, incomes in urban areas had risen by 1.8 times and in rural areas by 1.6 times relative to the beginning of the analysis period. Salaries, contributing roughly 50% of total income, remain the primary source of income, complemented by a growing share of social benefits, which reached 20% by 2023. Together, these components account for about 70% of the population's total income, reflecting governmental efforts to address socioeconomic instability through measures such as social benefits and assistance for utility bills amid rising costs of gas and electricity.

Figure 1

Dynamics of available population income by area of residence



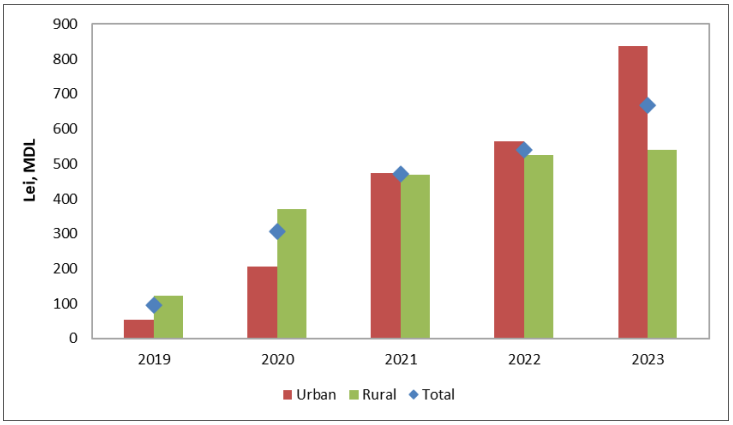
Source: Based on the NBS data

The disparity between urban and rural areas is further highlighted by income-to-expenditure dynamics (Figure 2). At the beginning of the study, urban households had smaller gaps between income and expenditures than rural ones. However, by 2023, urban households reported a significant positive difference, with incomes averaging 800 MDL compared to 500 MDL in rural areas. This gap underscores stagnation in rural income growth, which has constrained spending primarily to essential needs like food and utilities. In contrast, urban households have shown stronger financial resilience, enabling discretionary spending and widening the urban-rural divide.

These dynamics are reflected in overall expenditure patterns across the population. More than 40% of household expenditures are directed toward food and non-alcoholic beverages, while approximately 20% is spent on utilities. These figures illustrate the financial constraints faced by many households, whose budgets are predominantly consumed by basic necessities. This limitation is particularly acute in rural areas, where slow income growth exacerbates financial vulnerability. These patterns align with broader socioeconomic challenges, where income disparities and instability continue to shape the financial realities of different population groups.

Figure 2

Dynamics of differences between income and expenditures by area and overall



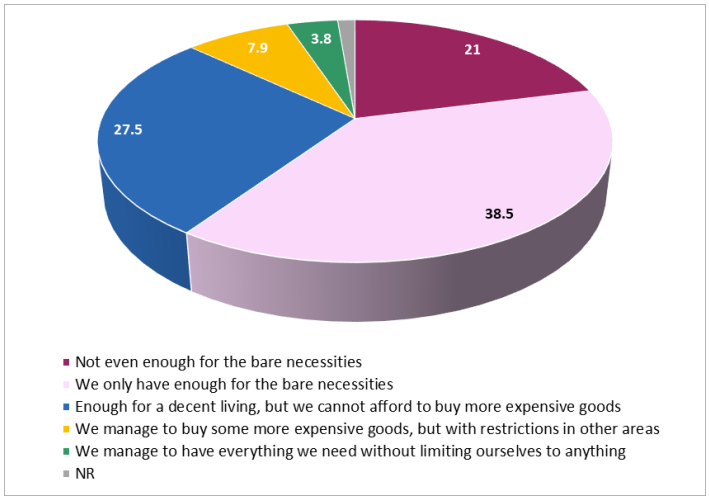
Source: Based on the NBS data

Building on these observed trends – the low difference between income and expenditures - the majority of the population is restricted

to meeting only basic needs. Data from the Public Opinion Barometer further support this conclusion, showing that 40% of respondents consider their income sufficient only for basic needs, while 21% report that their income is inadequate even for these essential needs (Figure 3). These findings emphasise widespread financial constraints and underline the systemic economic deficiencies affecting large segments of the population.

Figure 3

Self-assessment of income level



Source: BPO data for August 2023, http://bop.ipp.md/

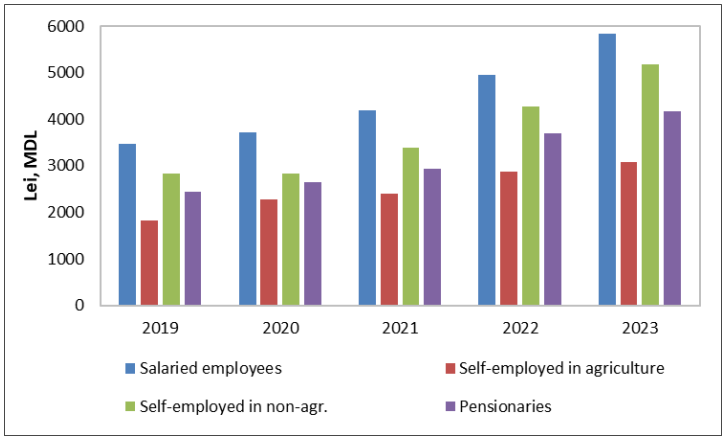
Economic deficiencies become much more apparent when analysing data across specific population categories. The analysis of Figure 4 demonstrates notable disparities in income levels across different socioeconomic groups over the 2019–2023 period. Salaried employees consistently report the highest income levels, with a significant upward trend observed over time. By 2023, their average income exceeded 5,000 MDL, far outpacing other groups. This highlights the financial advantage of individuals with formal employment, driven by stable wages and potential access to benefits.

Self-employed workers in non-agricultural activities exhibit moderate income levels, positioned between salaried employees and agricultural workers. Their income shows a gradual increase over time, albeit at a slower pace compared to salaried employees, suggesting moderate economic resilience in non-agricultural sectors.

In stark contrast, self-employed workers in agriculture consistently exhibit the lowest income levels, remaining stagnant throughout the analysis period. By 2023, their income was less than half that of salaried employees, illustrating the persistent economic challenges faced by this group. This stagnation reflects structural barriers such as limited market access, low productivity, and the absence of financial safeguards.

While similarly constrained, pensioners show slightly higher income levels compared to self-employed agricultural workers. However, their income remains significantly lower than other groups, with limited improvements observed over time. This reflects their reliance on fixed pensions, which are inadequate to match rising living costs.

Figure 4
Dynamics of income based on the socioeconomic status of the household head



Source: Based on the NBS data

Income-to-expenditure differences further illustrate financial disparities across groups (Figure 5). Salaried employees consistently exhibit positive income-to-expenditure differences throughout the analysis period. This trend reflects their relative financial stability, likely due to consistent wage earnings and better access to financial resources. By 2023, the income surplus for this group reached its highest level, exceeding 800 MDL. This improvement demonstrates their capacity to generate savings or allocate funds toward discretionary spending, highlighting the benefits of formal employment.

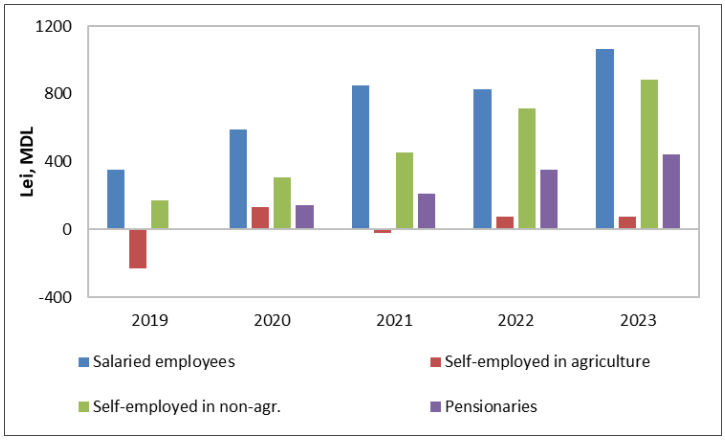
Self-employed workers in non-agricultural sectors demonstrate moderate financial resilience, with consistently positive income-to-expenditure differences. Their financial position improves steadily over time, reaching a surplus of around 800 MDL by 2023. This reflects the relative stability and growth potential of non-agricultural activities compared to agricultural work, suggesting greater income diversification and market integration opportunities in this group.

Self-employed workers in agriculture face persistent financial difficulties, with negative income-to-expenditure differences recorded in most years. This trend indicates that their expenditures often exceed their income, underscoring their precarious financial situation. While a slight improvement is observed in later years, their overall financial position remains the weakest among all groups, reflecting structural challenges such as low agricultural productivity, limited market access, and vulnerability to external shocks.

Pensioners maintain modest but positive income-to-expenditure differences, indicating a slight financial surplus. However, their position shows little improvement over time, with their surplus remaining significantly lower than that of employees or non-agricultural workers. This stagnation reflects their heavy reliance on fixed pensions, which limit their capacity to adapt to rising living costs or improve their economic situation.

Figure 5

The dynamics of the difference between income and expenditure by socio-economic status of the household head



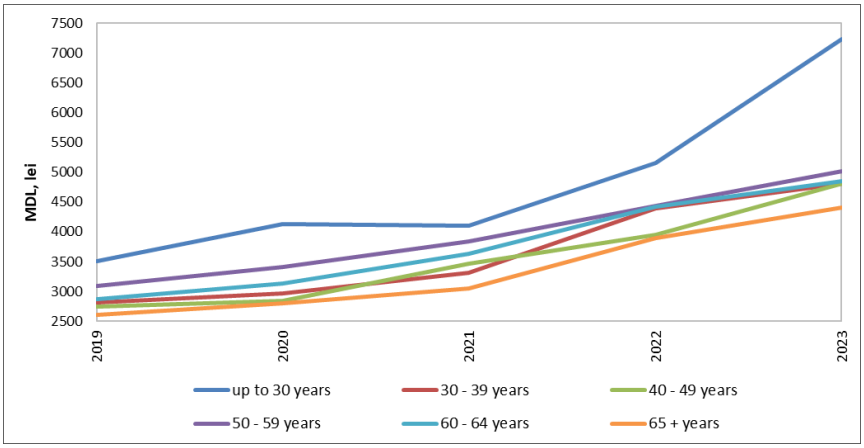
Source: Based on the NBS data

Age also plays a critical role in income disparities. As shown in Figure 6, individuals from households headed by individuals aged 65 years and older consistently report the lowest income levels throughout the observation period (2019–2023). This trend is largely attributable to their reliance on fixed pensions, which provide a stable but insufficient income to meet rising living costs. Despite modest increases over time, the income of this group remains significantly lower than that of younger age groups, highlighting the persistent economic challenges faced by older households.

Conversely, households headed by individuals under the age of 30 exhibit the highest income levels. This group experienced a marked upward trajectory in income, particularly from 2021 onwards, with incomes exceeding 7,000 MDL by 2023. This sharp growth may reflect more significant access to higher-paying employment opportunities and a stronger connection to dynamic sectors of the economy.

Figure 6

Income dynamics by age of household head



Source: Based on the NBS data

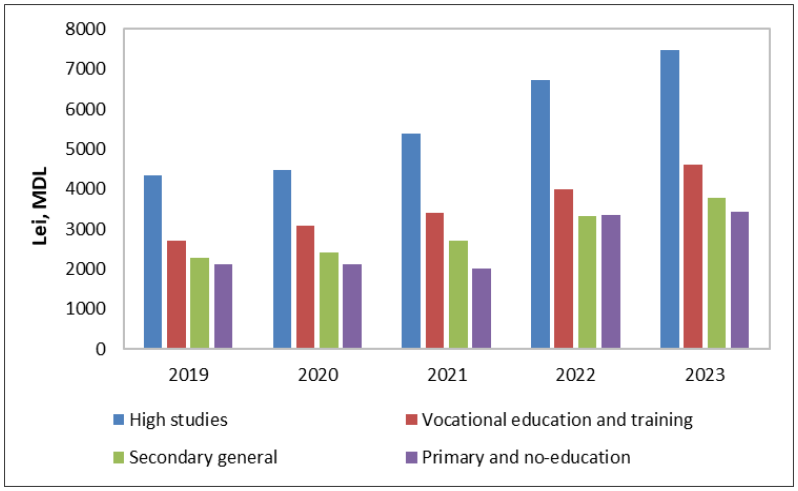
The situation for middle-aged household heads, particularly those aged 30–49 years, is somewhat more complex. While these individuals are typically in their peak productive years, their income levels do not significantly outpace those of older age groups, particularly those aged 50–59.

Interestingly, the income gap between age groups narrows for individuals aged 50–59 years and those in the 60–64 age range. Both groups demonstrate steady income growth but do not exhibit the same rapid increases observed in younger groups. This trend suggests that economic opportunities may plateau as individuals approach retirement age.

Educational attainment emerges as a key determinant of income. On the one hand, higher education levels provide access to more stable and well-paying employment opportunities. On the other, education equips individuals with the skills needed for effective financial management and adaptability in a changing economy. The data in Figure 7 demonstrate a clear and substantial income gap based on educational attainment, highlighting the strong correlation between education and economic resilience.

Figure 7

Income dynamics by education level of the household head



Source: Based on the NBS data

Households headed by individuals with higher education consistently report the highest income levels throughout the 2019–2023 period. By 2023, the average income for this group exceeded 7,000 MDL, showing a steady and substantial increase over time. In contrast, individuals with only primary education or no formal education exhibit the lowest income levels, with an average income that

stagnates around 2,500–3,000 MDL throughout the observation period.

Those with general secondary education and technical vocational training occupy intermediate positions. By 2023, households headed by individuals with vocational training reported incomes averaging around 5,000 MDL, reflecting moderate financial improvement over time. Meanwhile, individuals with general secondary education exhibited slower income growth, with their incomes lagging behind vocational graduates.

5. Conclusion

This study highlights significant disparities in income and expenditure dynamics across socio-demographic groups, regions, and educational levels in the Republic of Moldova, offering critical insights into financial vulnerabilities. Certain high-risk groups emerge as particularly susceptible to financial exclusion, including self-employed agricultural workers, pensioners, individuals with low education levels, and rural households. These groups face persistent income stagnation, limited economic opportunities, and expenditure patterns dominated by essential needs.

A key finding is the strong correlation between education and income levels. Individuals with higher education consistently achieve better financial outcomes, benefiting from stable employment, career advancement opportunities, and higher salaries. Conversely, those with only primary education or no formal education experience persistently low incomes, limiting their ability to diversify income sources and heightening their risk of economic exclusion.

Age also plays a pivotal role in shaping financial realities. Older individuals (65+ years) are heavily reliant on insufficient pensions, which fail to meet rising living costs. Younger groups (30–49 years) face financial pressures stemming from family-related consumption demands, such as raising children, education expenses, or mortgage payments. These factors constrain disposable income, even during what is typically an economically active phase of life.

Regional disparities further compound these inequalities. Urban households consistently report higher income growth and greater financial stability than rural households. In rural areas, income stagnation and limited economic opportunities exacerbate vulnerabilities. Self-employed workers in agriculture are particularly

disadvantaged, with negative or negligible income-to-expenditure differences highlighting their precarious financial conditions. Pensioners, while slightly better off, remain constrained by fixed incomes that cannot keep pace with inflation or rising costs.

This analysis underscores the systemic inequalities shaping financial realities in Moldova, driven by intersecting factors such as education, age, labour market participation, and regional disparities. Addressing these challenges requires a comprehensive, evidence-based approach that prioritises equitable access to economic opportunities, robust social protection mechanisms, and initiatives to enhance economic resilience. By focusing on these measures, policymakers can mitigate vulnerabilities, reduce inequalities, and foster sustainable socioeconomic development for all segments of society.

Acknowledgments

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THE RELATIONSHIP BETWEEN RISK MANAGEMENT AND FIRM PERFORMANCE - EVIDENCE FROM THE GEORGIAN MANUFACTURING INDUSTRY

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Sevinji MAMEDOVA, MBA**

Abstract

This paper investigates the existence of the relationship between risk management (RM) and the financial performance of Georgian manufacturing firms. By looking into risk management information disclosures of manufacturing companies in Georgia for the year 2021, seven factors were studied to assess the RM level they used. RM factors were chosen based on the Enterprise Risk Management (ERM) requirements of two leading risk management standards: ISO 31000:2018 and COSO (2017). The Risk Management Disclosure score (RMD) was designed and calculated. The study analysed performance measures of a firm represented by: Operating Profit Margin, Non-operating Profit Margin, Net Profit Margin, ROA and ROE. OLS regression was used to reveal the relationship between RMD and performance. The results show a positive linkage between RMD and Operating and Net Profit Margins. On the other hand, no linkage is found between RMD and other measures. The study highlights how effective risk management enhances firm performance, aiding managers and policymakers. From the theoretical aspect, the study contributes to the literature by reinforcing the link between risk management and firm performance and offering an updated framework for further empirical research using RMD.

Keywords: enterprise risk management, risk management disclosures, financial performance, emerging economies

JEL Classification: G32, L60, M41

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1. Introduction

Business has to deal with uncertainty, and unpredicted and unexpected events. Risk management presumes to reduce negative effects of adverse events. Because of rapidly developing economic environment, risks become more complex and not easily avoidable by organizations. Most risks can be reduced to some extent, but can never be eliminated (Przetacznik, 2022). Those risks can threaten companies with financial and reputational losses and loss of competitive advantage.

In the 1970s, financial risk became an important concern for firms because of interest rate volatility, changing prices, and unpredictable exchange rates. Afterwards, financial risk management and mitigation tools were developed (D'Arcy & Brogan, 2001). Firms and institutions mainly focus on mitigating risks and minimizing the harm that occurs after the occurrence of the harm. Not every company has a proper system and enough competence to handle unexpected events. Florio and Leoni (2017) outline that business failures and collapse of high-profile corporates such as Enron, WorldCom once again highlighted the importance of managing risks and readiness for them anytime. Later, the 2007-08 financial crisis stimulated activities to reduce risks in the financial system by closer regulation of financial firms and institutions (Balasubramanian & Cyree, 2012).

Nowadays, most successful organizations place a greater emphasis on establishing proper risk management system to identify potential risks, evaluate and prioritize them and take appropriate actions in a timely manner. Risk management is an integral part of an organization's corporate strategy, and its main task is to prevent or mitigate the risks to a minimal level in order to survive in today's competitive environment (Iswajuni, Manasikana and Soetedjo, 2018).

Traditional Risk Management (TRM), although widely practised, has limitations that make it less effective in today's complex business environment. Firstly, it has a silo approach to risk management, which means it assesses and manages risks in isolation, and while mitigating the risks, it focuses on the impact on individual business units rather than focusing on the entire organization (Lundqvist, 2015). For years, companies managed their risks through a non-systemic approach, and each department was responsible for its own risk and had its own risk terminology and methodology despite the fact that each dealt with the risk that the organization as a whole was

facing (D'Arcy & Brogan, 2001; Widjaja, 2019). TRM is more reactive, as it focuses on minimizing the impact of the risk that has already occurred (Przetacznik, 2022).

Because of those limitations, a new approach - Enterprise Risk Management (ERM) emerged. Its scope is far beyond the TRM (Kennedy, 2008). According to ERM, each company member should be aware of and responsible for company-wide risks. It helps organisations to identify and manage multiple and cross-enterprise risks by providing the proper response to the interrelated impacts of these risks (Kbiltsetskhlashvili & Mamedova, 2017). The main purpose of ERM is to take a more holistic approach and develop a portfolio view of significant risks to the achievement of the entity's organizational objectives.

ERM is considered the method to shift focus from "cost/benefit" to "risk/reward", and it sees a system as a language for communicating an organisation's efforts to create and maintain a manageable risk profile. Standard and Poor's has included a risk management system as a significant factor in its overall rating system (Dreyer & Ingram, 2008). Lam (2014) describes ERM as balancing risk and reward, art and science, and processes and people. He explains that the challenge for every leader is to take intelligent risks that bring opportunity.

Although ERM has been a widely debated topic for a long time, most Georgian firms are still not familiar with it. In the report "Enterprise Risk Management Survey Risk Intelligence in Banking on the Georgian Market" (2016), Deloitte presented the first enterprise risk management survey in Georgia that was concentrated on Georgian banks. As outlined in the survey, ERM is still in the stage of an early stage of development in the Georgian market, though it is a rather rapidly developing field in Georgian banks than in other industries. Avalishvili (2011) conducted a survey in the non-financial sector to evaluate how risks are managed and if there is any sign of ERM adoption. The conclusion was that ERM is not even at the initial stage of its maturity (Avalishvili, 2011).

Kbiltsetskhlashvili and Mamedova (2017) have conducted a study to investigate the role of risk management in the economic growth and development of companies in the insurance sector. As their results show, risk management is still in the developing stage in Georgia, though it plays a vital role in the insurance industry and its economic growth.

No other survey about risk management in different sectors in Georgia could be found at the time of our study (May 2024). What we know today is that only a few banks have partially or fully adopted ERM and the insurance sector is only in the developing stage.

This paper concentrates on the manufacturing industry of Georgia. Pirveli et al. (2022) investigated the sectoral efficiency of Georgia. As their findings show, manufacturing is one of the most efficient sectors in Georgia and plays an essential role for country.

The objective of the current study is to investigate risk management practices that are common in the Georgian manufacturing industry, the degree of risk management disclosure, and last but foremost, if there is any relationship between risk management and the financial performance of a firm through studying disclosed information in financial and management reports.

With its results this paper gives limited but necessary insights about ERM and performance measures linkage. Firstly, the paper, by considering two world-known risk management standards, combines ERM determinants and adds some new measures for assessing risk management in firms, and, secondly, it strives to provide evidence about the relationship between risk management degree and its effect on firms' performance.

2. Literature review

2.1 Enterprise risk management

Companies admit that ERM gives them a competitive advantage. The result of ERM is assessed based on the company value or its performance (Naik & Prasad, 2021). The main benefit of ERM is that it increases shareholder value by improving capital efficiency and reducing expenses on risks. Additionally, by considering risks in the decision-making process, companies are able to stabilise their financial performance and build investor confidence (Quon, Zeghal and Maingot, 2012).

Naik and Prasad (2021) identified the following benefits of ERM adoption in their study: increased profitability, efficient resource allocation, stabilised earnings, better risk communication, enhanced firm performance, competitive advantage, and increased cost-effectiveness.

Stroh (2005) admits that for organisations that possess a strong enterprise risk management capability and discipline, it is a valuable source of competitive advantage and may become the key to survival.

Effective risk management systems can help companies avoid operational surprises, and companies are less likely to encounter direct and indirect costs such as bankruptcy and reputational effects (Pagach & Warr, 2010). Firms can avoid duplication of risk-related expenditure by integrating the decision-making process across all risk classes and exploiting natural hedges (Hoyt & Liebenberg, 2011).

2.2 Positive linkage between ERM and firm performance

In the study of Baxter et al. (2013), the correlation between ERM quality and firm performance and value was investigated using a sample from the banking and insurance sectors. The final result revealed a strong positive linkage between ERM and the firm's financial performance (measured by the company's ROA) and its value (measured by Tobin's Q).

A broader industry analysis was conducted by Callahan and Soileau (2017). The study found that companies with more sophisticated ERM processes have higher operating performance than their peers with less mature ERM. Thus, regardless of industry, adopting ERM is positively associated with operational performance measured by ROA and ROE (Callahan & Soileau, 2017).

Gates et al. (2012) covered several UK industries and suggested that the ERM framework allows the management of the company to be more effective; therefore, ERM implementation may help companies improve their performance. Soliman and Adam (2017) provide strong evidence of a positive correlation between ERM adoption and performance in the Nigerian banking sector. The study investigated whether firms with high ERM ratings or maturity stages of ERM implementation perform better than the ones with low ERM ratings or the ones that are still at the foundation stage.

The study, which evaluated Italian non-financial companies' ERM systems, also demonstrated that companies with more sophisticated ERM show healthier financial performance with better operational and strategic decisions and are more appreciated by investors. On the contrary, companies with rudimentary or no ERM show less profitability and are negatively evaluated by financial markets (Florio & Leoni, 2017).

Other authors have found a positive relationship between ERM adoption and company performance: Pan et al. (2023) in China, Malik et al. (2020) in the UK, and Ai Ping and Muthuveloo (2015) in Malaysia. Suttipun et al. (2019) demonstrated that no matter whether the firm is an SME in a developing country or a large firm in a developed one, both are getting the same benefit from adopting ERM.

While some researchers use appointing Chief Risk Officer (CRO) as a sign of ERM implementation (Pagach and Warr, 2010; Hoyt and Liebenberg, 2011; González, Santomil and Herrera, 2020), others employ the ERM index, which was developed by Gordon et al. (2009) in their study (Gordon, Loeb and Tseng, 2009; Widjaja, 2019). The index suggested risk management objectives for ERM implementation, including strategy, operating, reporting, and compliance. Widjaja (2019) concluded that the ERM index is positively associated with the profitability performance of banking industry firms. The result coincides with Gordon et al.'s (2009) finding that the ERM index is positively linked with the performance of non-financial firms.

2.3 Controversial suggestions about ERM and the firm's performance

There are several opposite views that found no linkage between ERM and an organisation's performance or found some negative relationship. The implementation and adoption of ERM take some resources, and if not used efficiently, those resources may cause significant expenditures and have a negative effect on the company's profitability and performance. Apart from this, some firms adopt ERM only for the purpose of complying with the law rather than adopting it to gain economic and non-economic benefits and opportunities.

PricewaterhouseCoopers carried out research of Finnish companies between October 2005 and January 2006 and, as research revealed, the main motivation for adopting ERM is tightening corporate governance pressures, as over 85 per cent of participants admit (Enterprise Risk Management (ERM) Benchmarking Survey 2006, 2006).

Tekathen and Dechow (2013) argue that ERM is not oriented on improving performance or compliance.

Quon et al. (2012) surveyed 156 non-financial firms during 2007 and 2008 years. Operational, accounting and financial market performance and risk reporting of each firm were examined during the

crisis. Researchers concluded that ERM does not have any considerable effect on business performance.

Agustina and Baroroh (2016) assessed the influence of ERM on the firm value through its financial performance. By sampling banking companies listed on the Indonesia Stock Exchange, the data was analysed, and the result indicated that ERM has no significant influence on firms' value and profitability.

Şenol and Karaca (2017) attempted to determine the influence of ERM on a firm's financial performance and to study the main determinants of ERM in Turkey. As they conclude, ERM does not affect firm value, ROA, Market-Book Value and Price Stability.

By studying the sample of 45 banking companies listed on the Colombo Stock Exchange (CSE), Alawattegama (2018) revealed that none of the ERM elements suggested by the COSO ERM integrated framework indicated a significant impact on firms' ROE. What is more, empirical evidence reveals that some elements, such as objective setting, event identification, control activities and monitoring, have negative but not significant effects on firm performance.

The study of Ramlee and Ahmad (2015) find no significant relationship between ERM adoption and the performance of non-financial Malaysian firms.

Gonzalez et al. (2020) examined if the financial stability of firms was associated with their ERM implementation level. The annual and management reports of Spanish non-financial companies from 2012 to 2015 were evaluated. Results exhibited no linkage between ERM and performance measured by ROA, ROE, and Tobin's Q. The study also found no evidence to conclude a positive relationship between companies with risk committees and their financial performance. Interestingly, the study found that hiring a CRO has a negative effect on a company's ROA and ROE.

2.4 Enterprise risk management components

The most popular and recently revised standards for ERM are ISO 31000:2018 Risk Management Guidelines (Risk Management - Guidelines, 2018) and Committee of Sponsoring Organizations ERM - Integrated Framework (Enterprise Risk Management - Integrated Framework, 2017). Both provide information about how a proper risk management framework should be implemented and what key factors should be considered. They emphasise the role of embedding risk management into an organisation's decision-making.

The ERM framework of COSO released in 2017 includes 20 principles that is divided into five groups and support different aspects of the framework. Those five components are the following: Governance and Culture, Strategy & Objective-setting; Performance; Review and Revision; Information, Communication and Reporting.

According to ISO 31000:2018 risk management is based on principles, framework guidelines and the process. It proposes the following eight principles that should be taken into consideration when establishing a company's risk management framework: Integrated, Structured, Comprehensive, Customized, Inclusive, Dynamic, Best Available Information, Human and cultural factors, and continuous improvement.

Both COSO and ISO 31000 frameworks require direct support from top management in order to be successfully implemented (Rampini & Berssaneti, 2022). Like in COSO framework, ISO 31000 (2018) puts a great emphasis on the risk culture and its role in the risk management system.

Apart from principles and guidelines, COSO defines the exceptional role of Chief Risk Officers (CRO) when establishing an enterprise risk management system. Several studies agree that the existence of CRO is essential to ERM implementation (Dickinson, 2001; Pagach and Warr, 2010; Hoyt and Liebenberg, 2011). As shown in the survey by Ramlee & Ahmad (2015), CROs existed in 86.3% of ERM-established firms.

Having a separate committee, such as an Audit or Risk Committee, can be another signal of a healthy enterprise risk management system. Many companies delegate risk oversight to Audit Committees, which periodically assess, monitor and communicate the effectiveness of the risk management system. Nevertheless, with the increasing duties and responsibilities of the Audit Committee, some companies doubt the effectiveness in the assessment of risk management and prefer to have a separate committee, namely the Risk Management Committee, that will only deal with the oversight of enterprise risk management (Badriyah, Sari and Basri, 2015). The presence of the Risk Management Committee is a critical resource for the board of directors in order to meet the company's risk management responsibilities (Subramaniam, McManus and Zhang, 2009). Halim et al. (2017) also state that having a Risk Management Committee will increase the oversight of risk management and make it more sophisticated.

2.5 Financial performance measures

Most researchers use several metrics to measure the financial performance of companies.

Return on Asset - ROA is used as a financial performance indicator in most of the studies (Badriyah et al., 2015; Bailey, 2022; Baxter et al., 2013; Bertinetti et al., 2013; Callahan & Soileau, 2017; Florio & Leoni, 2017; González et al., 2020; Hoyt & Liebenberg, 2011; Manab & Ghazali, 2013; Mohammed & Knapkova, 2016; Pan et al., 2023; Ramlee & Ahmad, 2015; Setiawan et al., 2021; Widjaja, 2019).

Quon et al. (2012) took a comprehensive look by examining operational, accounting, and financial market performance with respective measurement metrics: sales changes, operating profit changes, and changes in Tobin's Q.

Operating Profit Margin of a company is used to measure internal operational risk management and is a significant variable that shows the company's financial condition (Manab & Ghazali, 2013). Kbiltsetskhlashvili and Mamedova (2017) call operating profit as the principal sign of the effectiveness of the company.

Alawattegama (2018) suggests that the most popular and useful indicator of financial performance for a company is Return on Equity - ROE. It is used by several other researchers (Pagach & Warr, 2010; Agustina & Baroroh, 2016; Kbiltsetskhlashvili & Mamedova, 2017). Soliman and Adam (2017) include ROAE – Return on Average Equity in their three major performance measuring metrics together with share price and firm value. Manab and Ghazali (2013) used Net Profit Margin as an indicator of financial performance and ROA and ROE.

Tobin's Q is used by many researchers to investigate how ERM affects the market value of a company (Pagach and Warr, 2010; Hoyt and Liebenberg, 2011; Baxter et al., 2013; Badriyah, Sari and Basri, 2015; Ramlee and Ahmad, 2015; Florio and Leoni, 2017; González, Santomil and Herrera, 2020; Malik, Zaman and Buckby, 2020; Pan et al., 2023). Even though Tobin's Q is widely used, it is not a useful metric in Georgia because no information of market values of Georgian companies' is obtainable.

2.6 Hypotheses development

By considering the mixed results that different researchers worldwide concluded, our study hypothesises that there is a positive linkage between the company's Risk Management Disclosure (RMD)

in its financial and management statements and its financial performance. 5 performance measures of companies were chosen as dependent variables to one independent variable - assessed RMD score. Thus, five formulated hypotheses are indicated below:

- H1: There is a positive relationship between RMD and Operating Profit Margin.
- H2: There is a positive relationship between RMD and Non-operating Profit margin,
- H3: There is a positive relationship between RMD and Net Profit margin.
- H4: There is a positive relationship between RMD and ROA.
- H5: There is a positive relationship between RMD and ROE.

Considering the benefits outlined in the study, companies with proper risk management are expected to make better operational and strategic decisions and have better financial performance.

3. Research methodology

3.1 Risk management disclosure score

The study analysed suggestions made by both COSO and ISO 31000:2018 frameworks and chose the ones that will fit Georgian manufacturing industry and their risk management implementation practice. As a result, seven focus areas were developed, which were considered as a proxy for ERM adoption degree in Georgian firms. Information from the annual management report was collected and judgment was made according to ISO 31000:2018 and COSO general risk assessment requirements.

First is the presence of CRO or Head of ERM responsible for the implementation of an integrated risk management system across the organisation.

The second focus area is the risk assessment depth and frequency, which plays a significant role in the risk management process according to ISO 31000:2018 and is one of the most important components of COSO framework.

The next aspect under consideration is the completeness and appropriateness of mitigating activities and risk management monitoring according to ISO 31000:2018 and COSO. Establishing proper policies and procedures to proactively mitigate the exposure

and minimise the loss that it can bring to the business is one of the main tasks of risk management. As for monitoring, simultaneous review and control are suggested by both standards in order to find any gaps in internal control and fill them in a timely manner.

Fourth, the research checks if there is any sign of integrated risk management. It is investigated if terms associated with risk culture and its significance are mentioned in the reports. Additionally, any term related to ERM is explored, like risk management framework, system, principles or guidelines and their role in the company's risk management.

Because ERM is still not a popular practice in Georgia, some components that are specific to Georgian firms and may be a sign of ERM practice were added. For example, it was investigated if the list of the risks mentioned in the management reports is complete if companies consider not only financial but also other (operational, strategic, etc.) risks, and (as a sixth measure) how much attention is paid to risks in management report of companies.

Finally, as concentrating on financial risks is standard practice in Georgia, as a seventh focus area, it was analysed if all probable financial exposures related to the business are considered and fully elaborated in the report.

Considering all revealed ERM components in companies' annual and management reports, the Risk Management Disclosure score was calculated, showing at what stage of maturity the company's risk management is. Simple Yes/No measures, or not comprehensive ones, were scored by 0 or 1. More complex measures, or ones that have distinguishable subcomponents were scored by 0, 1 or 2.

Five performance measures were used in the study: ROA and ROE, the most popular performance measures; Operating Profit Margin and Net Profit Margin, which some researchers use as indicators of operational and financial performance. Additionally, this paper checks the linkage between the non-operating profit margin and risk management, as this margin includes extraordinary losses that may be minimised if there is proper risk management in the company.

Table 1

RM disclosure score components and definitions

Measures	Definitions and scoring
The Presence of CRO/Head of ERM	Equals one if the company has mentioned in its risk disclosures a chief risk officer or someone responsible for implementing ERM in the company (CFO, Head of ERM), zero otherwise.
Risk Assessment Depth and Frequency	Equals two if the company has mentioned the complete risk assessment process according to standards, equal 1 if it has mentioned some information about risk assessment, and zero otherwise.
Mitigating Activities & Monitoring	Equals one if the company has any necessary mitigating and monitoring activities according to standards, zero otherwise.
Information about Integrated Risk Management	Equals two if the company has mentioned that it has integrated risk management process in place with risk culture and proper framework in place, equal to 1 if the company has mentioned anything about risk culture, risk management framework, principles or system, and zero otherwise.
Complete List of Total Risks	Equals two if the company has included all risks related to its business in its management or annual report (financial, strategic, operational), equal to 1 if the company has included its risk not fully but partially, and zero otherwise.
The attention given to Risks	Equals one if a separate risk section is included in the management report, zero otherwise.
Completeness of Financial Risks	Equals one if the company has fully explained its financial risks and considers all of them, zero otherwise.

Source: own study

The maximum possible RMD score is 10, based on which the study assumes that according to its risk management disclosures, a company has proper integrated risk management in place.

A cross-sectional study was carried out based on Georgia's first and second-category manufacturing firms for 2021. Lower-category companies' reports were not considered because of the absence of the requirement to publish management reports and reduced financial reporting requirements. 118 firms were chosen in this study to observe. Random sampling was used to choose 118 manufacturing firms out of

167. After excluding some companies because of missing necessary data, the final sample size includes 105 observations. Data was collected from the official website of https://reportal.ge (Service for Accounting, Reporting and Auditing Supervision - Reporting Portal, no date), which provides annual and management reports of Georgian companies.

Data used in the study is quantitative and qualitative. Qualitative information was obtained from the 2021 annual reports, management reports, and quantitative data from audited financial statements for the same year.

3.2. Research model

A linear regression analysis was conducted to test the hypotheses. The study follows the approach of Ramlee and Ahmad (2015), who investigated the direct linkage between performance measures and ERM.

This approach is sufficient to reliably uncover links between the variables, which is the primary goal of the research. It is worth mentioning that the study does not try to create a model that fully explains independent variables or is used for forecasting and projections.

Given the variables and research design, a regression model is derived as follows:

$$\boldsymbol{ROA} = \alpha + \beta RMD + e \quad (1)$$

$$\boldsymbol{ROE} = \alpha + \beta RMD + e \quad (2)$$

$$\boldsymbol{Operating\ Profit\ Margin} = \alpha + \beta RMD + e \quad (3)$$

$$\boldsymbol{Non-operating\ Profit\ Margin} = \alpha + \beta RMD + e \quad (4)$$

$$\boldsymbol{Net\ Profit\ Margin} = \alpha + \beta RMD + e \quad (5)$$

Where dependent variables are the above-mentioned performance measures, the independent variable (RMD) is the calculated Risk Management Disclosure score, α is an intercept, β is a slope, and e is an error term.

3.3. Research limitations

The main limitation of the research is that conclusions are made based on risk management disclosures in annual financial and management reports. In contrast, those reports may lack information, or information can be unclear, and the real picture can be different from the one that appears in the reports.

Apart from that, Berishvili and Kavelashvili (2022) describe that up to 5% of financial statements data of Georgian companies contain errors. As a result, our performance measures may not be an exact indicator of a firm's financial and operational performance.

4. Results and discussion

4.1 Summary of companies' RMD disclosures

Table 2 below shows the number of companies with corresponding scores in each component of risk management.

No company is given the highest point (2) in each component. 76 out of 105 companies did not disclose the presence of an appointed manager responsible for implementing an integrated risk management system. Moreover, 68 companies lack proper risk assessment processes, and 93 companies do not disclose any mitigating activities and monitoring of risks, which means that more than half of our sample disregards the requirements of ISO 31000:2018 and COSO risk management standards. 72 companies do not have mentioned any point of risk management, its framework or system and culture in their management and annual reports.

On the other hand, more than half of companies (81) have described potential financial risks in detail. 38 companies have considered all types of risks (financial, strategic, operational) that are company-specific or related to activities, and 49 of them have partially covered other risks together with financial exposures. That means most companies pay attention to disclosing some information about their potential risks and plans to deal with them.

Table 2

Summary of RMD disclosures - number of companies with the corresponding score

RMD Components	0	1	2
1) Presence of a person responsible for reporting risk and implementing an integrated risk management system (0,1)	76	29	-

RMD Components	0	1	2
2) Frequency and depth of Risk Assessment (0,1,2)	68	31	6
3) Mitigating Activities and Monitoring (0,1)	93	12	-
4) Presence of any information about risk management framework, system, culture, etc. (0,1,2)	72	31	2
5) The importance given to risks in the management reports (0,1)	24	81	-
6) The completeness of the list of risks mentioned in reports (0,1,2)	18	49	38
7) The completeness of the financial risks described in reports (0,1)	24	81	-

Source: own study

4.2 Descriptive statistics results

Descriptive statistical analysis was conducted on 105 companies' performance measures. Information about the maximum, minimum, average, median and standard deviation of each variable of the sampled firm can be seen in Table, below.

Table 3

Descriptive statistics of data

	Min	Max	Average	Median	StDev
Net Income*	(9,589)	68,793	7,790	4,277	12,493
EBIT*	(15,256)	73,836	8,116	4,451	14,096
Non-operating Income*	(28,544)	29,714	(326)	(222)	4,913
Sales Revenue*	2,434	797,152	70,599	38,934	105,292
Total Assets*	4,433	461,512	63,531	42,786	70,739
Equity*	497	191,633	30,256	18,331	34,402
Debt*	128	360,172	33,274	17,590	53,519
Operating Margin (%)	-168.9	71.6	6.9	9.9	30.3
Non-Operating Margin (%)	-30.7	328.9	2.6	-0.50	32.9
Net Margin (%)	-128.9	160.0	9.5	9.2	28.1
ROA (%)	-29.3	85.8	11.7	11.4	16.4
ROE (%)	-522.1	4,212	78.6	23.1	435
Leverage (debt/equity) (%)	0.53	18,02	459	93.2	1,895
Total Asset Turnover	0.27	8.90	1.65	1.03	1.73
Relative Market Share (within the sample) (%)	0.03	10.8	0.95	0.53	1.4

*Note: * - in thousands of Georgian Lari*
Source: own study

4.3. Regression results summary

The linear regression results that checked the linkage of the RMD score with the firm's performance measures are presented in Table 4.

As regression results show, Operating Profit Margin and Net Profit Margin (both at p-value < 0.05) show a significantly positive association; thus, H1 and H3 can be supported.

Analysis shows that RMD is positively associated with ROE and ROA. However, the result is insignificant with high p-values. Thus, there is no evidence to support H4 and H5.

Analysis of the Non-operating Margin revealed a negative relationship, but again, with high p-values not significant enough to make confident conclusions.

Table 4

Regression results

Independent Variable	Dependent Variables	Coefficient	p-value
RMD Score	Operating Profit Margin	0.029249	0.0472**
	Non-operating Profit Margin	−0.000218	0.9892
	Net Profit Margin	0.029031	0.0338**
	ROA	0.013377	0.0944*
	ROE	0.026091	0.9030
	"Big Four"	0.039353	0.2565

*Note: ***p < 0.01, **p < 0.05, *p < 0.10.*
Source: own study

One additional variable that was checked in this regression is Audit Reputation to see if there is any linkage between the companies audited by the "Big Four" (Ernst & Young (EY), Deloitte, PricewaterhouseCoopers (PwC), and Klynveld Peat Marwick Goerdeler (KPMG)) and their RMD score. Observations show that 13 firms out of 105 have been audited by the "Big Four". Nevertheless, they do not have better results in risk management disclosures.

These regressions can support the positive linkage between RMD and the company's operational performance. Findings also show that RMD is positively associated with the company's ROA and ROE and negatively with Non-operating Profit Margin. However, the results are insignificant and cannot lead to any conclusions.

5. Conclusion

The study looked into Risk Management Disclosures of 118 manufacturing firms in Georgia for the 2021 year and investigated the level of Risk Management employed by the firms based on best practices and guidelines.

By analysing the annual financial and management reports of each firm, the study investigated the following: do firms have a CRO or some executive responsible for ERM implementation? Is there a proper risk assessment depth and frequency in place, with complete mitigation tools and activities, and if there is mentioned any term or activity related to integrated risk management, how much attention is paid to the risks in annual and management reports, if all risks related to the particular business activity are taken into consideration and if financial risks are adequately described with respective mitigation tools. Based on the findings, the RMD score was created and calculated for each company. Assuming that firms with higher levels of risk management will have higher levels of disclosure of associated information, the relation between risk management level and company financial performance was assessed.

The study analysed performance measures of a firm represented by Operating Profit Margin, Non-operating Profit Margin, Net Profit Margin, ROA and ROE. Results demonstrate that there is a positive linkage between RMD and the financial performance of a firm, represented by Operating and Net Profit Margins. On the other hand, no reliable linkage is found between the RMD level and the Non-operating margin, ROE, and ROA of companies.

This study highlights the RMD score as a structured measure of risk management effectiveness, providing firms with a practical tool for assessing and improving their risk strategies. These insights are particularly valuable for businesses in emerging economies, where structured risk management can enhance stability and resilience.

Apart from that, the study mitigates the reverse opinion that ERM adoption level is negatively associated with performance because no significant negative linkage is found.

As this is the first ERM research made in the manufacturing industry in Georgia, it gives additional information for new adopters and practitioners of ERM.

The current study's main contributions may be stated as follows: it introduces the RMD score as a quantifiable metric for

evaluating a firm's risk management effectiveness, offering a standardized approach for future studies and business applications; it empirically establishes the relationship between RMD and financial performance, demonstrating that firms with stronger risk management practices achieve higher financial results. These findings provide both theoretical and practical insights for improving corporate risk strategies, particularly in emerging economies.

Results open a new room for further investigation to identify new ERM assessment factors, the level of ERM employed by different firms in different industries of Georgia and the relationship between risk management of firms and their performance.

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CONNECTING INNOVATION AND ECONOMIC PROSPERITY: THE IMPACT OF R&D EXPENDITURES ON ECONOMIC GROWTH

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Abstract

The role of research and development (R&D) as a main foundation of innovation, productivity improvement, and a key element for national competitive advantage in the global economy is well established. This study aims to examine the relationship between R&D investment and economic growth through empirical analysis using panel regression techniques. Our results reveal that human capital specialised in science and technology significantly contributes to economic growth. Overall, innovation and a well-educated workforce are helpful in achieving sustainable development. Our model provides a statistically valid framework for analysing economic growth, enabling the formulation of sound policy recommendations while accounting for potential biases commonly found in panel data analysis.

Keywords: government R&D spending, human capital, empirical analysis

JEL Classification: O30, O47, E24

1. Introduction

One of the main forces behind technological improvement is research and development (R&D), which promotes innovation, boosts productivity, and fortifies a country's ability to act on the global market. R&D is important to long-term economic development since it promotes the growth of new industries and streamlines industrial procedures. Rapid industrial modernisation, more job possibilities, and

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improved economic resilience are common outcomes for countries that invest heavily in research and development.

Furthermore, a highly qualified workforce is compulsory for converting scientific discoveries into useful commercial applications, making human capital a key element in this dynamic. By encouraging cooperation between companies, academic institutions, and policymakers, government action further enhances these advantages and guarantees that research initiatives produce observable economic results.

Scholars have long investigated the connection between R&D investment and economic performance. R&D is a basic component of both national and international economic plans since the capacity to produce and utilize new knowledge turns to be more and more valuable as economies change.

Even though R&D and economic advancement are frequently associated, it is still unclear what the nature of this relationship is exactly. Depending on institutional frameworks, market conditions, and the economy's ability to absorb innovation, the degree to which R&D investment affects economic growth differs among nations, sectors, and period of time.

Through empirical research employing panel regression techniques, this study seeks to examine the relationship between R&D investment and economic growth in a European framework. Using this econometric methodology, we aim to give policymakers more insight into how R&D spending affects the main macroeconomic results and to provide a better understanding of how R&D expenditures influence growth driven by innovation.

2. Current state of knowledge

Both theoretical and empirical study have thoroughly investigated the contribution of R&D to economic growth. Technology advancement and innovation are becoming key forces behind sustainable development as economies shift toward knowledge-based structures.

Numerous facets of the R&D-growth association have been studied by academics, who have emphasized the need of comprehending how diverse forms of research impact economic performance. Some academics contend that R&D in the private sector directly affects productivity the most, while others emphasize how

important government financing is for sustaining basic research and encouraging innovation spillovers. Additionally, because economies with a highly skilled workforce typically yield higher returns from research activities, the relationship between human capital and R&D expenditure has drawn more attention.

With early theoretical foundations established by Solow (1956), the phenomena of economic growth have been thoroughly investigated in economic literature (Aghion and Howitt, 1992; Romer, 1990). These models highlight how innovation and knowledge acquisition propel technological advancement, which is essential to sustained economic growth. Since then, empirical research has examined the effects of R&D expenditure on a range of economic variables, including GDP growth, labour productivity, and industry competitiveness, in order to test these theoretical assumptions.

While generating interest in research, the relationship between R&D and economic growth varies based on an economy's absorptive capacity, institutional characteristics, and the effectiveness of research allocation (Coe and Helpman, 1995; Griliches, 1998).

In addition to macroeconomic analyses, research has examined the effects of sectoral and regional differences in R&D expenditure. The results of Suarez et al. (2020) confirm that R&D investments drive growth in high- and medium-income countries, while only medium-income countries benefit from investments in skilled human resources. In low-income countries, neither investment type significantly influences growth.

Some academics contend that not everyone profits equally from R&D in the business environment. For example, the funding gap for innovation, finding that small firms face high capital costs despite venture capital support, while large firms prefer internal financing, with venture capital proving limited in markets lacking strong public equity options (Hall and Lerner, 2010). On the other side, smaller, younger, and less leveraged firms are more vulnerable to contractionary monetary policies, impacting their R&D investments and productivity, especially in manufacturing (Alam and Alvi, 2024).

Other studies explore the role of government policies in fostering R&D-driven growth, by examining the specific mechanisms through which government subsidies influence the behaviour of business firms (David et al., 2000). For emerging economies, findings suggest that national investment in R&D contributes to economic growth by generating positive effects (Tung and Hoang, 2024).

Additionally, while the contribution of human capital and education to maximising R&D returns is well-documented, the influence of its composition on economic growth remains underexplored, despite evidence emphasising the importance of high-tech skills (Sequeira, 2007).

The panel data methodology has often been used for analysing the interplay between R&D and economic growth. Gokkaya et al. (2021) employ this method to investigate the impact of R&D, education, and health expenditures on economic development from 45 upper-middle and high-income countries (2000-2019). The findings suggest that while R&D expenditures have a limited short-term effect on economic growth, their influence becomes more significant in the long run. Similarly, the long-term analysis confirms that R&D activities have a positive impact on economic growth, whereas in the short term, this relationship is not significant for Arab countries (Shahateet, 2020).

Given these findings, ongoing research continues to refine the understanding of how R&D contributes to economic progress, particularly in diverse institutional and technological contexts.

3. Methodology

3.1. Description of the database and variables

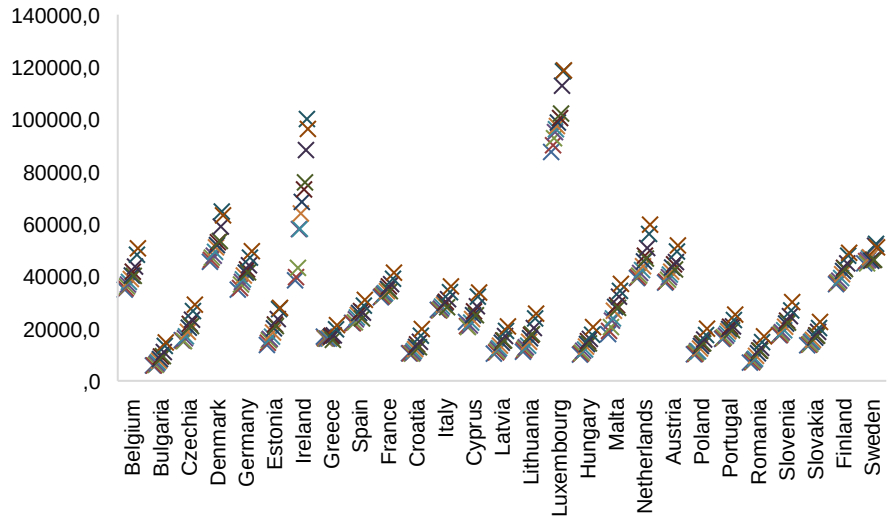
Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, and Sweden are the 27 EU members on which we base our analysis. The Eurostat database served as the source of the yearly economic data, which covered the years 2012–2023.

GDP per capita is used as the main dependent variable to analyse economic growth. R&D spending, labour productivity, the percentage of science and technology-related human resources in the working population (ages 25–64), and employment rates of recent graduates are the explanatory factors. Inflation and the export ratio are included as control variables.

A boxplot of GDP per capita from 2012 to 2023 is shown in Figure 1, providing a graphical representation of economic differences between countries. Certain countries consistently display higher GDP per capita than others, indicating structural economic disparities, especially those with robust financial sectors or high-value industries.

Each economy's value distribution has unique growth trends, with some economies showing consistent and predictable growth while others are characterized by turbulence and oscillations. These discrepancies could be the result of different industrial compositions, economic strategies, or outside shocks that have an impact on country economies. The information also highlights the ongoing economic gap between Eastern European countries and wealthier Western European countries, which contributes to the region's overall pattern of unequal development.

Figure 1
The boxplot of GDP per capita over the period from 2012 to 2023

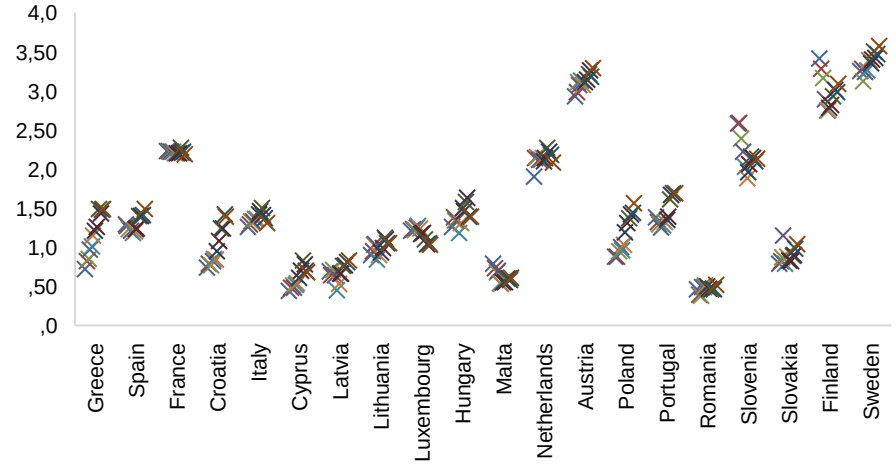


Source: own processing using Eurostat data

The distribution of R&D spending by country during the same time period shows a similar pattern of discrepancy (Figure 2). Certain economies, particularly those with highly developed technology sectors or robust innovation programs, continuously devote larger percentages of their resources to research and development (R&D), solidifying their status as leaders in both economic growth and technological advancement. Other nations, on the other hand, have lower investment levels, which would limit their capacity to promote long-term innovation and productivity increases. The variance within each nation is a

reflection of various industrial systems, national priorities, and the availability of money for research projects. While some economies exhibit consistent and long-term investments in research and development, others exhibit more variable expenditure patterns that are impacted by changes in governmental policies, economic cycles, or outside financial constraints.

Figure 2
The boxplot of R&D expenditure over the period from 2012 to 2023



Source: own processing using Eurostat data

3.2. Theoretical presentation of methodology

Panel regression techniques are used in our investigation to look into the factors that affect GDP per capita. To choose the best estimating technique, we first perform a number of diagnostic tests using the methodology described in (Wooldridge, 2009). To select between the Pooled Ordinary Least Squares (OLS), Fixed Effects (FE), or Random Effects (RE) models, we have to check for exogeneity, homoscedasticity, and the presence of autocorrelation.

We use both the Breusch-Pagan test and the White heteroskedasticity test to evaluate homoscedasticity. While the Breusch-Pagan test looks for heteroskedasticity explicitly related to the independent variables, the White test looks for heteroskedasticity in a

broader sense. Alternative ways of modelling or resilient standard errors are taken into consideration if heteroskedasticity is detected.

The Durbin-Watson test, which assesses whether serial correlation exists in the residuals, is then used to examine autocorrelation. While values significantly below or above 2 imply positive or negative autocorrelation, respectively, a value near 2 indicates no autocorrelation. Generalized least squares (GLS) techniques or the addition of lagged dependent variables are two appropriate solutions that are taken into consideration if serial correlation is found.

We apply the Hausman test, which contrasts the consistency of the RE and FE estimators, to ascertain whether the FE or RE model is more appropriate. Rejecting the null hypothesis implies that the FE model is more appropriate because of possible endogeneity in the regressors, while the null hypothesis of the test presupposes that the RE model is the preferred specification because of its efficiency. The FE model is represented as:

$$y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (1)$$

where α_i represents entity-specific effects, X_{it} is the vector of explanatory variables, and ε_{it} is the error term. The RE model, in contrast, assumes that α_i is a random variable:

$$y_{it} = \alpha + \beta X_{it} + u_i + \varepsilon_{it} \quad (2)$$

where $u_i \sim N(0, \sigma_u^2)$ captures unobserved heterogeneity. If the RE model is deemed appropriate, we proceed with estimation using Generalized Least Squares (GLS) to account for within-group correlation and heteroskedasticity.

Based on these diagnostic tests, a proper estimator is selected for the final model definition. The selected model ensures computational efficiency while allowing us to capture both within-entity and between-entity differences. Additionally, we use an F-test to determine the joint significance of the explanatory variables and evaluate the model's overall fit.

The main factors influencing GDP per capita are informed by the estimation results. Through careful examination of potential biases and inconsistencies inherent in panel data analysis, the methodology guarantees that policy recommendations are produced from a statistically valid foundation.

4. Results and interpretation

4.1. Empirical results

Following the methodology outlined, we apply the Pooled Ordinary Least Squares (Pooled OLS) model to estimate the determinants of GDP per capita. The choice of the Pooled OLS model is based on diagnostic tests, including the White heteroskedasticity test, Breusch-Pagan test, and Durbin-Watson test. The results indicate that heteroskedasticity and autocorrelation are not present in the dataset, making the Pooled OLS approach the most appropriate estimation method.

Pooled OLS Estimation Summary:

- R-squared (Overall): 0.9509
- F-statistic: 1022.6 ($p < 0.01$)
- Log-likelihood: 28.428
- Covariance Estimator: Clustered

The model explains approximately 95.09% of the variation in GDP per capita, indicating a strong fit. The F-statistic and its p-value confirm the joint significance of the explanatory variables, supporting the robustness of the model.

Table 1

Parameter Estimates

Variable	Coefficient	Std. Error	T-stat	P-value	95% Confidence Interval
Constant	0.0081	0.0037	2.167	0.0310	(0.0007, 0.0154)
R&D expenditure	0.0396	0.0161	2.465	0.0142	(0.0080, 0.0711)
Labour productivity	0.0831	0.0122	6.816	0.0000	(0.0591, 0.1071)
Human resource in science & technology	0.2871	0.0398	7.210	0.0000	(0.2088, 0.3655)
Employment rates of recent graduates	0.1127	0.0230	4.897	0.0000	(0.0674, 0.1580)
Exports ratio	-0.0077	0.0022	-3.550	0.0004	(-0.0120, -0.0035)
Inflation	0.6496	0.0370	17.545	0.0000	(0.5768, 0.7225)

Source: own processing

4.2. Interpretation of results

GDP per capita stays marginally positive when all explanatory variables are at their baseline, according to the calculated intercept, which is modest but statistically significant. This implies that other economic variables that were left out of the model can still have a small impact on GDP calculation.

The coefficient for government spending on R&D is positive and statistically significant. According to this research, more government spending on R&D raises GDP per capita, perhaps through fostering productivity growth and technological innovation. The assumption that increases in worker efficiency result in better economic performance is further confirmed by the large and considerable positive influence that labour productivity exhibits.

A particularly strong relationship is observed between GDP per capita and human resource investment in science and technology. The large and highly significant coefficient underscores the importance of investing in human capital, especially in scientific and technical fields, to drive long-term economic growth. Similarly, employment rates of recent graduates have a positive and significant effect, suggesting that a well-integrated workforce enhances economic performance.

Interestingly, the GDP to exports and imports ratio exhibits a negative and statistically significant coefficient. This suggests that higher trade exposure may be associated with lower GDP per capita, potentially due to trade imbalances, structural dependencies, or the competitiveness of domestic industries. Further research is required to better understand this relationship.

Finally, inflation demonstrates a strong and positive impact on GDP per capita. This finding suggests that moderate levels of inflation may be beneficial for economic growth, as they can stimulate spending and investment. However, it remains essential to ensure that inflation does not reach excessive levels, which could destabilise economic performance.

5. Conclusions

Our results underline the importance of R&D investment in promoting industrial change and increasing productivity, which in turn drives economic growth. However, the effects of R&D differ in different economies due to factors including market conditions, institutional frameworks, and the capacity to adopt new ideas. By using panel regression approaches to evaluate the relationship between R&D spending and macroeconomic performance, this study advances the empirical understanding of these dynamics.

The findings show that economic growth is significantly influenced by investments in human capital, especially in science and technology. The necessity of encouraging innovation and a competent

workforce is further supported by the favourable effects of labour productivity, government R&D investment, and employment rates. Conversely, it seems that trade exposure and GDP per capita are negatively correlated, indicating the necessity of cautious trade policy management. For policymakers looking to boost economic development by calculated investments in workforce integration, education, and research, the findings offer insightful information.

Even with the wealth of study in this field, there is still much to learn about the exact mechanisms by which R&D affects economic growth, especially when considering different institutional frameworks and economic environments.

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FISCAL AND MONETARY POLICY INTERACTIONS: IMPACTS AND ECONOMIC IMPLICATIONS

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Abstract

This paper analyses the impact of various macroeconomic shocks - including aggregate demand, supply, monetary policy, real exchange rate, and budget deficit deviation shocks - on Romania's economy using a VAR model with Bayesian inference. The study captures the period following the adoption of inflation targeting by the National Bank of Romania, emphasising the challenges posed by economic policy decisions in an uncertain environment. Simultaneously, monetary policy followed a restrictive approach to counter inflation, causing high interest rates that tightened credit access. This monetary-fiscal policy divergence highlighted the trade-offs in economic stability. The results suggest that the monetary policy response was more effective than the fiscal policy response. Monetary policy measures contributed to the containment of inflationary dynamics while exerting only a moderate adverse effect on real economic activity. In contrast, the expansionary fiscal interventions appear to have amplified macroeconomic imbalances. These findings support the recommendation of adopting a medium-term fiscal consolidation strategy to ensure a sustainable reduction in the budget deficit.

Keywords: macroeconomic shocks, public debt and budget deficit, VAR model - Bayesian inference

JEL Classification: E52, E62, F41

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1. Introduction

Given the economic context in which Romania currently finds itself, this chapter examines the impact of multiple shocks on a set of macroeconomic variables, both in the fiscal and monetary domains. The analysis follows a methodological approach that considers economic growth, labour productivity, and output. Key indicators such as the adjusted CORE 2 inflation index, the ROROR 3M interbank interest rate, the EUR/RON exchange rate, and the budget deficit are included. The study covers Romania's economic developments from the fourth quarter of 2005 to 2024.

Regarding macroeconomic variables, shocks occur when their evolution deviates significantly from expectations, triggering large-scale effects. To apply constraints consistent with economic theory, the VAR methodology is used as a tool to identify monetary policy shocks. The selection and establishment of the method for identifying these shocks play a crucial role in the correct application of economic models.

This analysis examines five types of shocks. First, the aggregate demand shock is analysed, assessing its impact on GDP growth and inflationary pressures. The second shock, on the supply side, captures the reaction of the economy to a restrictive monetary policy, potentially leading to a slowdown in economic growth but contributing to inflation reduction. Additionally, the study investigates the effect of this shock on interbank interest rates, which serve as a channel for monetary policy transmission. The next shock analysed is the exchange rate shock, which exerts pressure on inflation through currency depreciation. The final shock considered is the budget deficit shock, examining its cyclical nature and its role in influencing macroeconomic variables under uncertainty conditions.

2. Literature review

The study of fiscal and monetary policy interactions has been central to economic research, with various methodologies employed to quantify the effects of policy shocks on macroeconomic stability. A foundational framework in this area is the Vector Autoregressive (VAR) model, introduced by Sims (1980), which has since been widely applied in economic analysis.

One of the key aspects of this interaction is how monetary policy influences inflation and economic activity. Christiano et al.

(1999) examined the monetary policy transmission mechanism in the U.S., finding that an increase in interest rates leads to a rapid decline in economic activity while inflation adjusts more gradually. This observation is closely related to the "price puzzle", introduced by Eichenbaum (1992), which highlights that restrictive monetary policy may initially lead to a rise in inflation before achieving its intended stabilizing effects. To refine inflation forecasting, Giordani (2004) emphasized the importance of incorporating potential GDP into VAR models.

Further, Mojon and Peersman (2001) analysed the impact of monetary policy shocks on selected European economies, demonstrating heterogeneous responses across countries due to structural differences. The role of quantitative easing policies was later investigated by Boeckx et al. (2017), who applied a SVAR model to assess the effects of balance sheet expansions by central banks. Their findings suggest that asset purchases by monetary authorities contribute to lower interest rates, a depreciation of the domestic currency, and improved credit conditions, reinforcing the importance of unconventional monetary policy tools.

Fiscal policy has also been widely studied as a determinant of macroeconomic stability. Blanchard and Quah (1989) examined the effects of demand and supply shocks, concluding that expansionary fiscal policy often leads to inflationary pressures, necessitating monetary countermeasures. Canova and Nicolo (2002) analysed fiscal and monetary shocks in G-7 countries, emphasising the significance of policy coordination in ensuring macroeconomic balance.

External shocks, such as commodity price fluctuations and financial crises, further complicate the effectiveness of monetary and fiscal interventions. Kilian (2009) investigated the impact of oil price shocks on stock markets, finding that the reaction depends on whether the price movement originates from demand or supply-side factors. These findings are particularly relevant for emerging economies, including Romania, where inflation dynamics and exchange rate fluctuations are highly sensitive to external conditions.

Despite significant advancements in this field, challenges remain in fully capturing the non-linear interactions between fiscal and monetary policy, particularly in economies undergoing structural changes. To address these complexities, this study employs a Bayesian VAR model, which allows for a more flexible and data-driven

approach to analysing Romania's economic dynamics following the adoption of inflation targeting by the National Bank of Romania.

3. Data and methodology

The dataset used in this analysis consists of quarterly macroeconomic variables presented in the table below (Table 1).

Table 1

Data description

Variable	Description
GDP gap	Estimated using the Hodrick-Prescott filter
Adjusted quarterly CORE2 inflation	Inflation indicator capturing price adjustments
Interest rate spread	Difference between the 3-month ROBOR and the monetary policy interest rate
Real effective exchange rate dynamics	Measures changes in the real exchange rate
Deviation of the consolidated general budget balance	Expressed in GDP percentage points

Source: Authors' own research

The dataset covers the period 2005Q3–2024Q1, capturing Romania's post-inflation targeting era. The data sources include Eurostat, the National Bank of Romania (NBR), and the National Institute of Statistics (INS). To assess the impact of policy shocks on macroeconomic variables, this study estimates a VAR model using Bayesian inference, implemented via the BEAR toolbox developed by the European Central Bank. The methodology applies the Normal-Wishart prior distribution, ensuring flexibility in modelling the variance-covariance matrix of residuals.

The stationarity transformations applied to the dataset are presented in Table 2.

Table 2

Data transformations

Transformation	Applied Variables	Calculation Method
Log differences	GDP, Inflation	Used for quarter-over-quarter (QoQ) changes
Simple differences	Interest rate spread	Expressed in percentage points
Level deviations	Budget balance deviation	Expressed in GDP percentage points

Source: Authors' own research

The used model is a Bayesian VAR estimated using the BEAR Toolbox, designed to assess the impact of macroeconomic shocks—demand, supply, monetary policy, exchange rate, and budget deficit—on key Romanian economic variables. By applying a Normal-Wishart prior, the model ensures robust and flexible estimation, well-suited to the uncertainty following the adoption of inflation targeting by the National Bank of Romania.

The Bayesian estimation integrates prior information with observed data, enhancing result robustness. By updating parameter distributions with new observations, this approach provides more adaptive and precise estimates than classical frequentist methods.

Finally, the stability of the VAR model was verified by ensuring that the inverse characteristic roots of the coefficient matrix fall inside the unit circle, confirming the model's reliability. The structural identification scheme follows an identification strategy that decomposes innovations into orthogonal components, allowing for a clear interpretation of the underlying economic mechanisms.

This methodological framework enables an in-depth examination of Romania's fiscal and monetary policy interactions, offering insights into the effectiveness of policy measures in maintaining macroeconomic stability.

4. Main results

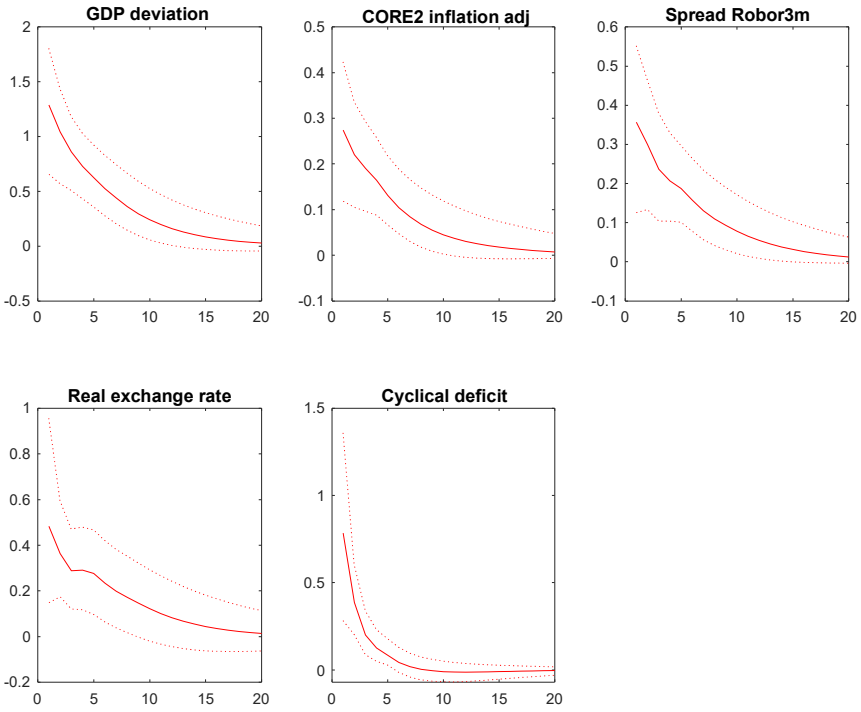
Following a positive aggregate demand shock (Figure 1) of a standard deviation, which tends to 0 after about 10 periods. This response indicates the gradual dispersion effect of the shock, explained by the increase in the total demand for goods and services in the economy. Regarding the inflation response, the direct impact on core price dynamics can be observed, the 0.3% increase in qoq inflation (*quarter-over-quarter*), in the context of positioning aggregate demand above the potential level. This effect is even more amplified if the economy is already operating close to its optimal capacity (potential GDP), where resources are used to the maximum, and it is difficult to expand production quickly.

Next, it can be seen that the gap between the 3-month ROBOR interest rate and the reference rate increases immediately after the application of the shock, which suggests the prompt reaction to combat inflation by increasing the cost of credit, having the effect of taking over liquidity and, implicitly, gradually stabilising the variable. The response

of the real exchange rate is a real depreciation amid pressure on it through the net export channel. The cyclical deficit tends to close at a positive output gap shock, as the economy is above potential, suggesting a lower level of social protection expenditure and, at the same time, a higher amount of tax revenues generated by more robust economic activity.

Figure 1

Impulse response functions of macroeconomic variables to a positive demand shock



Source: Authors' own research

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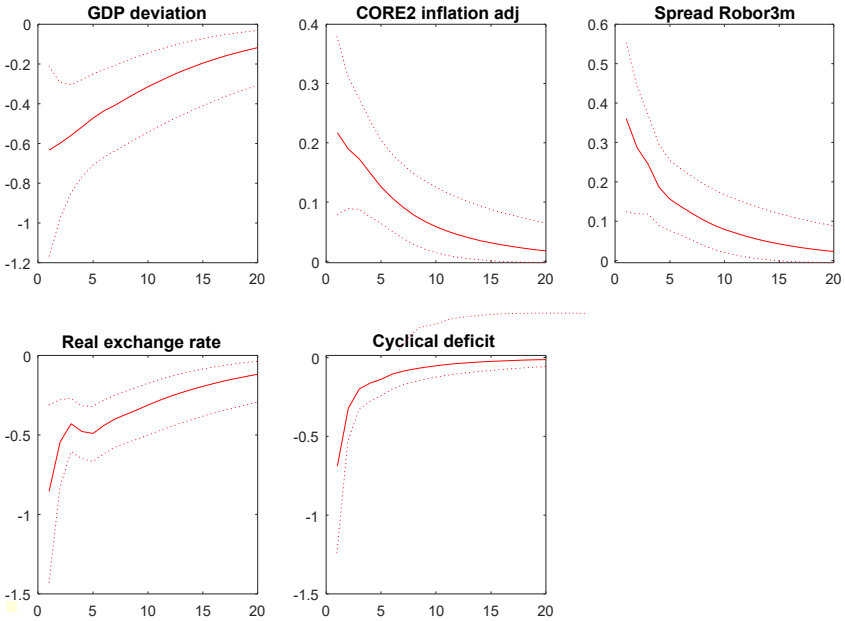
Figure 2

Impulse response functions of macroeconomic variables to a positive supply shock



Source: Authors' own research

Figure 2 shows the impact of rising inflation on the variables introduced in the analysis, namely: the GDP gap shows a significant negative response, gradually recovering towards the end of the horizon. This behavior is explained by the low purchasing power of consumers, which generates a decrease in the aggregate demand for goods and services. Inflation is rising rapidly in response to the supply shock, as expected, input prices are rising and so traders are forced to resort to passing these costs on to the final prices paid by households. As for the central bank's response, monetary policy becomes restrictive, thus curbing inflationary pressure, to the detriment of economic growth.

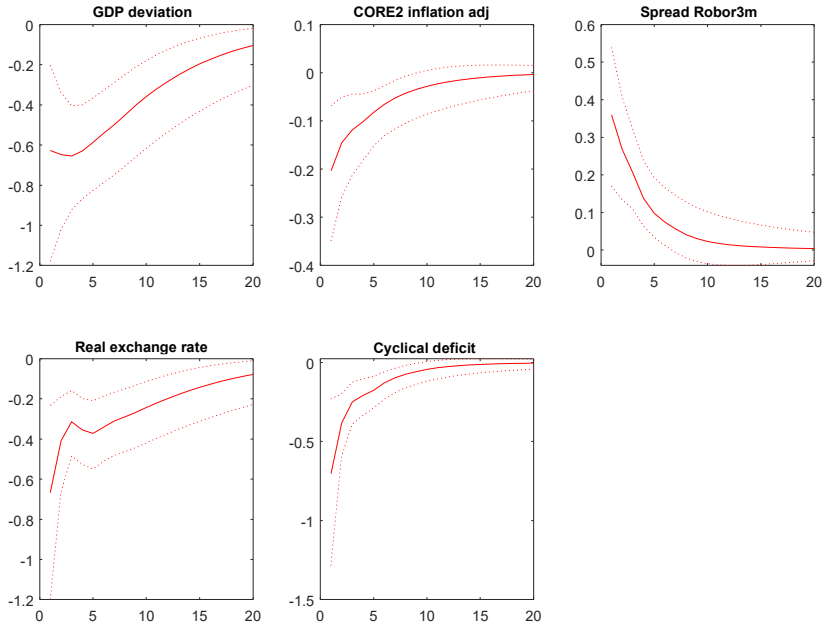
The response of the 3-month ROBOR spread is a positive one, justified by banks' expectations that the interest rate will increase, and because of this they will ask for a higher risk premium for short-term loans, thus leading to a more alert dynamics of the 3-month ROBOR rate, compared to that offered by the monetary policy interest rate.

The interest rate increase implies a real appreciation of the leu compared to the European currency, as investors want higher yields and, therefore, foreign capital is attracted to the country. Following the reduction in economic activity, the cyclical deficit is widening, with fiscal policy intervening to support households and economic agents through fiscal stimuli. As observed during the COVID-19 pandemic, the government applied a series of measures to support the sectors of the economy affected by the strict quarantine imposed, leading to the widening of the cyclical deficit to 5.3% of GDP.

At an increase in the interbank interest rate above the reference rate by 0.4 percentage points (Figure 3), demand contracts by about 0.6% through the increase in the cost of loans granted to both economic agents and households.

Figure 3

Impulse response functions of macroeconomic variables to a positive monetary policy shock



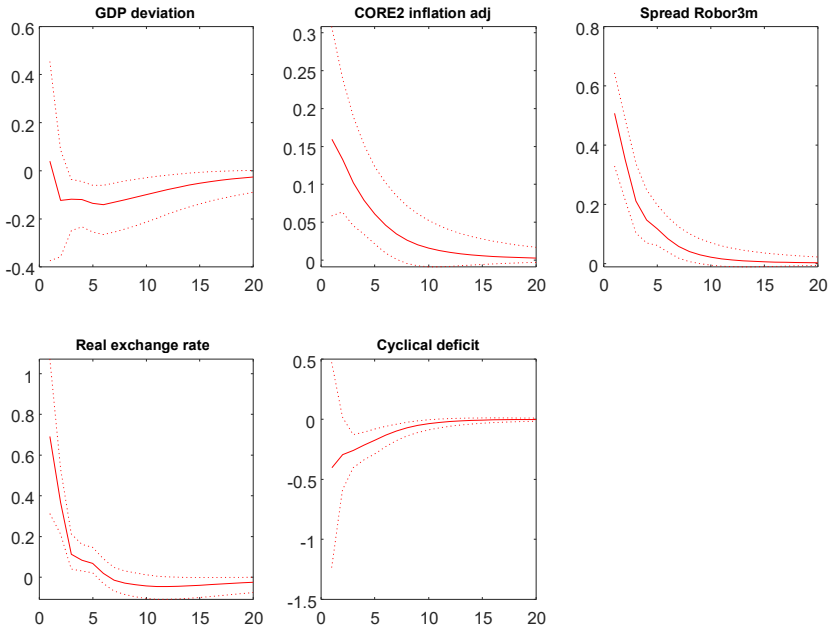
Source: Authors' own research

High interest rates favour the savings process and discourage the contracting of investments, mortgages or even consumer loans. As in the case of the output gap, the deviation of the budget deficit deepens following the increase in the government's financing cost, as the interbank interest rate is in direct correlation with the yields offered by the government through the bonds issued.

As mentioned above, the real exchange rate of the leu appreciates when the interest rate on the interbank market increases, bringing an *inflow* of foreign capital in order to obtain a more attractive return. Finally, the inflation rate reacts negatively to a restrictive monetary policy, leading to a reduction in core price dynamics by 0.2%. As can be seen in the recent period (since the outbreak of the war in Ukraine), the 3-month ROBOR interest rate has been above the monetary policy rate, leading to the reduction of the inflationary pressure of the adjusted CORE 2 index.

Figure 4

Impulse response functions of macroeconomic variables to a real depreciation shock of the leu exchange rate

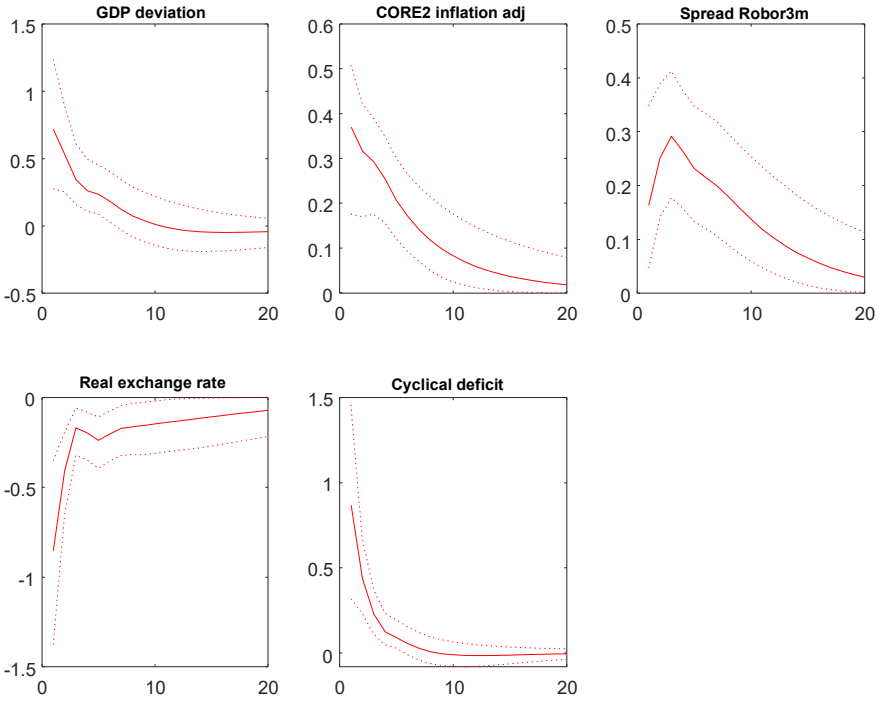


Source: Authors' own research

Figure 4 illustrates the responses of macroeconomic variables to the real exchange rate depreciation shock. The GDP gap slows down slightly, followed by stabilisation towards baseline, reducing demand for domestic goods and increasing demand for imported goods, leading to a decrease in aggregate demand through net exports. In a context where the economy is overheated, this adjustment contributes to bringing actual GDP closer to its potential level. Core inflation reacts positively to the increase in the real exchange rate, with imported goods becoming more expensive for domestic consumers through "imported inflation". In response to rising prices, central bank policy becomes restrictive as a counterbalance to inflationary pressure. However, the cyclical deficit response is not entirely captured, as the uncertainty bands (68% probability) associated with the median are not econometrically significant, as they span both positive and negative territory.

Figure 5

Impulse response functions of macroeconomic variables to a budget deficit deviation shock



Source: Authors' own research

The effects of a cyclical deficit closure shock are highlighted in Figure 5, and the first variable to show a positive effect is the GDP gap. The cyclical component can also be seen as a transitory effect, deviation from the level of the (equilibrium) trend. The direct relationship between the output gap and the deviation of the budget deficit can be explained by both increase and decrease. In the case of reducing the cyclical deficit, it goes from an impasse to a beneficial state for the smooth running of economic activity, thus reducing additional expenditure meant to support the economy. Through the demand channel, associated with a positive GDP deviation, core inflation is fueled by the excess demand for goods and services, leading to an advance in annual price growth of 0.4%. The motivation being given by the increase in aggregate demand while the economy

cannot respond sufficiently by increasing the supply of goods and services, this can lead to inflationary pressures.

A measure to take liquidity from the market, in the context of robust demand and the closure of the cyclical deficit, consists of a restrictive monetary policy with a stabilising role for the economy. When the deviation of the consolidated general budget balance increases by one standard deviation, the gap between the 3-month ROBOR interbank interest rate and the reference interest rate increases by 30 basis points. As for the response of the real exchange rate of the leu, at the end of the cyclical deficit with a standard deviation, the leu appreciates against the European currency in real terms by about 0.9%. The reduction of the deficit leads to a relaxation of the pressure on the current account deficit. Therefore, this fact leads to the appreciation of the leu.

Following the estimation of the SVAR model by Bayesian inference, in addition to the impulse response functions, the historical decomposition of the variance, the long-term equilibrium value (*steady state*) of the input variables and the residual of the model.

5. Conclusions

This paper focuses on analysing the impact of different shocks (aggregate demand shock, supply shock, monetary policy shock, real exchange rate shock and budget deficit deviation shock) using a VAR model estimated by Bayesian inference. The analysis period captured the period after adopting the monetary policy strategy on direct inflation targeting by the National Bank of Romania, namely the third quarter of 2005 until the first quarter of this year. The results suggest increased attention to the implementation by decision-makers of public policies with an impact on the macroeconomic framework. In other words, the application of measures of a type of policy, be it fiscal or monetary, must be calibrated so as not to create major imbalances on economic stability.

In this international context marked by uncertainty, Romania's economy has managed, with a few exceptions, to successfully respond to multiple challenges such as the COVID-19 pandemic, the effects of the Russian Federation's invasion of Ukraine, the energy crisis and strong inflationary pressures. The pandemic strongly influenced the potential GDP, in the sense that a large part of the economy was temporarily closed, but probably the most pronounced impact, from an

economic point of view, was on the situation of public finances. The strong increase in expenditure but also the shock felt in revenues generated a budget deficit at a record level. Therefore, an explosion of public debt could also be observed.

The increase in public spending has been an important point in the economy's return to potential, stimulating practically all economic sectors. It should also be noted that the effects of the energy crisis, amplified by the liberalization of energy prices, have contributed strongly to them, the state having to provide significant subsidies to the population in order to ensure a bearable level of prices for the population. Another factor that put pressure on the budget is military spending. Romania, being a NATO member state, assumed a level of military spending of 2% of GDP.

However, the level of investments as a share of the budget also as a percentage of GDP was very high, the government assuming a policy strongly based on investments in infrastructure, energy and environmental protection. This investment program is strongly supported by the European structural funds made available to Romania in the 2021-2027 multiannual financial framework[1], but also through the Recovery and Resilience Facility[2].

From a monetary policy perspective, the last few years have been characterized by a high level of interest rates. The effect was strongly felt on the population through the lending channel, both from the perspective of the increase in current rates and from the fact that access to credit was much hardened. In fact, monetary policy acted in a manner contrary to the increasingly expansionary fiscal policy, mainly due to inflationary pressures. Although in the last year, the price level has decreased significantly (NBR, 2025), the potential for a return of inflationary pressures exists, mainly against the backdrop of a very dry and probably very weak year in terms of agricultural production, but also as a result of rising tensions in the Middle East leading to a significant increase in oil prices.

A noteworthy aspect is the stability of the real exchange rate, which has remained at an acceptable level in recent years, with twin deficits at record levels, mainly due to the high level of market interest rates.

[1] *https://www.europarl.europa.eu/factsheets/en/sheet/29/multiannual-financial-framework*

[2] *https://mfe.gov.ro/wp-content/uploads/2023/12/6d181d46692c94bd2e40ecb7aed9f754.pdf*

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