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# CONTENTS

• FINANSE I PRAWO FINANSOWE •
• JOURNAL OF FINANCE AND FINANCIAL LAW •

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# REVISITING THE 2007–2009 FINANCIAL CRISIS: A HOLISTIC PERSPECTIVE

**ABSTRACT**

**The purpose of the article** This article provides a multidimensional assessment of the wide--ranging impact of the 2007–2009 financial crisis, with the particular emphasis on its financial, macroeconomic, and socio-political impacts. It examines the profound disruption to the banking sector and deterioration of macroeconomic conditions, as well as the subsequent political and social consequences. The findings support the research hypothesis that a crisis-induced decline in public trust in the banks and financial sector increased skepticism towards globalization and heightened political polarization.

**Methodology** Adopting an interdisciplinary approach, the study employs desk research and comparative methods to examine financial, macroeconomic and socio-political perspectives over the past decade. This research provides a critical appraisal and comparative synthesis of wide range of studies on the impact of financial crisis on macroeconomic trends and public trust.

**Results of the research** The global financial crisis precipitated structural changes in bank regulations with tighter capital requirements and prompted a retrenchment from the socially beneficial lending. Large-scale state intervention undermined market discipline and fueled public distrust. Economically, the crisis triggered deglobalization and accelerated the relocation of production towards emerging markets. Socially, it widened inequality, eroded trust in capitalism, and energized populist and anti-establishment movements.

**Keywords:** global financial crisis, banking regulation, macroeconomic impact, public trust, deglobalization, populism, neoliberalism

**JEL Class:** G01, G21, H63, F60


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## Introduction

The global financial crisis of 2007–2008 was one of the most significant economic disruptions since the Great Depression. Its consequences were far--reaching, transcending national borders and traditional sectoral boundaries. Initially triggered by the collapse of the US subprime mortgage market, the crisis quickly escalated into a systemic breakdown of global financial markets, severely impacting credit flows, market liquidity and investor confidence. As Reinhart and Rogoff (2009) noted, the crisis revealed the fragility of the global financial architecture and exposed the limitations of regulatory frameworks in both developed and emerging economies.

In the immediate aftermath, governments and central banks worldwide responded with unprecedented fiscal and monetary interventions. However, research by Stiglitz (2010) and Pisani-Ferry and Sapir (2009) suggests that, while these emergency measures were essential in preventing the collapse of financial systems, they did not avert deep macroeconomic deterioration. Rising unemployment, falling GDP and mounting public debt became widespread phenomena, particularly in countries with high financial risk exposure or limited fiscal capacity.

From a Polish perspective, scholars such as Koziński (2011) and Grosse (2013) emphasized that, although Poland avoided a formal recession during the crisis, the country was not immune to its consequences. The contraction of foreign demand, reduced investment and temporary credit tightening impacted economic growth and fiscal stability. At the same time, the crisis exposed structural vulnerabilities in the EU's institutional response, particularly within the Eurozone periphery, as emphasized by Janik and Wróbel (2012), NBP (2017: 78–79; 133–134).

Importantly, the repercussions of the crisis extended beyond the financial and economic spheres. The erosion of trust in financial institutions, growing discontent with inequality and austerity policies, and rise of populist movements, all reflected the deeper socio-political dimensions of that crisis. As Mair (2013) and Żuk and Sowa (2015) argue, the post-crisis period saw a significant change in public opinion regarding globalization, technocracy and democratic representation.

The purpose of this paper is to provide a multidimensional assessment of the 2007–2009 financial crisis with the particular emphasis on its financial, macroeconomic and socio-political impacts. Drawing critical review of the Polish and international academic literature, the study uses cross-country comparisons alongside contextual insights to provide a comprehensive view of how the crisis changed economic governance and political discourse. The findings support the research hypothesis that a crisis-induced decline in public trust in the banks and financial sector increased skepticism towards globalization and heightened political polarization.

## Crisis of Trust and the Transformation of the Banking Sector

Financial crises tend to expose significant shortcomings in the design and implementation of administrative rules within the banking sector, as well as deficiencies in the organization of financial supervision. The global financial crisis of 2007–2009 was no exception, sparking an intense debate on the lessons to be learned in order to develop more effective and resilient regulatory frameworks. One of the key outcomes of the crisis was the introduction of a range of new supervisory measures that fundamentally challenged the previous paradigm of market discipline as a reliable mechanism for regulating financial institutions. In particular, the effectiveness of market-based tools – such as the cost and availability of capital, transaction sizes, and contractual safeguards to

limit excessive risk-taking – has been called into question (Anginer & Bertay, 2019: 4–8; Palvia et al., 2024: 1–35).

Crucially, the crisis also triggered a deep erosion of public confidence in the banking sector as a whole. The revelation of excessive risk-taking, lack of transparency, inadequate capital buffers and poor quality market information significantly weakened confidence in the ability of banks to manage the funds entrusted to them responsibly. Societies forced to bear the costs of large-scale bailouts began to perceive the banking sector as both privileged and disconnected from broader socio-economic realities. As a result, the crisis undermined not only confidence in market mechanisms, but also in the banking system itself as a pillar of financial stability – and became a major catalyst for regulatory and institutional reform after 2008 (Algan et al., 2017: 309–400).

Further analysis of the causes of the crisis highlighted the limited confidence in *market discipline* to motivate financial agents to monitor and influence the condition of banks. External control mechanisms proved insufficient to constrain risk-taking, particularly given the misaligned incentives of financial market participants (e.g., moral hazard) and the lack of reliable information needed to objectively assess the risk embedded in credit and investment portfolios. As a result, the crisis shattered the credibility of previously accepted instruments of transparency-such as rigorous disclosure requirements, independent external audits, and public and private investment ratings-and undermined the notion that market forces alone could ensure responsible banking behavior (Dagher, 2018: 3–12; Palvia et al., 2024: 1–35).

In the aftermath of the global financial crisis, market discipline virtually collapsed in many countries, mainly due to the removal of incentives for stakeholders to monitor banks' risk-taking behavior. Deposit insurance schemes were significantly expanded, in some cases becoming virtually unlimited, while

large-scale government interventions to rescue distressed financial institutions further undermined the role of market-based accountability. These developments weakened the motivation of market participants – especially depositors and creditors – to monitor banks' risk profiles. This dynamics was exacerbated by misaligned incentives within the prudential framework, which undermined the effectiveness of supervisory institutions. The failure to enforce existing regulations prior to the crisis exposed structural weaknesses in regulatory governance and contributed to the erosion of supervisory credibility. In response, the post-crisis period has seen a significant increase in both the volume and complexity of prudential regulation, extending into new areas such as liquidity risk management and enhanced rules for the disclosure of sensitive financial information. In addition, entirely new institutional mechanisms were put in place, including systems for mandatory restructuring and orderly resolution of failing banks (Basel Committee on Banking Supervision, 2021: 9–10).

To enhance confidence in *transparent reporting*, the implementation of stress testing and enhanced data disclosure requirements has created additional challenges for supervisors, particularly with respect to the collection, integration, and interpretation of data necessary for informed regulatory decision-making. Despite the tightening of prudential rules, many frameworks continue to provide supervisors with considerable discretion in enforcement and interpretation. While this flexibility can facilitate the adoption of new rules, it also leads to inconsistent application across jurisdictions. In the context of highly globalized banking activities, regulatory divergence in the aftermath of the financial crisis increases the *risk of regulatory arbitrage*, thereby undermining the consistency and effectiveness of international financial supervision (Algan et al., 2017: 309–400).

One of the main reasons for the erosion of public confidence in banks during the global financial crisis was the *excessive risk-taking behavior* of

financial institutions operating with insufficient capital reserves to absorb unexpected losses. From a macroeconomic perspective, this risk was closely linked to a prolonged period of excessive credit expansion, which led to a growing mismatch between the volume of lending and the quality of banks' capital bases. As the credit cycle matured, lending standards deteriorated and banks increasingly extended credit to riskier borrowers, further exacerbating systemic vulnerabilities. The crisis exposed deep structural weaknesses related to excessive financial leverage-often referred to as the *Minsky moment* that had been building in the years leading up to the collapse (Vercelli, 2011: 49–67; Gropp et al., 2019: 266–299).

A significant number of banks lacked sufficient high-quality capital to absorb mounting losses, necessitating public sector intervention and bailouts. These actions fueled *public distrust* and reinforced the perception that financial institutions were operating with impunity under implicit government guarantees. The widespread use of market-based funding, particularly through the issuance of loan-backed securities, further facilitated excessive leverage. This trend was exacerbated by declining underwriting standards, flawed credit assessments, and the proliferation of complex structured credit instruments. The expectation that insolvent institutions would be bailed out with public funds ultimately undermined market-based incentives for prudent risk management, creating a *moral hazard*. In addition, regulatory frameworks that were inadequately designed and poorly enforced to monitor leverage allowed banks to accumulate substantial exposures with limited oversight.

Given the procyclical nature of banking regulation and the tendency for financial crises to trigger institutional reform under political pressure, there is a risk that post-crisis regulatory responses will be shaped as much by political and social considerations as by economic rationale (Caprio et al., 2010: 125–

155). In the wake of growing public dissatisfaction with the global banking system, concerns have arisen that some regulatory reforms may prioritize symbolic responsiveness over technical effectiveness. In advanced OECD economies, the average capital adequacy ratio of the banking sector increased from 14.6% of risk-weighted assets (RWA) in 2010 to 18.7% in 2016. Notably, this increase was observed across both large and small banking institutions, with smaller banks maintaining relatively higher levels of regulatory capital across the OECD region (Anginer et al., 2019: 13; Idzik, 2020: 119–130).

As a result, while regulatory capital requirements have been raised significantly, concurrent changes in the definitions of high-quality capital have complicated the assessment of overall regulatory progress. Beyond the CET1 and Tier I capital ratios, a key determinant of capital quality lies in the balance sheet items that regulators allow to be included in capital calculations.

As banks faced practical and time constraints in raising high quality capital, greater reliance was placed on supplementary capital instruments classified as Tier II. Under pressure to accelerate the *recapitalization of the banking sector*, many jurisdictions permitted the expanded use of lower-quality capital components, such as hybrid debt instruments, revaluation gains, and subordinated debt. This broadening of the definition of capital raises several concerns (Lane, 2013: 555–580). First, a more comprehensive definition of regulatory capital may undermine the transparency and reliability of assessments of a bank's resilience to financial stress. Second, in emerging market economies where financial markets tend to be less liquid-the valuation of debt instruments is more volatile, further reducing the reliability of these instruments as buffers. Third, the complex and idiosyncratic nature of hybrid instruments, asset revaluation gains, and subordinated debt requires supervisors to have advanced technical expertise and robust verification mechanisms to ensure accurate and

credible capital adequacy assessments (NBP, 2017: 78–79; 133–134; Basel Committee on Banking Supervision, 2021: 9–10).

**Economic Consequences of the Financial Crisis: Financialization Challenged and Deglobalization Intensified**

The global financial crisis of 2007–2009, triggered by instability in the US financial sector, rapidly spread to the real economy, culminating in the most severe global recession since the Great Depression of the 1930s (Mishkin, 2011: 49–70). Despite growing concerns about expansionary monetary policies, asset price inflation, financial liberalization, and mispricing of systemic risks, the scale and intensity of the crisis surprised not only investors and financial institutions, but also entrepreneurs and policymakers around the world (Lenza & Slacalek, 2018: 31–35).

The crisis exposed deep *structural vulnerabilities* in the modern economic system, notably excessive private sector leverage and persistent fiscal deficits in advanced economies. These imbalances – supported by global capital flows and financed by excess savings in emerging markets and energy-exporting countries – proved highly unstable and prone to abrupt reversals. The financial architecture underpinning these flows failed to absorb shocks, thereby amplifying the crisis on a global scale.

Beyond its economic and financial dimensions, the crisis generated significant *social unrest*. Mass layoffs, rising poverty, and the widespread loss of household savings and homes contributed to heightened social frustration, especially among the middle class. In many countries, particularly in Europe and the United States, the socio-economic impact of the crisis served as a catalyst for public protests, social mobilization and growing political polarization. The erosion of trust in public institutions and financial elites fueled the emergence of new political and social movements that openly criticized the neoliberal model

of development and advocated for more equitable economic systems and greater social protection.

The financial crisis thus not only destabilized the foundations of the global economic system, but also undermined its legitimacy in the eyes of many citizens, triggering a wave of structural and institutional reforms. Its impact was far-reaching, as its effects quickly cascaded through global economic networks. By 2010, many economies in Europe and Asia had fallen into recession (Ball, 2014: 149–160). In East Asia, particularly China, the collapse in global trade caused exports to fall by as much as 16% in 2009, forcing the closure or bankruptcy of many export-oriented factories, particularly in the southern provinces. In response, the Chinese government launched a massive stimulus program, embarking on major infrastructure investments and expanding social spending. These measures allowed China's GDP growth to rebound to 10% by 2010, although labor shortages soon resurfaced as a structural challenge (Chan & He, 2018: 402–417).

The crisis also triggered a *global employment shock*. The sudden contraction in the supply of credit – commonly referred to as the credit crunch – put downward pressure on the real economy and disrupted international trade flows. Many countries experienced negative growth rates, and almost all experienced a significant slowdown in GDP growth. Global unemployment is estimated to have exceeded 200 million people, with the employment gap reaching 61 million by 2014 relative to projections based on pre-crisis employment growth trends. Signs of recovery began to emerge almost a decade later. In 2017, global GDP grew by 3.8% and international trade increased by 4.9%, although uncertainty remained about the long-term impact of the crisis (Johnstone, 2019: 455–456). While the effects of the financial crisis were unevenly distributed across countries and regions, the crisis also underscored the

degree of interdependence among economies and the systemic nature of global financial vulnerabilities.

The pronounced volatility of national economic trajectories in the aftermath of the global financial crisis highlighted the significant dependence of contemporary economic systems on debt-financed growth (Epstein & Crotty, 2013: 3). This dependence has been extensively examined in the economic literature through the lens of *financialization*, a concept broadly understood as the increasing dominance of financial motives, institutions, and markets in the functioning of national and global economies. Financialization also encompasses the evolving behavioral logic of economic agents in which profit generation is increasingly driven by financial activities rather than by the production and exchange of goods and services.

Key indicators of advancing financialization include the exponential growth of financial transactions, the acceleration of deregulation and liberalization processes in financial markets, and the proliferation of complex financial instruments and services. These include securitization mechanisms and the emergence of derivative instruments such as futures contracts on novel asset classes (e.g., carbon emissions) and credit default swaps (Vercelli, 2014: 19–25). This transformation of financial market infrastructure reflected a shift in the structural basis of economic value creation.

In the aftermath of the crisis, there has been a renewed academic and policy debate about the *disproportionate role of banks* and financial markets in shaping macroeconomic outcomes. The pre-crisis paradigm-which assumed a linear, positive relationship between financial sector development and economic growth-has been increasingly challenged. In its place, scholars have posited an inverted U-shaped relationship, in which financial development initially stimulates growth, but beyond a certain threshold, further expansion of

the financial sector may hinder long-term economic performance. This suggests the existence of an optimal level of financial development, beyond which the risks associated with over-financialization begin to outweigh its benefits (McKinsey Global Institute, 2019: 48–50).

Empirical studies suggest that the financial crisis led to a significant, albeit temporary, *deleveraging* of the banking sector in many economies. In particular, cross-border banking activity contracted sharply, especially in the countries most affected by the crisis. These developments reflect not only increased risk aversion, but also a broader reassessment of the sustainability of financial globalization (Rose & Wieladek, 2014: 2127–2149; ECB, 2017: 145–157).

As with previous systemic financial disturbances, the 2007–2009 crisis triggered processes commonly referred to as *deglobalization*, characterized by a slowdown in the international integration of national economies. The contraction in international capital flows contributed to a marked slowdown in global trade, prompting a critical reassessment of the role of trade in modern economic systems. At the same time, the stagnation in the expansion of financial assets began to be interpreted as a symptom of a broader phenomenon referred to as the *peak of globalization*. This notion reflected growing skepticism about the continued viability of unbounded financial and trade liberalization as an engine of economic progress (Lund et al., 2017; James, 2018: 221–242).

It is important to note that while globalization in its current form is a relatively modern concept, the term itself began to appear in academic and policy discourse in the late 1960s. It gained particular prominence in the 1970s, when it was used to describe the rapid internationalization of markets-especially financial markets-as the volume of international lending soared following sharp increases in oil prices. Over time, however, the concept of globalization has evolved beyond purely economic dimensions to encompass transnational flows

of labor, ideas, technology, and culture-often captured in the metaphor of the "global village". These cross-border transfers are highly interdependent and mutually reinforcing (Gropp et al., 2019: 266–299).

Most definitions of globalization emphasize interconnectedness as a core feature. Actors, both state and non-state, are increasingly embedded in networks of interaction that transcend national boundaries. Socio-economic processes once confined to the territorial state now unfold within broader transnational frameworks. While the degree of integration varies across countries and regions, virtually no society remains untouched by the dynamics of globalization. In economic terms, globalization is primarily associated with the integration of national economies into the world market through mechanisms such as international trade, foreign direct investment (FDI) – especially by multinational corporations – short-term capital movements, cross-border labor mobility, and the diffusion of technology (Bhagwati, 2004: 3; ECB, 2017: 145–157).

The current phase of globalization functions through a highly institutionalized system of rules, many of which have been established through international agreements. The global financial crisis of 2007–2009 marked a significant turning point, initiating a reversal in the momentum of economic globalization. This period is often associated with the emergence of deglobalization, which shares the same dimensions as globalization but reflects a retreat or weakening of integrative processes. In the aftermath of the crisis, trade flows have been severely disrupted – if not, in some cases, suspended altogether – leading to increased unemployment and economic contraction in export-dependent economies. Taken together, these developments represent not just a cyclical downturn, but a structural turning point in the trajectory of globalization – marked by growing skepticism about liberal economic integration and a reassertion of national economic sovereignty.

It is important to emphasize that globalization played a key role in the rapid transmission of the financial crisis to the real economy. For example, international trade contracted almost immediately after the first wave of bank failures related to the subprime mortgage crisis. Between September 2008 and April 2009, the collapse in global trade volumes was more severe than during the Great Depression. Although swift intervention by public authorities helped arrest the sharp decline in global exports and imports, a notable shift occurred: since 2014, global trade expanded more slowly than overall global economic activity, in stark contrast to the post-World War II era when trade consistently outpaced output growth (James, 2018: 221).

The reemergence of trade protectionism is another defining characteristic of classic phases of deglobalization, such as the reversal of globalization in the late 19th century. Contemporary protectionist discourse echoes earlier periods; however, despite heightened rhetoric about trade wars, the actual implementation of restrictive measures has so far played a more limited role in shaping the dynamics of current deglobalization trends. Nevertheless, the global economy of the early 21st century is very different from that of the 19th century. As a result, large-scale trade wars seem unlikely given the high costs they would impose on today's interconnected economies. Several factors underline this distinction. First, the gains from international trade remain substantial, especially for developing countries (Costinot & Rodríguez-Clare, 2014: 197–261). Second, modern globalization is characterized by highly specialized and concentrated trade in niche goods, in sharp contrast to the commodity-based trade patterns of earlier eras. Moreover, contemporary economic growth is increasingly driven by the free flow of data and information, as well as efficient logistics and transportation networks (James, 2018: 221–242). Third, and perhaps most critical, the significant job losses caused by the

financial crisis have been concentrated in sectors that are unlikely to be revived by trade alone. For example, the U.S. steel industry employs about 140,000 workers, compared with 4.7 million in China – illustrating the scale and complexity of global industrial shifts (Baldwin, 2018; McKinsey Global Institute, 2019: 48–50).

**The Financial and Economic Fallout of the Global Crisis: Implications for Social Structure and Public Trust**

From a social perspective, the contestation of the pre-2008 economic order in the aftermath of the crisis focused on a *critical reassessment* of capitalism and its perceived institutional underpinnings, particularly financial markets and, in particular, the banking sector. As these institutions depend on public trust to operate effectively, the financial sector was particularly susceptible to reputational damage amid widespread public skepticism about the wider capitalist system. This vulnerability was exacerbated by the public's general lack of understanding of the complex mechanisms of modern finance, despite money playing a central role in household economic security. Social movements that emerged in the immediate aftermath of the crisis, such as Spain's Indignados and the Occupy Wall Street movement, targeted financial institutions as emblematic of systemic failure. They accused banks and stock markets of betraying the fundamental promise of capitalism: the equitable distribution of wealth. Instead, they were perceived as contributing to the deepening of socio-economic inequalities and the erosion of democratic accountability (Lenza & Slacalek, 2018: 31–35).

The financial crisis also brought a growing *sense of disenfranchisement* from representative democracy to the fore. A significant proportion of the population began to feel that they had no meaningful influence over the political decision-making process in their own countries and that mainstream

political elites no longer represented their economic, social or cultural interests. This sense of alienation was not purely economic, but was also deeply intertwined with issues of identity, cultural belonging and political recognition. Three structural dynamics contributed to this growing sense of alienation. Firstly, the perceived distance between citizens and national governments increased as decision-making power shifted towards supranational institutions, such as the European Union and the International Monetary Fund. This was particularly evident in the context of post-crisis recovery programs. Secondly, the contrast between the large-scale bailouts of financial institutions and the concurrent rise in unemployment and social hardship caused public trust in national governments to collapse. Thirdly, the crisis reinforced the public perception that political elites and the mainstream media had become detached from the everyday concerns of ordinary citizens, operating instead within closed, self-preserving networks.

The deepening of income inequality and growing disillusionment with capitalism's failure to deliver rising living standards for the majority has perhaps been the most tangible driver of *post-crisis social discontent*. While the incomes of the wealthiest segments of society increased significantly in real terms, income growth for the majority either stagnated or declined. By 2010, for instance, the real incomes of the bottom 60% of earners in the United States had fallen relative to the 1990s, whereas the incomes of the top 20% had doubled. Meanwhile, the income share of the top one % had doubled since 1980 in both the United Kingdom (from 7% to 14%) and the United States (from 10% to 20%), while that of the bottom 50% had halved (Wright & Benson, 2019: 7). In the United Kingdom, a decade after the crisis, average real wages had still not returned to pre-crisis levels. This persistent economic stagnation, coupled with perceptions of systemic injustice, is widely regarded as a contributing factor to

the 2016 decision to leave the European Union – a political watershed reflecting broader patterns of social frustration and institutional distrust.

The global financial crisis has highlighted a key aspect of economic inequality: the increasing significance of *rentierism*. This is where individuals earn substantial income not from productive labor, but from owning significant capital assets. This phenomenon is closely linked to the concentration of wealth and has exacerbated disparities in income and opportunity. The consequences are particularly acute when viewed through the lens of intergenerational inequality, calling into question the long-held assumption that each successive generation will enjoy improved living standards compared to the previous one (Ampudia et al., 2018: 1–4).

Although central banks and public authorities responded swiftly to the crisis with unprecedented monetary expansion and liquidity injections, these interventions disproportionately benefited asset holders. Expansionary monetary policies, such as quantitative easing, triggered a rapid and sustained recovery in financial markets, inflating the value of stocks, bonds, and other assets. However, large segments of the population, especially those without financial assets, were effectively excluded from this recovery. In the United States, for instance, almost half of the population reported having only a few hundred dollars in emergency savings during a decade of stock market growth. This disparity has deepened perceptions of inequity and social exclusion (Lenza & Slacalek, 2018: 31–35).

The crisis has also exacerbated public dissatisfaction with the broader economic order, reinforcing the belief that access to opportunities, particularly those associated with social mobility, is neither fair nor meritocratic. Perceptions of inequity have been particularly pronounced in relation to educational opportunities. As knowledge-intensive sectors have become more dominant in

advanced economies, the value of higher education has increased significantly, and educational attainment has emerged as a key factor in determining socioeconomic outcomes. However, access to elite education – and, by extension, to prestigious and high-paying jobs – remains highly stratified by social class. In the United States, for example, two-thirds of Harvard University students come from the top 20% of the income distribution. Even more striking is that the proportion of Ivy League students from the top one % of households slightly exceeds that of students from the bottom fifty % combined. Such disparities in access to elite institutions perpetuate broader patterns of inequality, contributing to mounting political and cultural polarization as education emerges as a pivotal axis of identity and social belonging (Wright & Benson, 2019: 9).

The global financial crisis has exacerbated the growing disparity between high-productivity, high-wage jobs in knowledge-based sectors and lower-wage, less secure roles in other areas of the economy. This has contributed to a stronger perception of inequality, not only in terms of income and opportunity, but also across geographic regions. Dynamic, rapidly expanding industries such as finance, technology and media tend to be concentrated in large metropolitan areas, where they offer attractive career prospects and are largely dominated by multinational corporations. In contrast, sectors such as hospitality, retail and leisure tend to offer lower wages, limited career progression and increasing employment insecurity.

In recent decades, a growing proportion of the labor force has been absorbed into low-paid, low-autonomy service roles supporting the infrastructure of expanding sectors such as finance and information technology. The aftermath of the crisis also saw a sharp rise in precarious employment typified by temporary, unstable and often informal contractual arrangements with limited protections and social benefits, commonly referred to as ‘junk contracts’.

Consequently, secure, well-paid, fulfilling employment opportunities have become increasingly concentrated in a limited number of sectors, which are often accessible only to graduates of elite, frequently prohibitively expensive, private universities.

The widespread use of public funds to support struggling financial institutions during the crisis led to growing public support for radical economic reforms, such as the nationalization of banks and higher capital gains tax. In many countries, government-sponsored bailout programs were seen as emblematic of systemic injustice. While the banking sector was stabilized through extensive public subsidies, other large non-financial firms in distress were often permitted to fail. This asymmetrical treatment fueled public resentment and heightened perceptions of inequity in the application of economic policy (Anginer & Bertay, 2019: 4–8).

The demands voiced by post-crisis protest movements were rooted in the belief that capitalism had been distorted by the disproportionate influence of large corporations, a concept commonly referred to as *corporatism*. The close and often opaque relationship between government and major business actors has long been viewed as problematic, particularly given the growth of corporate lobbying, which facilitates the shaping of regulatory and legislative frameworks in favor of well-resourced firms. A key criticism is the 'revolving door' phenomenon, whereby individuals frequently transition between public office and high-level corporate positions. This has contributed to a perceived contradiction between public rhetoric about free-market principles and private actions by corporations to entrench their market dominance through regulatory capture and preferential treatment.

Consequently, the widespread belief has emerged that contemporary capitalism is structurally biased in favor of the wealthy and powerful. This

perception has been reinforced by the increasing concentration of economic power in the hands of a small number of transnational corporations, particularly in the digital economy. Scholars and policymakers have increasingly highlighted the monopolistic or quasi-monopolistic tendencies within key sectors, which undermine competitive market dynamics and reduce consumer welfare. Technology giants such as Amazon, Facebook and Google have repeatedly been accused of abusing their market dominance to impose unfavorable terms on consumers and suppliers alike. In some cases, they have operated as monopsonies, exercising significant control over labor and input markets.

**Conclusion**

The purpose of the article is to provide a multidimensional assessment of the wide-ranging impact of the 2007–2009 financial crisis, with the particular emphasis on its financial, macroeconomic, and socio-political impacts. The article examines the profound disruption to the banking sector and deterioration of macroeconomic conditions, as well as the subsequent political and social consequences, and advances the research hypothesis that a crisis-induced decline in public trust in the banks and financial sector increased skepticism towards globalization and heightened political polarization. The main rationales of this research hypothesis are outlined below.

Firstly, post-2008 regulatory reforms resulted in a substantial rise in capital requirements and a nominal strengthening of banks' capital positions. However, these improvements were accompanied by a strategic shift in bank portfolios towards assets with lower regulatory risk weights. This reallocation often came at the expense of socially desirable activities, such as retail mortgage lending or investments that stimulate employment, thereby undermining the developmental role of financial sector.

Secondly, the crisis prompted unprecedented levels of state intervention. The extensive public resources allocated to rescuing systemically important financial institutions provoked a strong social reaction, contributing to the emergence of protest movements and a broader crisis of legitimacy. The expansion of deposit insurance schemes and the normalization of government bailouts weakened the incentives for market participants to independently monitor financial risk, thereby undermining one of the key mechanisms of market discipline.

Thirdly, although financial supervision has become more complex and formalized, supervisory authorities have struggled to keep pace with the growing scope and technical demands of the new regulatory environment in terms of enforcement capacity. The transparency and quality of information disclosed by banks has remained limited, exacerbating the erosion of public trust in the financial sector and reinforcing concerns over its accountability and resilience.

From an economic standpoint, analyzing the change in public trust reveals that the crisis catalyzed a process of gradual deglobalization, reflected in the declining openness of markets to cross-border flows of capital, goods and labor. Rising geopolitical tensions, the resurgence of protectionist policies and shifting political narratives in many countries have collectively challenged the long-standing consensus on the benefits of global economic integration. At the same time, the crisis has accelerated the rise of new economic powers, particularly China, and facilitated the relocation of production hubs to emerging economies. This transformation was further reinforced by the expansion of outsourcing and multinational corporations' increasing reliance on low-cost labor markets in the Global South.

Nevertheless, the crisis had its most profound and lasting consequences in the social and political spheres. The erosion of trust in financial institutions led to a more widespread disillusionment with the capitalist system and the

neoliberal policy paradigm. This disaffection was particularly pronounced among younger generations, contributing to the radicalization of political attitudes and the intensification of ideological polarization.

Moreover, the crisis brought long-standing inequalities in income and wealth into sharper public focus. While these disparities were shaped by structural trends such as globalization and technological change, the post-2008 context made them more visible and socially significant. In many societies, a clear divide emerged between those who benefit from globalized economic systems and those who are left behind by structural transformations. A growing sense of injustice and socio-economic exclusion fueled support for anti-establishment and populist movements, ultimately reshaping political discourse and generating renewed debates over the role of the state, the legitimacy of globalization and the social responsibility of the financial sector.

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# ALTERNATIVE INVESTMENTS BASED ON THE EXAMPLE OF INVESTMENTS IN WINE FROM THE BORDEAUX REGION

**ABSTRACT**

**The purpose of the article**. The article aims to indicate the economic conditions influencing the prices and distribution of Bordeaux wines on the European market, as well as to identify the key factors shaping their value. It raises the question of which aspects, including seasonality, quality, prestige, and consumer behavior, play a role in shaping the market for this unique good.

**Methodology**. The study employs a literature review and secondary data analysis concerning Bordeaux wine prices. The methodology is based on the synthesis and description of conclusions from other authors, supplemented with a bibliometric analysis of literature from the Web of Science database covering the years 2001–2024. The bibliometric analysis aimed to identify major research trends and map the knowledge structure in the field of wine investment. Comparative analyses of prices across different seasons and quality categories were also conducted, taking into account factors such as vintage and region of origin. Statistical analyses were performed on the data to draw conclusions about the wine price dynamics over recent years.

**Results of the research**. The research results indicate that the price of Bordeaux wines is influenced by both objective factors, such as quality and region of origin, and subjective factors, such as prestige and vintage. Seasonality was also found to play a significant role, affecting wine availability and prices at different times of the year. Ultimately, consumer preferences, especially among collectors and enthusiasts, significantly impact the market value of Bordeaux wine, underscoring the complexity of this market segment.

**Research hypothesis**. The research hypothesis assumes that the investment value of Bordeaux wines is determined to a greater extent by the reputation and brand of the winery than by the objective quality of the product.

**Keywords:** alternative investments, Bordeaux, investment wine

**JEL Class:** C83, Q11, L66, D5, Q1


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## Introduction

Alternative investments are — as the name suggests — a form created in certain opposition to classical forms of investment (e.g., stocks, bonds, investment funds). As Najman (2020) points out, alternative investments are not something historically new, as the accumulation of wealth through the acquisition of luxury goods already took place in ancient times. Alternative investments are difficult to define and categorize. The essence of some of these investments lies in the ownership of a particular item (most often a luxury or collectible good), but defining them solely through this lens would exclude, for example, hedge funds, which are also considered alternative investments (Perez, 2011). The issue of defining alternative investments has been raised, among others, by Banasik (2016), who notes the multitude of ambiguous and sometimes mutually exclusive definitions. Researchers attempting to define alternative investments struggle to create a definition that, as a rule, should synthetically encompass all assets classified as alternative investments, whereas even among researchers there is a lack of consensus regarding some forms of investment. For example, according to Pełka (2009) real estate investments are classified as alternative investments, while according to Cichorska (2015) they are considered classical investments.

Banaś (2023) notes that alternative investments are an attractive option in a dynamic, unstable environment, particularly in the context of long-term investments. This thesis can also be confirmed in the case of the investment wine market. Antczak (2017) indicates that wine of very high quality (such as those from Bordeaux) reaches maturity after five–seven years, and the optimal maturation period is as long as 12–18 years. Gierałtowska (2014a) observes that, in the case of wine, a short-term investment strategy is impossible due to high transaction costs and low liquidity. Thus, it is a market resistant to speculation.

Gierałtowska (2014b) also notes that, due to its physical form, wine has the potential to maintain its value during periods of financial crises or hyperinflation.

Ostrowska (2011), in turn, classifies wine as an emotional asset, which Adamska (2015) defines as an object of investment that brings investors satisfaction simply from owning the invested object. This outlines an image of wine as an asset bringing both material benefits and the joy of ownership. Tatarkiewicz (1985) pointed out that for people with a possessive personality, owning things is important for achieving happiness. Nowak (2016), on the other hand, notes that the collectible aspect can also be beneficial for society, as the collector protects an item from possible loss or destruction. In the case of alternative investments, the role of the investor intertwines with that of the collector. From an economic standpoint, however, the most important role of such a person is as a market participant influencing the proper valuation of a given asset. Masztalerz (2010) points out that market value is the averaged opinion of investors on the actual value of a company, which can also be applied to investment assets. Potrykus (2015) points to the high level of interest in wine investment.

Trading of investment wines is coordinated mainly through specialized exchanges, the most popular of which is the London exchange Liv-ex (London International Vintners Exchange), whose rules of operation are based on capital market exchanges (Martysz & Gogiel, 2019). Wine is also a product that requires appropriate storage conditions. As Gierałtowska (2014a) notes, it should be stored in special cellars where temperature, pressure, and humidity are monitored to provide appropriate maturation conditions.

The aim of this article is to identify the economic conditions affecting the prices and distribution of Bordeaux wines on the European market and to identify the key factors shaping their value.

The research hypothesis assumes that the investment value of Bordeaux wines is determined to a greater extent by the reputation and brand of the winery than by the objective quality of the product.

**Research methodology**

In this study, bibliometric analysis was employed for a systematic review of the literature regarding wine investment. The bibliometric analysis was conducted in accordance with the methodology proposed by Aria & Cuccurullo (2017), which enables the identification of key research trends as well as principal authors and publications within a given domain.

Data for analysis was retrieved exclusively from the Web of Science database, encompassing publications from 2001 to 2024. The search was conducted using the keywords “Bordeaux” AND “investment wine” to identify relevant scholarly literature specifically addressing Bordeaux wine as an investment asset. The selection of this database was justified by the high quality of its indexed journals and comprehensive bibliometric data. The period 2001–2024 was chosen as it represents the contemporary era of wine investment research, capturing both the maturation of traditional markets and the emergence of digital trading platforms, whilst providing sufficient temporal depth for identifying long-term trends and patterns in scholarly output.

The principal stages of the study comprised:

1. defining keywords associated with wine investment (“Bordeaux”, “investment wine”);
2. retrieving data from the Web of Science database using the specified search terms;

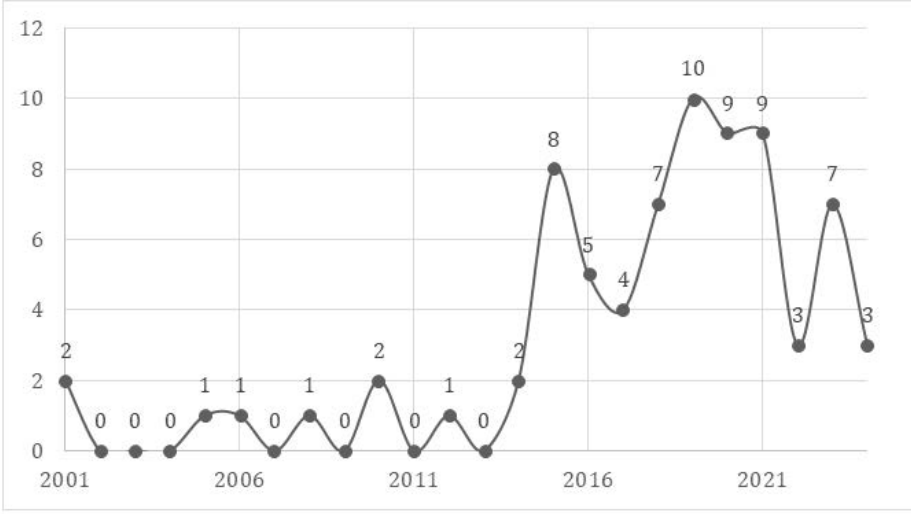
3. conducting keyword co-occurrence analysis;
4. identifying thematic clusters;
5. performing citation network analysis.

**Literature review**

For the purpose of the bibliometric analysis, the bibliometrix tool (Aria & Cuccurullo, 2017) was employed. A total of 75 publications authored by 409 individuals were gathered from the Web of Science (WoS) database, all focusing on alternative investments in wines from the Bordeaux region. The analyzed articles covered the period from 2001 to 2024.

**Figure 1.**

*Number of published articles in the WoS database on investments in wines from the Bordeaux region, by year*




Source: Own elaboration based on data from the Web of Science (WoS) database, processed using the bibliometrix tool.

Figure 1 illustrates the number of articles published in the Web of Science (WoS) database on the topic of investments in Bordeaux wines, broken down by year. The initial period (2001–2014) is characterized by sporadic publications, usually limited to one or two articles annually. This stage may be regarded as a period of low research interest.

From 2015 onwards, a distinct increase in the number of publications is evident, peaking in 2019 when as many as ten articles were published. In 2020 and 2021, this number slightly decreased, although it remained high, reaching nine articles per year. In recent years (2022–2024), a slight decline can be observed, but the number of articles remained stable, fluctuating between three and seven publications annually.

The overall trend indicates growing interest in the subject of Bordeaux wine investments, especially after 2015, which suggests heightened scholarly attention to this topic over the past decade.

**Table 1.**

*Citation statistics for published articles in the WoS database on investments in wines from the Bordeaux region, broken down by year*

| Rok | MeanTCperArt[1] | N | MeanTCperYear[2] | CitableYears |
|---|---|---|---|---|
| 2001 | 98.00 | 2 | 4.08 | 24 |
| 2005 | 0.00 | 1 | 0.00 | 20 |
| 2006 | 10.00 | 1 | 0.53 | 19 |
| 2008 | 55.00 | 1 | 3.24 | 17 |
| 2010 | 19.50 | 2 | 1.30 | 15 |
| 2012 | 53.00 | 1 | 4.08 | 13 |
| 2014 | 31.00 | 2 | 2.82 | 11 |
| 2015 | 28.62 | 8 | 2.86 | 10 |

[1] Average total citations per article in the dataset.
[2] Average citations per article per year since publication.

| Rok | MeanTCperArt[1] | N | MeanTCperYear[2] | CitableYears |
|---|---|---|---|---|
| 2016 | 19.80 | 5 | 2.20 | 9 |
| 2017 | 14.25 | 4 | 1.78 | 8 |
| 2018 | 85.14 | 7 | 12.16 | 7 |
| 2019 | 14.10 | 10 | 2.35 | 6 |
| 2020 | 7.78 | 9 | 1.56 | 5 |
| 2021 | 6.56 | 9 | 1.64 | 4 |
| 2022 | 5.00 | 3 | 1.67 | 3 |
| 2023 | 2.29 | 7 | 1.15 | 2 |
| 2024 | 1.33 | 3 | 1.33 | 1 |

Source: Own elaboration based on data from the Web of Science (WoS) database, processed using the bibliometrix tool.

Table 1 presents the average number of citations per article by year for studies on investments in Bordeaux wines, published in the Web of Science database. The columns provide information on the number of articles published in a given year (N), the average number of citations per article in the year of publication (MeanTCperArt), the average number of citations per article for each year following publication (MeanTCperYear), and the number of years in which an article could be cited (CitableYears).

In 2001, the highest average number of citations per article (MeanTCperArt) was recorded at 98 citations, although the annual average (MeanTCperYear) was only 4.08 citations. In 2018, the average number of citations per article was also high, reaching 85.14, while the annual average (MeanTCperYear) was 12.16 citations, which is the highest value in this column.

In recent years, the number of citations per article has been decreasing — particularly since 2021, when the annual average number of citations per article has not exceeded two. The length of the period during

which articles can be cited shortens with the year of publication, which is natural for more recent research.

The most cited study (139 citations) turned out to be “Wine Market Prices and Investment under Uncertainty: an Econometric Model for Bordeaux Crus Classés” from 2001 (Jones & Storchmann, 2001). The article analyzes the impact of climatic factors, quality aspects, and the aging process on Bordeaux wine prices, focusing on Crus Classés vineyards. The authors present an econometric model that includes factors such as climate, grape composition, expert ratings, and wine aging. The results indicate that Merlot is more sensitive to climate change than Cabernet Sauvignon. Optimal weather conditions, such as a warm and dry summer, foster higher wine prices by improving grape quality.

Quality ratings — for example, as Parker points — significantly affect prices, especially for wines dominated by Cabernet Sauvignon. In smaller vineyards, an increase in rating causes a greater rise in prices than in larger estates. Aging has a positive effect on wine prices, especially for wines with higher Merlot content, as increasing rarity raises their value. The model predicts that the 1995 vintage will have higher prices than 1994, while the 1996 and 1997 vintages will have lower prices due to poorer climatic conditions, which affected their quality.

The authors conclude that investments in Bordeaux wines should take into account grape composition and estate size, as well as the impact of climatic conditions in a given year. It should be noted that the analysis does not include the prestige of the vineyard, as is covered in later analyses described in this publication.

**Table 2.**

*The most common key phrases of published articles in the WoS database on investments in wines from the Bordeaux region*

| Termin | Liczba | Termin | Liczba | Termin | Liczba |
|---|---|---|---|---|---|
| quality | 23 | cointegration | 4 | brand | 2 |
| investment | 20 | demand | 4 | california | 2 |
| return | 17 | growth | 4 | climate | 2 |
| bordeaux wine | 14 | oil | 4 | consumption | 2 |
| market | 11 | reputation | 4 | determinants | 2 |
| prices | 9 | risk | 4 | determines | 2 |
| asset | 8 | volatility | 4 | dynamics | 2 |
| diversification | 8 | cabernet-sauvignon | 3 | expert opinion | 2 |
| price | 8 | exchange-rates | 3 | exuberance | 2 |
| fine wine | 7 | red wine | 3 | firms | 2 |
| impact | 7 | time-series | 3 | gas-exchange | 2 |
| markets | 6 | vitis-vinifera l | 3 | grapevine phenology | 2 |
| savor | 6 | wine | 3 | hedge | 2 |
| art | 5 | art investment | 2 | information | 2 |
| equation | 5 | auction | 2 | management | 2 |
| bordeaux | 4 | auction market | 2 | mass-spectrometry | 2 |
| climate-change | 4 | | | model | 2 |

Source: Own elaboration based on data from the Web of Science (WoS) database, processed using the bibliometrix tool.

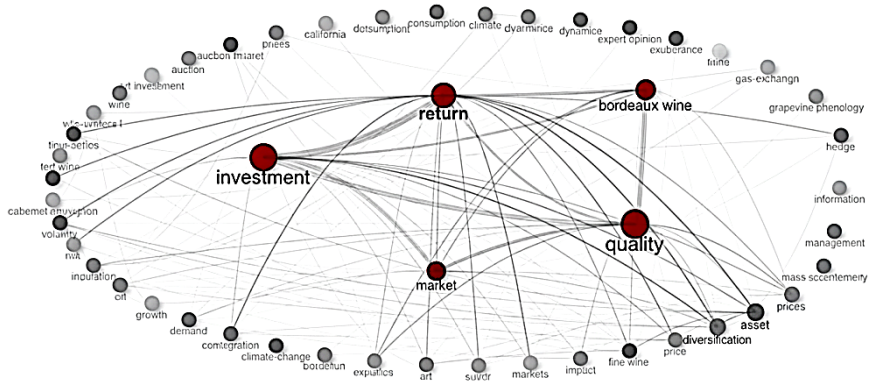
Table 2 presents the frequency of keywords related to investments in Bordeaux wines, wine economics, and the influence of various factors on the wine market. The most frequent keywords are “quality” (23), “investment” (20), and “return” (17), indicating dominant topics concerning the quality, profitability, and returns on investments within the wine market.

Other commonly occurring words include “bordeaux wine” (14), “market” (11), and “prices” (9), emphasizing an interest in the analysis of prices and the Bordeaux wine market. Terms associated with assets and diversification, such as “asset” and “diversification” (each with eight occurrences), are also significant, suggesting that wine is considered an alternative form of investment within the context of portfolio diversification.

Less frequently appearing keywords, such as “volatility” (4), “risk” (4), and “climate-change” (4), reflect an interest in market risk and volatility in the context of climate change, which can impact grape cultivation and wine quality.

**Figure 2.**

*Co-occurrence network of keywords related to investments and the Bordeaux wine market*




Source: Own elaboration based on data from the Web of Science (WoS) database, processed using the bibliometrix tool.

Figure 2 presents the co-occurrence network of keywords related to the topic of wine investment, the Bordeaux wine market, and wine economics. Each keyword is represented as a node, and its size and proximity to other nodes indicate both the frequency and the strength of its co-occurrence with other words.

The central concepts are “quality” and “investment,” which suggests that the main issues analyzed in the network concern the relationship between wine quality and its investment value. “Return” is also closely linked to investments, demonstrating that return on investment is a significant topic of analysis. Words such as “market,” “prices,” and “diversification” are also

strongly connected, indicating that portfolio diversification and market analysis are key elements of the discussion.

The network contains several thematic clusters. The green cluster focuses on "quality" and "market," suggesting an emphasis on the impact of wine quality on its market position. The blue cluster includes words such as "investment," "diversification," "risk," and "volatility," indicating discussions about risk and diversification strategies in the context of investment. The red cluster, with terms such as "reputation," "climate," and "brand," may refer to external factors influencing the perceived value of wine.

Some more distant nodes, such as "grapevine phenology" and "vitis-vinifera l.," refer to biological topics, which may indicate the influence of climatic and agricultural factors on wine production and quality. The node related to "mass-spectrometry" is also noteworthy.

**Determinants of investment wine prices**

Le Fur and Outreville (2019) analyze wine investments as an alternative form of capital allocation, emphasizing their role in portfolio diversification. A key observation is that, although wine investments are a relatively new type of asset, their value is increasing, particularly in the case of fine wines from renowned regions such as Bordeaux. In their study, Le Fur and Outreville clearly indicate that these wines are valuable not only as alternative assets but also as unique luxury goods whose prices are determined by both microeconomic factors (wine characteristics, producer reputation) and macroeconomic factors (market conditions). From a portfolio diversification perspective, Le Fur and Outreville point out that wine investments can complement traditional assets. Wine, as a physical asset not linked to other financial assets, can act as a kind of "financial umbrella" during periods of market turmoil. Studies show that wine indices, such as the Liv-ex Fine Wine 100, can provide diversification benefits

in a portfolio based on stock markets. Le Fur refers to the low correlation between the wine market and stock markets, which is an argument in favor of including fine wines in a portfolio, especially as a hedge against inflation and instability in financial markets.

The study emphasizes that the main factors influencing the prices of investment wines are their prestige and rarity. This explains why the most valuable wines come from a limited number of top estates in the Bordeaux region, such as Château Lafite Rothschild, Margaux, or Haut-Brion. The high quality and limited supply of these wines mean they are treated as "blue chips" on the wine market, and their prices have shown significant resistance to market fluctuations in recent years. The researchers also analyze the impact of the popularity of these wines on the auction market, pointing to their exceptionally low correlation with traditional stock markets, which makes them a potentially stable component of an investment portfolio in times of economic uncertainty.

An additional element of the analysis is the use of hedonic models to assess wine value; using such models is one of the basic methods in the study of alternative wine investments (Cardebat & Figuet, 2004). As the authors note, most research on wine investments focuses on the relationship between quality and price, employing various regression methods. Hedonic modeling allows for the inclusion of both subjective sensory traits and more objective quality indicators, such as vintage year or vineyard reputation. The authors explain that the prices of high-quality wines are resistant to sudden market changes, offering investors an opportunity to diversify risk by investing in wines that are not closely correlated with stock and bond markets.

As Marcinkowska (2010) notes, most investment wines are from Bordeaux-Medoc and Saint-Émilion, as well as Burgundy and Rhine wines

classified as Premier Cru 1855 by the Bordeaux Chamber of Commerce (Appendix 1, Table 3), although it is worth noting that some prestigious investment wines are still not included in this classification (e.g., Château Pétrus). The Premier Cru classification from 1855 applies exclusively to the Medoc region and has only been modified twice: first on September 16, 1855, to include Château Cantemerle, and again in 1973, when Château Mouton-Rothschild was awarded Premier Cru status. However, the classification itself was a ranking of the best-selling wines in the years prior to 1855, and since then, there are certainly other wines on the market of similar or even better quality. It is also worth mentioning the famous Paris Tasting (also called the Judgment of Paris, a name referencing the Judgment of Paris from Greek mythology), where a jury composed of sommeliers, owners of renowned restaurants, and wine institutes awarded the Californian Stag's Leap Wine Cellars (127.5 points) more points than the Premier Cru wines tasted at the time, including Château Mouton-Rothschild (126 points). An American wine also won in the white wine category. Therefore, it is worthwhile to also pay attention to Californian wines as well as wines from outside France, as in the future they may achieve equally favorable or even better taste profiles. Their current lower prices offer an advantage, since unlike Bordeaux or Burgundy wines, they are only now gaining popularity and their price is less dependent on prestige. On the other hand, they may be more difficult to liquidate, which significantly affects their evaluation as an investment tool.

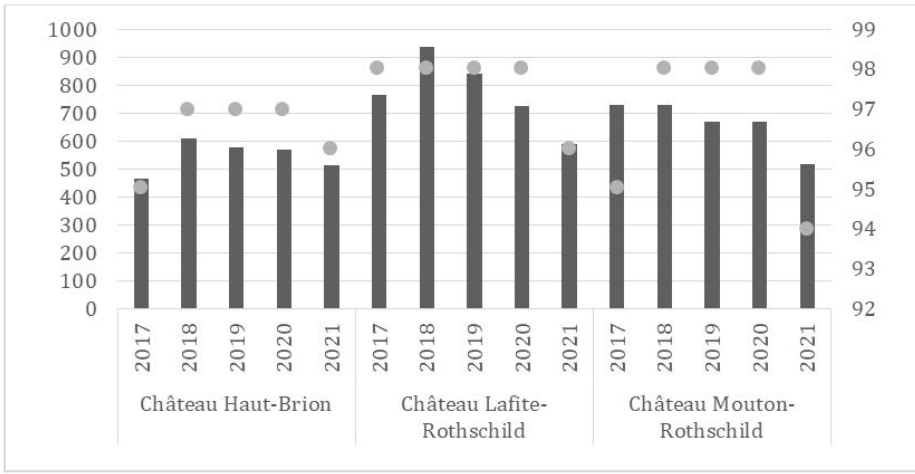
In assessing the importance of these factors (taste versus brand value), we can refer to the research of Ashenfelter and Quandt (1999), who analyzed the statistical significance of the wines tasted in Paris. According to their research, only the results for Stag's Leap Wine Cellars and Château Montrose were statistically significant, while the other results could not be differentiated on this

basis. We can thus conclude that the brand of wine, and therefore its history, prestige, etc., is a more important factor in the acquisition of investment wine, whereas Californian wines may offer a better price-to-quality ratio. This thesis is also confirmed by the studies of Cardebat and Figuet (2004), where statistical analysis demonstrated that reputation outweighs quality. An interesting perspective on wine assessment is also provided by Dong et al. (2020), who found that for some wines (e.g., Château Latour 2009), despite significant differences in tasting notes regarding wine characteristics, each reviewer rated the wine between 99 and 100 points. This is likely due to the fact that high-quality wines that have been aged appropriately feature a rich bouquet of aromas, and everyone can find their preferred notes within them.

As Mora and Livat (2013) note, numerous factors influence wine prices, as evidenced in previous studies. Earlier research highlighted the importance of origin (Nerlove, 1995), weather conditions (Di Vittorio & Ginsburgh, 1996), and sensory attributes such as taste (Combris et al., 1997; Cardebat & Figuet, 2009). Other works emphasized vineyard reputation (Landon & Smith, 1997; 1998), grape variety (Steiner, 2004), and the quantity of wine available on the market (Lima, 2006). Further studies expanded this perspective by including production technology (Gergaud & Ginsburgh, 2010), expert ratings (Dubois & Nauges, 2010), certification systems such as quality and green certificates (Delmas & Grant, 2010), and tasting scores (Ramirez, 2010). At the same time, Mora and Livat (2013) stress that external communication by the vineyard plays a crucial role, with the investment aspect being most visible in the Medoc region — renowned for its exclusive, high-value, and prestigious wines.

**Figure 3.**

*Comparison of prices (in Euros) and ratings (on a scale of up to 100) of Bordeaux Premier Grand Cru wines as of 25/07/2023 according to winedeciderpro.com (2025)*




Source: Own elaboration based on data from winedeciderpro.com (2025).

The selection of vineyards presented in Figure 3 results from the intent to compare three highest-valued estates from the previously mentioned Bordeaux wine classification, focusing on the years 2017–2021. As observed in Figure 4, wines from Chateau Lafite-Rothschild consistently achieved the highest prices in this comparison, regardless of their ratings.

An interesting trend can be noted with Chateau Mouton-Rothschild, where, despite a lower wine rating in 2017, its price matched that of 2018 — a vintage with a significantly better score. For Chateau Haut-Brion, on the other hand, a correlation is evident between a decline in wine ratings and corresponding decreases in price.

In all cases, 2021 was not a favorable vintage for Bordeaux wines. That year, natural factors such as mildew and frost led to lower wine production in the

Bordeaux region compared to the previous year. While the reduced number of bottles produced in 2021 could potentially have boosted wine prices, other weather-related issues (such as less sunshine) are likely to have affected the sensory qualities of the wines. Although a score of 95/100 is considered very good, only wines with ratings between 97 and 100/100 are regarded as exceptional, and such scores were mainly observed for the 2018–2020 vintages (McCoy, 2022).

Investment wines, especially those from prestigious and renowned estates, typically achieve very high ratings from wine critics, often exceeding 90 out of 100 points. Such high scores not only attest to quality, but also serve as indicators of a wine's uniqueness and distinction, enhancing its perceived value. These stringent quality standards contribute to both price growth and the long-term stability of the wine's value.

The main advantage of wines from the Bordeaux region lies in their reputation and the worldwide prestige they enjoy. Despite wines of similar quality being produced in other parts of the world, Bordeaux wines maintain consistent popularity in the wine community. From an investor's perspective, they also remain an attractive choice for diversifying investment instruments.

However, investing in wines from this region also entails certain risks. One such risk is the possibility that potential buyers might withdraw if they start to focus more on the price-to-quality ratio rather than the prestige of a given wine, which is, after all, a subjective perception based on a certain level of respect and appreciation for the history of the particular vineyard. Advances in winemaking technology significantly increase this risk. It was noted as early as 2013 that wines such as Chateau Lafite-Rothschild were targets of counterfeiting in the People's Republic of China (Jones, 2013). While this issue has long been recognized, it remains relevant: in subsequent

years, counterfeit Bordeaux wines continued to find their way to Europe. In 2023, Chinese authorities seized counterfeit bottles of Chateau Lafite and Penfolds valued at an estimated $150 million (Mustacich, 2023). Such actions are likely motivated by pressure from France, as well as China's desire to maintain good relations with France and to pursue food safety initiatives. However, it should be considered that, should relations between France (or the European Union) and China deteriorate, China might "turn a blind eye" to the export of counterfeit wine. Finally, one should also consider a scenario in which technological progress makes it possible to produce wines with similar, identical, or even superior flavor characteristics. In such a case, neither purchasing wine from a particular vineyard nor maturing it over time would be economically justified. This does not mean, however, that the market for alternative investments in wines would cease to exist, but it could suffer a significant downturn, especially if new production methods prove cheaper than traditional ones and more environmentally friendly.

When assessing the prospects for Bordeaux wines, an ambiguous picture emerges. On one hand, these are long-established wines, rich in history, widely recognized, and highly prestigious. On the other, their valuation may be affected by factors that have an obvious impact on the volume and quality of the harvest, such as climate and weather, but also by technological innovations that could improve the quality of existing wines or increase competition by expanding the range of wines with outstanding taste profiles. Lastly, the geopolitical factor that affects the prevalence of counterfeit wines in circulation could, in future, negatively influence Bordeaux wine prices, since potential conflicts between the EU and China are possible. In such a scenario, investing in wine could become disadvantageous or even impossible for the layperson unable to distinguish originals from counterfeits.

**Summary**

Verification of the research hypothesis confirms that the investment value of Bordeaux wines is indeed determined to a greater extent by the reputation and brand of the winery than by the objective quality of the product. The bibliometric analysis and literature review revealed that the prices of Bordeaux wines are shaped by both objective factors, such as quality, vintage and region of origin, and subjective factors, including prestige, reputation, and expert ratings. Seasonality plays a significant role, affecting the availability and prices of wine at different times of the year, consumer preferences, especially among collectors and enthusiasts, exert a strong influence on the market value of these wines.

The research objective was achieved by indicating the key economic conditions affecting the prices of Bordeaux wines, including: the prestige and reputation of the producer, limited supply, vintage specificity, expert assessments, quality certificates, adaptation to climate change, and the particular conditions of investment and collector demand.

In summary, investments in wines from the Bordeaux region represent a fascinating area of alternative investment instruments. From an investor's perspective, choosing to invest in such assets requires a thorough understanding of the market and careful consideration of the various factors influencing wine prices.

In recent years, Bordeaux wines have maintained their reputation and prestige on the global market, making them an attractive component of an investment portfolio. However, certain challenges and risks associated with this form of investment have also been observed. These include not only variable weather conditions but also advancing production technology, which may affect the balance between price and quality.

The threat posed by counterfeiting — highlighted by cases involving fake bottles of Chateau Lafite-Rothschild and Penfolds in China — must also be

taken into account. This phenomenon demands ongoing vigilance from investors, especially in light of potential changes in international relations.

Ultimately, the outlook for investing in Bordeaux wines remains uncertain. Despite their longstanding tradition and worldwide acclaim, investors must remain aware of the evolving environment where technology, weather conditions, and geopolitical factors can all affect these wines' value. The worth of Bordeaux wine depends not only on its intrinsic quality but also on the market's ability to understand and appreciate the subtleties and distinctions in taste, which influence perceptions of a vineyard's prestige.

Therefore, making decisions about investing in such assets requires caution, analysis of market trends, and an understanding of the variable factors affecting both price and quality. Nonetheless, wine from the Bordeaux region remains a unique and attractive option for investors seeking diversity within their portfolios.

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## Appendix 1

### Table 3.

*Classification of Bordeaux wines from 1855*

| Class | Vinery |
|---|---|
| 1er Grands Cru Classes | Château Lafite-Rothschild (Pauillac), Château Margaux (Margaux), Château Latour (Pauillac), Château Mouton-Rothschild (Pauillac), Château Haut-Brion. |
| 2eme Grands Cru Classes | Château Rausan-Ségla (Margaux), Château Rauzan-Gassies (Margaux), Château Gruaud-Larose (St-Julien), Château Brane-Cantenac (Cantenac), Château Léoville-Las-Cases (St-Julien), Château Léoville-Poyferré (St-Julien), Château Léoville-Barton (St-Julien), Château Dufort-Vivens (Margaux), Château Lascombes (Margaux), Château Pichon-Longueville (Pauillac), Château Pichon-Longuevlle-Lallande (Pauillac), Château Ducru-Beaucaillou (St-Julien), Château Cos d'Estournel (St-Estèphe), Château Montrose (St-Estèphe). |
| 3eme Grands Cru Classes | Château Giscours (Labarde), Château Kirwan (Cantenac), Château d'Issan, Cantenac, Château Lagrange, St-Julien, Château Langoa (St-Julien), Château Malescot-St-Exupery (Margaux), Château Cantenc-Brown (Cantenac), Château Palmer (Cantenac), Château La Lagune (Ludon), Château Desmirail (Margaux), Château Calon-Ségur (St-Estèphe), Château Ferrière (Margaux), Château Marquis-d'Alesme-Becker (Margaux), Château Boyd-Cantenac (Cantenac). |
| 4eme Grands Cru Classes | Château St. Pierre (St-Julien), Château Branaire-Ducru (St-Julien), Château Talbot (St-Julien), Château Duhart-Milon (Pauillac), Château Pouget (Cantenac), Château La Tour Carnet (St-Laurent), Château Beychevelle (St-Julien), Château Prieuré (Cantenac), Château Marquis de Terme (Margaux), Château Lafon-Rochet (St-Estèphe). |
| 5eme Grands Cru Classes | Château Pontet Canet (Pauillac), Château Batailley (Pauillac), Château Haut-Batailley (Pauillac), Château du Tertre (Arsac), Château Haut-Bages-Libéral (Pauillac), Château Pédesclaux (Pauillac), Château Grand-Puy-Lacoste (Pauillac), Château Grand-Puy-Ducasse (Pauillac), Château Lynch-Bages (Pauillac), Château Lynch-Moussas (Pauillac), Château Dauzac (Labarde), Château Mouton-d'Armailhacq (Pauillac), Château Belgrave (St-Laurent), Château Camensac (St-Laurent), Château Cos-Labory (St-Estèphe), Château Clerc-Millon (Pauillac), Château Croizet-Bages (Pauillac), Château Cantemerle (Macau). |

Source: Own elaboration based on: Bordeaux.com (2023).

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# TECHNOLOGICAL SOVEREIGNTY AND THE STABILITY OF THE EUROPEAN FINANCIAL SECTOR IN THE ERA OF ARTIFICIAL INTELLIGENCE

**ABSTRACT**

**The purpose of the article** The article aims to develop a composite index of technological sovereignty for EU member states and examine its relationship with systemic financial stress. It highlights technological dependencies as a potential source of systemic risk.

**Methodology** The study covers 16 EU countries. Six indicators on infrastructure, AI and cloud adoption, and ICT capacity were standardised and weighted using an optimisation procedure (SLSQP). The index for 2023 was compared with CISS values from February 2025. Correlation analysis was applied to assess relationships between index components and systemic stress.

**Results of the research** Northern and Western EU countries scored highest on technological sovereignty, while Southern and Eastern states lagged behind. AI and cloud adoption correlate positively with systemic stress, whereas infrastructural and human capital indicators show weaker or stabilising effects. Technological dependencies emerge as an overlooked dimension of systemic risk.

**Keywords:** AI, risk management, vendor lock-in, digital economy

**JEL Class:** O33, F52, L86


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## Indtroduction

The rapid development of artificial intelligence (AI) is profoundly transforming financial systems, enhancing processes ranging from credit scoring to algorithmic trading, while simultaneously introducing new sources of systemic risk. According to the Global Financial Stability Report (IMF, 2024), AI has the potential to amplify the procyclical behavior of markets during periods of stress, acting as a catalyst for turbulence rather than a stabilizing buffer.

In the meantime, the financial sector is becoming increasingly dependent on a small group of cloud and algorithmic service providers, leading to infrastructural concentration and vendor lock-in, which in turn heightens the risks associated with limited technological control — particularly in the context of geopolitical tensions. In this regard, technological sovereignty emerges as a key dimension of macro-financial resilience, understood as the capacity to independently develop, deploy, and govern digital technologies within strategic sectors.

The purpose of this article is to examine how the lack of technological sovereignty in the field of AI affects the level of systemic stress in the financial sectors of EU countries. This is achieved by constructing a technological sovereignty index and comparing it with the CISS (Composite Indicator of Systemic Stress) developed by the European Central Bank.

## Literature

The concept of digital sovereignty emerged in the 1990s in response to the dominance of US Internet companies (Cong & Thumfart, 2022; Glasze et al., 2023), gaining prominence with the politicization of technology in the late 1910s. The French concept of *souveraineté numérique* in 2012 was a reaction to the U.S. reliance on technology (Musiani 2013; Thumfart 2022), and the Snowden revelations in 2013 sparked a debate about technological independence

in Germany (Pohle, 2020; Glasze et al., 2023). The turning point came in 2016 with the election of Donald Trump and the trade war with China.

At the EU level, the acceleration of legislative action (RODO, Digital Markets Act, Digital Services Act, AI Act) was part of the definition of digital sovereignty as an element of strategic autonomy (European Council, 2021), understood as the ability to act independently and protect infrastructure (Madiega, 2020). The contemporary debate emphasizes its character as a political construct legitimizing the technological practices of various actors (Pohle et al., 2025), and the concept of "unthinking digital sovereignty" postulates a shift from a state-centric view to an analysis of its relational, historical and negotiated aspects.

Technological sovereignty goes beyond ownership of infrastructure and digital competencies to include the ability to shape rules and standards in the areas of data, AI and platforms, with its meaning varying regionally, with Europe emphasizing democratic values and individual rights and China emphasizing defense against external interference (Creemers, 2020; Pohle et al., 2025). In the face of the dominance of global technology corporations, reflection is needed on the mechanisms of control and accountability of these new forms of power.

At the same time, the development of AI as a general-purpose technology – comparable to electrification or the Internet (Brynjolfsson & McAfee, 2017) – is increasing the financial sector's dependence on US and Chinese cloud services. This dependence becomes particularly important in the context of geopolitical tensions and deglobalization, fostering nearshoring, EU strategic autonomy or Chinese digital protectionism (Zuboff, 2019; Pohle & Thiel, 2020).

Meanwhile, Europe is lagging behind in terms of technology leaders – most financial data and AI algorithms are processed in US clouds (Bria, 2015). The cloud market is dominated by Amazon AWS (30%), Microsoft Azure (21%) and Google Cloud (12%), while Alibaba has only a 4% share (Statista, 2025). In

GPU manufacturing, NVIDIA controls 92% of the market, and together with AMD and Intel, the share of American companies reaches 97% (Fernandez, 2025). The lack of European giants is also evident in consumer electronics, where U.S. brands (Apple, 26%) and Chinese brands (Xiaomi, Motorola, Oppo; 25%) dominate, completely displacing European products (Canalys, 2025).

Lack of in-house infrastructure and limited ability to develop national or EU AI models generate systemic risks. The IMF (2024) points out that mass deployment of AI in finance increases system complexity, reduces transparency of decisions and hinders oversight, and in a crisis can amplify market panic. Additionally, the dominance of a few global cloud and AI providers (vendor lock-in) creates structural operational vulnerabilities, susceptible to exploitation in political conflicts or cyber attacks (DeNardis, 2014; IMF, 2024).

One of the key challenges of the digital transformation of the financial sector is vendor lock-in, or dependence on a single cloud and algorithmic service provider. Limited interoperability, lack of open standards and difficulties in migrating data or AI models tie institutions to specific platforms, limiting flexibility and increasing the risk of switching costs (Opara-Martins et al., 2016). The problem is exacerbated by limited awareness of the risks – 71% of companies cite vendor lock-in as a barrier to further migration (Opara-Martins et al., 2016) – and increasing reliance on third-party AI solutions (Soetan, 2023). Lack of control over data is becoming a significant systemic risk (Adeyelu et al., 2024), and for the EU it means limited ability to intervene in crises and protect consumers, making technological sovereignty a condition for financial stability.

The EU has increased funding for cyber security to €2.9 billion in IFF 2021–2027, a 200% increase over the previous period, but still small compared to the US budget ($13 billion in 2025) (PEI, 2025). Similarly, in AI investment, the EU ($10 billion in 2023) is clearly behind China ($18 billion) and the US

($90 billion) (OECD GPAI, 2025). However, without its own large language models, chip manufacturing and cloud technologies, even increased spending will go mainly to US companies. As a result, in line with the vendor lock-in phenomenon, increased productivity will reinforce dependence on external suppliers, creating a closed circle that limits the growth of European technology companies and threatens the sovereignty and stability of the financial sector.

Recent studies point to three main channels for AI to transfer systemic risk: homogeneous machine learning models fostering herding by design (Danielsson, Uthemann & Macrae 2024), concentration of operational risk in hyperscale cloud providers (Opara-Martins, 2016), and vulnerability to failure of individual SaaS components, as exemplified by the failure of CrowdStrike in 2024 (Douglas, 2024).

At the same time, the concept of digital sovereignty has expanded to include infrastructural, regulatory and competency dimensions (Fratini et al, 2024). Lack of control over the AI-cloud layer limits the ability of states to respond to crises, even with extensive data infrastructure (Fratini, 2024; Mügge, 2025). The degree of technological sovereignty acts as a moderator of systemic stress, increasing its level in countries with lower sovereignty.

Despite growing interest, systematic, empirical analyses of the links between AI, systemic risk and financial stability are lacking. Current indicators (DESI, AI Readiness Index) do not take into account control of computing infrastructure or crisis response capabilities, making it difficult to quantify technological sovereignty and its impact on macrofinancial resilience.

In the context of the growing use of AI and cloud solutions in finance, the key question becomes whether their intensification without ensuring an adequate level of technological autonomy increases systemic risk. This is indicated both by reports from the IMF, ECB and OECD, as well as empirical

cases revealing the vulnerability of digital infrastructure to disruption, such as the CrowdStrike crash in 2024.

The paper attempts to empirically verify this relationship by constructing an index of technological sovereignty for European Union member states and comparing its value with the CISS systemic stress index developed by the European Central Bank. The study aims to answer the following questions:

1. Is there a relationship between the overall level of technological sovereignty and the level of systemic stress in the financial sector of EU countries?
2. Which components of sovereignty (infrastructure, competence, use of technology) show a significant impact on the level of systemic stress?
3. Can the intensive use of artificial intelligence and cloud computing be associated with increased levels of systemic stress, regardless of the overall level of technological sovereignty?

Based on the above questions, the following research hypotheses were formulated:

- **H1**: There is a significant relationship between the overall level of technological sovereignty and the level of systemic stress in the financial sector.
- **H2a**: A high percentage of companies using artificial intelligence correlates positively with the level of systemic stress.
- **H2b**: A high percentage of enterprises using cloud computing correlates positively with the level of systemic stress.
- **H2c**: High share of ICT sector in GDP and high saturation of data center infrastructure (per capita) correlate negatively with the level of systemic stress.

- **H3**: The impact of intensive use of AI and cloud on the level of systemic stress is stronger in countries with lower levels of technological sovereignty.

Against this theoretical and conceptual background, the next section presents the empirical design of the study. It outlines the construction of the technological sovereignty index and explains how it is linked with systemic stress indicators to address the research questions formulated above.

**Methodology**

The analysis used a taxonomic method, which allows for the construction of a synthetic index of technological sovereignty based on a set of quantitative socio--economic variables. It was enriched with a comparative analysis of variables related to digital sovereignty.

The taxonomic method was chosen for its ability to aggregate multidimensional information into a one-dimensional synthetic index, while maintaining comparability across units of analysis. This method has previously been used in the literature to at least measure digital saturation (Dykas, Koscielniak & Tokarski, 2013) and to build comparative composite indices. In the study, it was assumed that all variables are stimulants, and therefore their higher values indicate a higher level of technological sovereignty. The variables were subjected to standardization.

The analysis covered the 27 member states of the European Union, and the time range of the input data was 2023. This year was chosen as the most recent period with available comparable statistics from the area of digital technology use and cloud infrastructure in the EU. The dataset on the number of data centers was dynamic and indicated only the current state which prevented the author from analyzing the dynamics.

The construction of the Technological Sovereignty Index (TSI) is based on six standardized quantitative indicators capturing key infrastructural, technological, and competency-related dimensions of digital sovereignty. Each variable was selected on the basis of data availability, comparability across EU member states, and its theoretical relevance to technological control and financial stability. Importantly, the indicators reflect different aspects of the phenomenon and are subject to specific interpretative limitations, which are:

- Number of data centres per 1,000 inhabitants

  This indicator reflects the degree of physical digital infrastructure saturation, which is a prerequisite for hosting and processing data within a country's jurisdiction. A higher number of data centres per capita suggests greater local computing capacity and, potentially, higher autonomy in storing and processing financial data. However, this measure does not account for ownership structure or operational control: many centres located in the EU are operated by foreign corporations. Moreover, data centres typically serve transnational markets and do not necessarily scale with population size. Consequently, this variable should be interpreted as a proxy for infrastructural presence rather than actual sovereignty.
- Number of cloud facilities per 1,000 inhabitants

  This variable captures the availability of cloud infrastructure services within national borders, encompassing public, private, and hybrid models. Its relevance lies in the centrality of cloud infrastructure for AI deployment, financial data management, and critical services. Similar to data centres, this indicator does not reflect the degree of domestic control or interoperability standards. The presence of foreign-operated hyperscale cloud facilities can in fact increase dependence on non-EU providers, underscoring the need for careful interpretation.

- Percentage of enterprises using artificial intelligence

  This measure reflects the diffusion of AI technologies[1] in the economy and, in particular, in the financial sector. While widespread AI adoption may indicate technological advancement, it does not capture who owns, develops, or governs these systems. Many commercial AI solutions are provided by foreign vendors, creating operational and legal dependencies. Furthermore, not every technology reported by enterprises as "AI" constitutes advanced or systemic AI within the meaning relevant for financial stability. This indicator should therefore be seen primarily as a measure of technological uptake rather than of sovereign capability.

- Percentage of enterprises using cloud computing[2]

  Analogous to AI usage, this variable reflects the intensity of cloud adoption across the enterprise sector. While cloud computing can enable scalability and innovation, dependence on foreign hyperscale providers introduces systemic vulnerabilities (e.g., vendor lock-in, jurisdictional fragmentation, or data localisation issues). The indicator captures adoption levels but does not measure the degree of control over cloud layers, making it necessary to complement it with infrastructural and regulatory considerations.

[1] Share of enterprises with ≥ 10 employees that used at least one artificial intelligence technology (e.g. machine learning/deep learning, image/text/speech recognition or analysis, natural language generation, autonomous systems or AI-based RPA). Definition and measurement follow Eurostat's *ICT usage and e-commerce in enterprises* survey. Dataset: isoc_eb_ai (and sectoral variant isoc_eb_ain2)."

[2] Share of enterprises with ≥ 10 employees that purchased cloud computing services (SaaS/IaaS/PaaS) delivered over the internet by external providers; services are characterised by on-demand self-service, flexible scalability, and pay-per-use pricing. Definition and measurement follow Eurostat's *ICT usage and e-commerce in enterprises* survey. Dataset: isoc_cicce_use (and sectoral variant isoc_cicce_usen2).

- Share of the ICT sector in gross domestic product

  This indicator represents the economic weight of the ICT sector in the national economy, capturing the structural embedding of digital activities and technological competencies. A higher share may indicate stronger endogenous capabilities to develop, maintain, and govern digital infrastructure. However, this variable does not directly measure ownership or strategic control, and should be interpreted as a complementary economic dimension of sovereignty.

- Percentage of enterprises employing ICT specialists

  This measure reflects the availability of human capital and technical skills necessary to support digital infrastructure, develop domestic solutions, and maintain operational autonomy. While essential for sovereignty, the indicator alone does not account for the direction of technological development or the presence of domestic versus foreign platforms.

Taken together, these six indicators offer a multi-dimensional view of technological sovereignty, encompassing infrastructure, adoption, and competencies. At the same time, it is crucial to distinguish between digital adoption and technological control: high levels of AI and cloud use do not automatically imply sovereignty and may, under certain conditions, increase exposure to systemic risk. The selection of these variables reflects a balance between theoretical relevance and data availability, but the interpretation of results must account for the limitations outlined above.

The weights for each variable were estimated using the Sequential Least Squares Programming (SLQP) nonlinear optimization method, using the scipy.optimize library in Python. A function was used to minimize the sum of relative errors, assuming that the sum of the weights equals 1 and that each weight

falls within the interval [0,1]. This approach provides both methodological transparency and the ability to account for the internal structure of the data.

The taxonomic index values of technological sovereignty (TSI) for each country were determined as a linear combination of the sum of the products of the values of each standardized variable and their weights (Equation 1).

$$TSI_t^i = \omega_1 Z_{i,1} + \omega_2 Z_{i,2} + \omega_3 Z_{i,3} + \cdots + \omega_6 Z_{i,6} \quad (1)$$

An alternative option, based on Hellwig's measure of distance from the development pattern, was considered at the sensitivity testing stage; however, the form (1) was chosen because it has less sensitivity to extreme observations and retains full interpretability of the weights as information shares of the variables.

The choice of a taxonomic method was preceded by an analysis of alternative approaches, such as principal component analysis (PCA), expert approaches and ready-made aggregate indicators (e.g. DESI, AI Readiness Index). These methods, while widely used, come with significant limitations: PCA generates components that are difficult to interpret directly, expert approaches are characterized by arbitrariness, and administrative indicators focus mainly on digitization, leaving out aspects of infrastructure and jurisdictional sovereignty.

The taxonomic method was chosen as a solution that allows for transparent aggregation of standardized quantitative data, preservation of control over the weighting structure, and the possibility of comparative analysis of EU countries, taking into account the complexity of the phenomenon. Its application is also confirmed by previous research on digital development and institutional resilience.

Macroeconomic input variables used to construct the Technological Sovereignty Index refer to the most recent period with comparable Eurostat

statistics available for all EU member states. The CISS values and number of data centers and cloud infrastructure come from February 2025, reflecting the latest data available at the time of analysis. The study therefore applies a cross-sectional design, comparing sovereignty levels at time *t* with systemic stress observed approximately two years later (*t+2*). This temporal structure allows for the possibility that structural characteristics of technological sovereignty precede and influence financial stress dynamics, but it does not capture full time-series effects. In the robustness checks, alternative specifications with lagged relationships were explored to account for potential timing discrepancies between index components and financial stress indicators.

To assess the robustness of the Technological Sovereignty Index (TSI), several complementary checks were carried out. First, an alternative aggregation procedure based on Hellwig's measure of distance from the development pattern was applied. This method, commonly used in taxonomic analyses, yielded country rankings and relationships with systemic stress that were highly consistent with the baseline index, confirming that the main results are not driven by the chosen aggregation formula.

Second, the temporal alignment between variables and financial stress indicators was examined. The TSI is based on data for 2023, while CISS values refer to February 2025, effectively introducing a two-year lag. This structure allows for a basic robustness check regarding timing: technological sovereignty indicators precede the observed levels of systemic stress. The results remain unchanged under this alignment.

In addition, simple alternative specifications, such as equal-weighted aggregation and the exclusion of individual variables, were explored. These did not materially alter the country ordering or the direction of the relationships

observed. Taken together, these tests indicate that the results are stable and not dependent on a single modelling assumption.

## Results

The flywheel of the Fourth Industrial Revolution, and therefore the digital economy, is virtual data. Their creation, analysis and processing are what hydrocarbon extraction and steel production used to be. Analyzing the countries with the greatest potential for "digital thinking" i.e., computing power as seen in Table 1, the dominance of the US is evident. Even after adding up the results of the countries of Europe (Italy, Switzerland, Germany, Finland, Spain, France, the Netherlands and the UK), they reach only 43% of the computing power of the United States.

**Table 1**

*Estimated computing power and number of country based on TOP500 supercomputer ranking in November 2024 (in TFlops)*

| Country | # of supercomputers in TOP500 | Estimated computing power in TFlops |
|---|---|---|
| USA | 172 | 6500000 |
| Japan | 34 | 941000 |
| Italy | 13 | 838000 |
| Switzerland | 5 | 474000 |
| Germany | 41 | 405000 |
| Finland | 3 | 391000 |
| China | 63 | 319000 |
| Spain | 3 | 222000 |
| South Korea | 13 | 213000 |
| France | 24 | 298000 |

| Country | # of supercomputers in TOP500 | Estimated computing power in TFlops |
|---|---|---|
| Taiwan | 7 | 104000 |
| Netherlands | 10 | 98000 |
| Saudi Arabia | 7 | 96000 |
| United Kingdom | 14 | 85000 |
| Russia | 6 | 71000 |
| Other | 84 | 697000 |

Source: Own compilation based on Voronoi (2025).

Supercomputers are an indicator of investments made in digital infrastructure. A similar indicator could be data centers – special storage facilities that process and manage digital data. This is the infrastructure needed to develop and train artificial intelligence algorithms, and therefore a strategic element of the economy's security. For this purpose, a spatial analysis of EU countries was made in terms of the number of functioning data centers as well as cloud service providers (public, private and hybrid clouds) for March 2025 presented in Table 2.

**Table 2**

*Values of factors used in the Technological Sovereignty Index*

| Country | Data centers [2025] | Cloud infrastructure [2025] | AI usage by enterprises in % [2024] | Cloud usage in % [2023] | ICT % GDP [2022] | Enterprises that employ ICT specialists in % [2024] |
|---|---|---|---|---|---|---|
| Austria | 45 | 4 | 20.27 | 46.48 | 3.83 | 19.91 |
| Belgium | 47 | 5 | 24.71 | 51.69 | 4.08 | 29.11 |
| Bulgaria | 30 | 6 | 6.47 | 17.5 | 7.42 | 17.81 |
| Croatia | 15 | 4 | 11.76 | 45.08 | 5.32 | 15.89 |
| Cyprus | 18 | 3 | 7.9 | 52.93 | 10.42 | 27.48 |

| Country | Data centers [2025] | Cloud infrastructure [2025] | AI usage by enterprises in % [2024] | Cloud usage in % [2023] | ICT % GDP [2022] | Enterprises that employ ICT specialists in % [2024] |
|---|---|---|---|---|---|---|
| Czechia | 49 | 4 | 11.26 | 47.15 | 4.93 | 20.2 |
| Denmark | 55 | 2 | 27.58 | 69.48 | 3.81 | 30.94 |
| Estonia | 12 | 0 | 13.89 | 58.57 | 5.97 | 19.22 |
| Finland | 50 | 5 | 24.37 | 78.29 | 5.81 | 30.51 |
| France | 254 | 19 | 9.91 | 26.76 | 4.36 | 15.94 |
| Germany | 416 | 33 | 19.75 | 47 | 4.77 | 22.86 |
| Greece | 19 | 8 | 9.81 | 23.59 | 3.04 | 22.53 |
| Hungary | 16 | 1 | 7.41 | 44.94 | 5.48 | 29.34 |
| Ireland | 99 | 9 | 14.9 | 63.1 | 34.78 | 30.28 |
| Italy | 164 | 10 | 8.2 | 61.39 | 3.21 | 12.44 |
| Latvia | 22 | 3 | 8.83 | 35.76 | 6.45 | 17.99 |
| Lithuania | 14 | 3 | 8.76 | 38.39 | 4.59 | 16.12 |
| Luxembourg | 13 | 2 | 23.73 | 37.04 | 5.67 | 23.35 |
| Malta | 7 | 1 | 17.3 | 66.74 | 10.14 | 34.11 |
| Netherlands | 191 | 21 | 23.06 | 64.19 | 5.31 | 29.73 |
| Poland | 83 | 8 | 5.9 | 55.67 | 4.03 | 25.99 |
| Portugal | 41 | 3 | 8.63 | 37.5 | 4.47 | 20.56 |
| Romania | 59 | 4 | 3.07 | 18.4 | 4.44 | 13.16 |
| Slovakia | 13 | 2 | 10.78 | 34.42 | 4.47 | 17.25 |
| Slovenia | 20 | 0 | 20.89 | 40.21 | 4.3 | 17.71 |
| Spain | 152 | 11 | 11.31 | 30.04 | 3.55 | 14.57 |
| Sweden | 95 | 2 | 25.09 | 71.62 | 6.24 | 21.6 |

Source: Data Center Map (2025); Eurostat (tin00074, isoc_eb_ai, isoc_cicce_use, isoc_ske_itspen2).

The largest number of data centers is in Germany (416), France (254), the Netherlands (191) and Italy (164). EU countries together have 1999 such centers. By comparison, major rivals have respectively:

- United Kingdom 404;
- Japan 180;
- India 259;
- China 432;
- United States 3648.

However, it is important to make the results more realistic by dividing them by the population in thousands to measure the saturation of data centers. By this measure, it turns out that only four EU countries have a higher score than the US (Luxembourg, Ireland, Malta and Latvia). The average for EU countries is 0.0067 data centers per 1,000 inhabitants, while the figure for the US is 0.0109.

In the case of cloud-enabled centers, the EU has 173 facilities, while competitors respectively:

- UK 45;
- Japan 5;
- India 14;
- China 12;
- United States 128.

This would indicate a strong position, especially when analyzing the number per 1,000 inhabitants, where the Union scores 0.0007 and the United States 0.0004.

The initial goal was to analyze the data centers present in EU countries by their origin, to divide them into domestic, European and foreign. Unfortunately, through difficulties in the availability of such data and in verifying the shareholding of many companies, a decision was necessary to

outline the location of data centers of the largest digital companies from the US and China.

In the case of US companies, it is as follows:

- Meta: three centers (Ireland, Denmark, Sweden) (Meta, 2025);
- Alphabet: 10 centers (Finland, Denmark, Germany, Netherlands, Belgium, Ireland) (Google, 2025);
- Amazon: 32 centers (Spain, Ireland, Sweden) (Amazon, 2025)
- Apple: one center (Denmark) (Apple, 2025).

In contrast, analysis of Chinese giants such as Alibaba and Tencent indicates sovereignty in the Chinese edition. None of these companies' 15 data centers are located outside the PRC (Tencent; Alibaba, 2025). However, China Telecom (the world's largest telco) works with more than 180 data centers worldwide. Significantly, and demonstrating the low transparency of the Chinese market, China Telecom claims on its website that it operates more than 450 data centers in China – despite the fact that even counting Macau and Hong Kong, they do not currently have that many (according to official data) (China Telecom, 2025).

The estimated weights for taxonomic index of technological sovereignty obtained the following values:

- Number of data centers per 1,000 residents – 0.142;
- Number of cloud facilities per 1,000 residents – 0.1433;
- Share of companies using artificial intelligence – 0.1379;
- Share of companies using cloud computing – 0.1706;
- Share of ICT sector in GDP – 0.2094;
- Share of companies employing ICT specialists in total employment – 0.1968.

**Table 3**

*Value of the index of technological sovereignty and CISS*

| Country | Technological Sovereignty Index | CISS |
|---|---|---|
| Austria | 0.3974 | 0.1778 |
| Belgium | 0.4780 | 0.1145 |
| Bulgaria | 0.2962 | – |
| Croatia | 0.3585 | – |
| Cyprus | 0.5801 | – |
| Czechia | 0.3557 | 0.0161 |
| Denmark | 0.5741 | 0.3306 |
| Estonia | 0.4077 | – |
| Finland | 0.6114 | 0.1575 |
| France | 0.2664 | 0.0649 |
| Germany | 0.4171 | 0.0448 |
| Greece | 0.2987 | 0.0193 |
| Hungary | 0.3544 | 0.0261 |
| Ireland | 0.8129 | 0.0189 |
| Italy | 0.2942 | 0.158 |
| Latvia | 0.4263 | – |
| Lithuania | 0.3335 | – |
| Luxembourg | 0.6535 | – |
| Malta | 0.6684 | – |
| Netherlands | 0.5925 | 0.1436 |
| Poland | 0.3519 | 0.1031 |
| Portugal | 0.3122 | 0.0306 |
| Romania | 0.1907 | – |

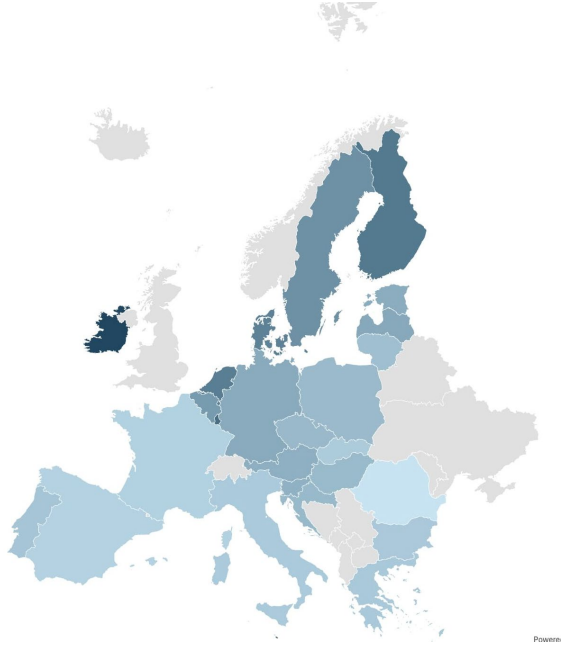
| Country | Technological Sovereignty Index | CISS |
|---|---|---|
| Slovakia | 0.2904 | – |
| Slovenia | 0.3888 | – |
| Spain | 0.2612 | 0.0401 |
| Sweden | 0.5184 | 0.11 |

Source: Own elaboration and European Central Bank (2025).

Analyzing the index values, it is possible to conclude that Ireland, Malta, Luxembourg and Finland have the highest digital sovereignty. In contrast, Romania, Spain, France and Slovakia have the lowest.

**Figure 1**

*The level of the index of technological sovereignty in the analyzed countries*



Source: Own study.

The Composite Indicator of Systemic Stress (CISS) index was used to measure the stability of a country's financial sector. This is an index developed by the European Central Bank (ECB) to monitor the level of systemic stress in the eurozone financial system. Its design is based on an analysis of five key financial market segments: the money market, the bond market, the stock market, the foreign exchange market and the financial intermediary sector. For each of these segments, sub-indices are calculated based on three raw measures of stress, such as price volatility, yield spreads and liquidity ratios. A total of 15 measures are used, which, after appropriate statistical transformation, are aggregated with time-varying correlations between the sub-indexes. As a result, the CISS assigns more weight to situations where stress occurs simultaneously in multiple market segments, reflecting its systemic nature. The index takes values in the range of (0,1), where a lower value indicates low volatility, consistency of market segments and overall stability. As the value of the index increases, stability decreases and more frequent sharp changes in asset prices are possible (Hollo, Kremer & Lo Duca, 2012).

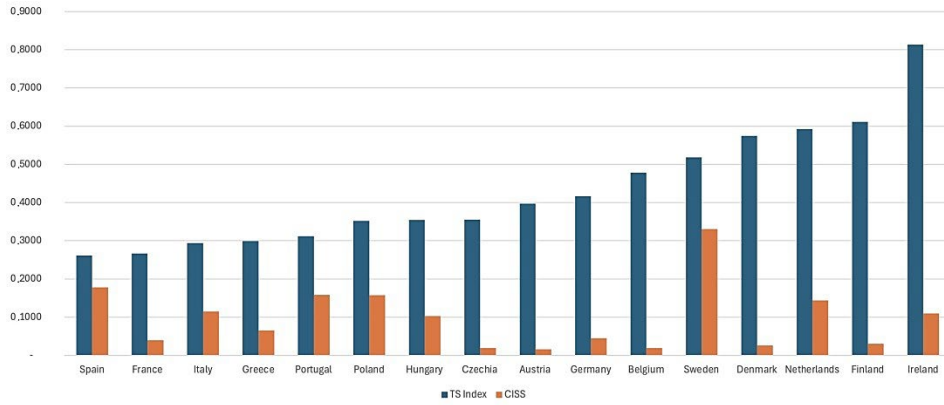
The most recent monthly data for EU countries at the time of the study was used. Data for February 2025 for 16 national financial markets can be seen in Table 3. The result for Bulgaria, Croatia, Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, Romania, Slovakia and Slovenia is not presented due to lack of available data.

An analysis of Table 3 shows a wide variation in the stability of national financial sectors. The highest value, and therefore the least stable market, is Denmark, Austria and Italy. In contrast, the Czech Republic, Ireland and Greece proved to be the most stable. At the same time, there is no apparent trend as to the higher stability of Eurozone countries. Two countries with moderate results are Poland and Sweden, countries with their own currencies. This may indicate

that the common currency is not the dominant factor in the case of sector stability.

**Figure 2**

*Comparison of the values of the technological sovereignty index and the CISS for the countries analyzed*




Source: Own study.

Pearson's correlation coefficient for the two indices was 0.0072, which indicates that there is no clear connection between the two values. The author analyzed the correlation of the various variables used to build the digital sovereignty index, obtaining the following values:

- Number of data centers per 1,000 residents: 0.186;
- Number of cloud facilities per 1,000 residents: −0.089;
- Share of companies using artificial intelligence: 0.622;
- Share of companies using cloud computing: 0.589;
- Share of ICT sector in GDP: −0.257;
- Share of companies employing ICT specialists in total employment: 0.254.

**Table 4**

*Comparison of correlation values between the component factors of the Technological Sovereignty Index and the CISS*

| Component | r (Pearson) | p-value | Interpretation |
|---|---|---|---|
| **Use of AI [% of companies]** | 0.622 | 0.00014 | Strong positive correlation, statistically significant |
| **Cloud usage [% of companies]** | 0.589 | 0.00039 | Strong positive correlation, statistically significant |
| **ICT in GDP [%]** | −0.257 | 0.155 | Negative correlation, not significant |
| **Data centers / 1,000 people** | 0.186 | 0.307 | Weak positive correlation, not significant |
| **Cloud facilities / 1000** | −0.089 | 0.63 | No correlation |

Source: Own study.

The correlation analysis between the components of the technological sovereignty index and the CISS index reveals that not all variables have a neutral or stabilizing effect on the financial sector. On the contrary, the high use of artificial intelligence and cloud services by companies is associated with a marked increase in the level of systemic stress. This may reflect increased vulnerability of the system to shocks, automation of pro-cyclical decisions or lack of control over the operating model. Thus, technological sovereignty should not be equated solely with the level of digitization, but with the quality of control and ability to manage modern infrastructure.

## Conclusions

The analysis confirms that technological sovereignty in AI can be an important component of macro-financial resilience, but it is not a clear-cut or unidimensional phenomenon. The Pearson correlation coefficient between the

sovereignty index and the CISS index was only 0.007, indicating that there is no statistically significant linear relationship between these variables. The results suggest that digital infrastructure alone is a necessary but not sufficient condition for financial stability.

A detailed analysis showed that variables related to the use of AI (+0.622) and cloud computing (+0.589) have the strongest positive correlation with CISS, which may reflect the risks posed by the automation of decisions, limited auditability of models and dependence on external vendors (vendor lock-in). In a crisis, these technologies may amplify shocks rather than cushion them. In contrast, the ICT sector's share of GDP (−0.257) and the number of data centers per 1,000 residents (0.186) showed a weak but stabilizing trend, suggesting that deeper embedding of digital competencies in the economy may act as a buffer against external shocks.

Based on the analysis, several directional recommendations were made for public policy in the area of digital sovereignty. First, building digital resilience should take into account not only the presence of infrastructure, but also real control over it – especially the ownership of EU entities. Second, the assumption that heavy use of AI and cloud without local control promotes stability should be reviewed, as without auditability, interoperability and strategic independence, it can increase systemic stress. Third, the EU should consider creating "digital macrostability" indices that measure systemic risk from automation, vendor lock-in and technology dependency, such as in the framework of EBA or FSAP activities. Fourth, the indices should take into account the ownership structure of digital infrastructure, determining the share of AI and clouds under the control of EU versus non-EU entities. Finally, digitization strategies should be synchronized with macroeconomic policies, treating AI development not just

as an innovation, but as a strategic resource, crucial to the ability to intervene effectively in a crisis.

The sample covers 16 EU countries with CISS availability during the analyzed period. The limited sample size and lack of full geographic coverage suggest caution in generalizing the results across the EU. The presented relationships should be considered as indicative of trends, not as universal evidence. In addition, the analysis is cross-sectional, comparing technological sovereignty levels in 2023 with systemic stress in early 2025. While this design provides useful insights into temporal ordering, it does not capture dynamic feedback effects over time.

A methodological limitation is that two of the six index variables (AI and cloud usage) reflect technology adoption rather than direct control, potentially blurring the distinction between structural sovereignty and the diffusion of foreign technologies. Moreover, integrating digital sovereignty indicators into macroprudential frameworks may face practical barriers related to data availability, differences in national capacities, and the cross-border nature of digital infrastructures. Future research should address these issues by developing alternative index specifications, using panel data to analyse dynamic relationships, and incorporating more granular indicators of ownership and control.

**Discussion**

The results undermine the prevailing assumption in the literature that the increase in digitization and use of AI automatically strengthens the systemic resilience of countries. Popular indexes, such as the AI Readiness Index or the Digital Economy and Society Index (Oxford Insights, 2023; European Commission, 2023), measure the degree of digitization and AI adoption as indicators of "digital readiness," assuming their positive impact on stability. Meanwhile, the analysis indicates that intensifying the use of AI and cloud

computing in an environment of limited infrastructure and competency control can increase systemic stress – this is supported by high positive correlations with CISS for the share of companies adopting AI (r = 0.622) and cloud (r = 0.589), as well as incidents of failure with cascading effects, such as CrowdStrike in 2024 (George, 2024).

The study proposes complementing the dominant normative-legal approaches (Pohle and Thiel, 2020) with an infrastructural and operational dimension, showing that digitization alone does not provide resilience without control over data localization, system interoperability and independence from foreign providers. In this sense, this approach fits in with the critique of the "de-sovereigntization" of digital infrastructure and the concept of technological neutrality of AI progress (Srivastava & Bullock, 2024). Technological sovereignty appears here not as an element of strategic ambitions, but as a prerequisite for the state's ability to respond to crises and limit contagion effects in complex financial systems.

An important practical consideration concerns the implementation barriers for the proposed digital macrostability indicators. While the results highlight the relevance of technological sovereignty for financial stability, integrating these indicators into existing macroprudential frameworks may be constrained by limited data availability, differences in national statistical capacities, and the cross-border nature of digital infrastructures. In particular, dependencies on non-EU technology providers complicate monitoring and regulatory oversight. Addressing these challenges would require improved data collection, harmonisation across EU member states, and closer coordination between financial supervisors and digital regulators.

**Summary**

The article assesses the impact of the level of technological sovereignty of EU countries on systemic stress in the financial sector, using the synthetic index and CISS data. Although no clear correlation was found between the overall level of sovereignty and the CISS, the analysis revealed that intensive use of AI and cloud computing – in the absence of local control – is associated with higher levels of systemic stress, suggesting vulnerability to disruption.

The study has limitations: cross-sectional nature (year 2023), limited sample of countries with CISS data availability, lack of consideration of qualitative differences in AI applications and cloud ownership structure. The results underscore the need for qualitative control of digital infrastructure in digitization policies and financial regulations, and the development of open, local and interoperable technology ecosystems appears as a tool for strengthening systemic stability, not just as an element of digital sovereignty.

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# USE OF THE VOLUME PROFILE IN MAKING INVESTMENT DECISIONS ON THE STOCK MARKET

**ABSTRACT**

**The purpose of the article.** In order to effectively multiply money on the capital market, it is necessary to use effective analytical methods to select the right financial instruments for an investment portfolio. This article focuses on the issue of the possibility to use the so-called volume profile to make investment decisions, which in its essence differs from classic indicators using turnover. In the article, the authors hypothesize that the volume profile makes it possible to identify the turning points of a listed instrument and thus can be an effective means for making investment decisions. On the basis of the assumptions made and in the light of the calculations performed, the research hypothesis presented in the introduction of the paper was positively verified. This indicates that the volume profile can be an important decision-making tool for investors and can thus be usefully applied in investment decision-making.

**Methodology.** Overall, this study focuses on determining the reaction of the WIG20 index in relation to the volume profile of the session immediately preceding the day under analysis. The study used the WIG20 index from January to June 2024.

**Results of the research**. According to the conducted analyses and calculations, a noticeable reaction of the WIG20 index value to the POC of the preceding session took place in approximately 90% of cases, which clearly indicates that this level determined during a given trading session is of significant importance for the course of quotations in the following day's session.

**Keywords:** stock market, investment strategies, volume profile

**JEL Class:** E22, E44, G11, G31


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## Introduction

Investing money in the capital market is a process that requires analyses to answer key questions about the choice of a financial instrument and the direction and right moment to take a position. Investors use a variety of methods to obtain an attractive rate of return, such as technical, fundamental or portfolio analysis, but it is also important to bear in mind the important influence of psychological factors on the decision-making process. One of the techniques used in this respect, which is rooted in technical analysis, is the evaluation and appropriate interpretation of trading volume in relation to the instrument of interest to the investor. Traditional tools using trading volume relate it to time, i.e., they indicate the turnover that has been realized in a given period (e.g., during a single trading session, or in other intervals: hourly, minute and others).

Modern computing technology and the continuous improvement of existing tools have led to the development of the so-called volume profile. In contrast to the traditional approach, volume here refers to the price at which transactions were made and not to the period of execution. This concept of calculating turnover provides a completely different perspective on the trades executed, as it makes it possible to determine which price level is of greatest interest to investors and, consequently, to identify potential support and resistance levels as turning points in the market.

The aim of submitted article, in the light of previous considerations, is to assess the possibility of using a volume profile in the process of making investment decisions on the stock market. The hypothesis adopted in the paper is that the volume profile makes it possible to identify the turning points of a listed instrument and thus can be an effective tool in investment decision-making.

To date, there are few studies on the subject of this article. This creates a research gap, which the authors intend to fill by devoting their attention to an in-depth analysis of the volume profile and how it can be used in making investment decisions in the stock market.

The results of the analyses and investigations carried out may be used in the future in practice by stock market investors wishing to enrich their arsenal of tools used in making decisions on capital allocation in the market.

In pursuit of the objective of this study, an analysis of the literature on the subject was carried out to the required extent, as well as quantitative research based on actual stock market quotations. Based on these, the applicability of the volume profile in the construction of an investment strategy was assessed.

**Using volume to make investment decisions – a literature review**

The possibility of making money on the capital markets has led investors to try to understand the mechanism that causes prices to move. This has developed various methods that, according to participants in the stock market game, enable them to make accurate decisions regarding the involvement of capital in specific financial instruments. The most commonly used tools in this regard include fundamental, technical and portfolio analysis (Tarczyński, 2001). The effectiveness of these methods varies. Depending on the analysis period adopted, the time interval, or the current market situation, the results obtained can demonstrate both the usefulness and uselessness of these methods (Anghel, 2015).

One of the key indicators that technical analysis offers can include the value of trading, or so-called volume. It represents the activity of traders in a specific time frame. The traditional evaluation of trading volume refers to the calculation of its volume in an assumed time interval. If, for example, we are interested in the volume of transactions for a given financial instrument during a single trading session, the value of all transactions must be added up and the result is generally presented in the form of a so-called histogram, i.e., a vertical line plotted on a graph of the relevant stock (Murphy, 2019).

In order to take a closer look at trading volumes, different types of indicators based on volume and price are used to provide an in-depth analysis of the market. Some of the most commonly used include the following ones.

On Balance Volume (OBV) is a so-called trading momentum indicator. Its use comes down to assessing the pressure from buyers and sellers to trade. It is a cumulative indicator, meaning that if the price in a given time interval has increased, the corresponding volume is added to the value of the OBV total, and if the price has decreased, the value of trading from that interval is subtracted from the value of the OBV total (Schade, 2014). The indicator is represented as a line on the chart, which is used to identify trends or divergence. It is assumed that the indicator should precede the price movement of the analyzed stock (Gallegos-Erazo, 2022).

Another useful tool in this area is the Chaikin Money Flow, whose formula was developed by Marc Chaikin. The indicator has the character of an oscillator and its values range from -1 to +1. In addition, a zero base line is drawn on the chart. Its crossing by the indicator indicates an inflow or outflow of money from the market (Thomsett, 2010; Cohen, 2020).

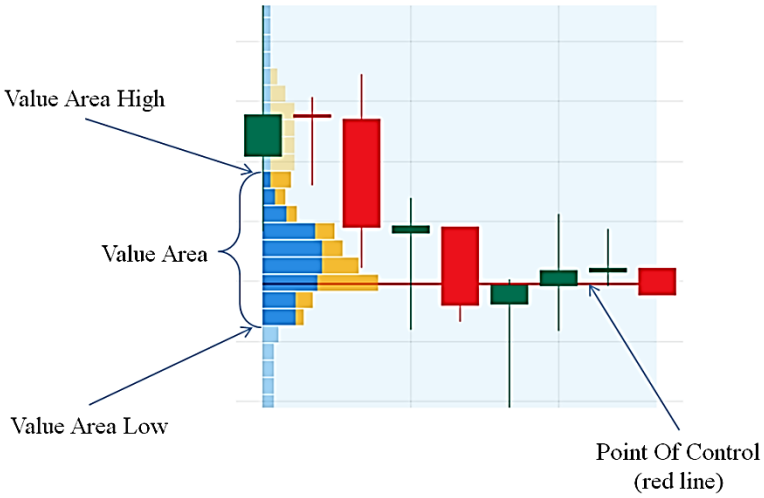
Another commonly used tool by investors to analyze turnover is the Money Flow Index, which also belongs to the group of oscillators. It measures the size of the money flow entering or leaving the market. It is generally used to assess the oversold and overbought levels of the market in a given time interval, facilitated by reference lines generally plotted at 20 and 80 points respectively (Phoung, 2021).

The next two indices, the Negative Volume Index and the Positive Volume Index, take into account price and turnover volume in the calculation. The difference between the two is that the former takes into account for its calculation only those periods with a lower turnover in a given interval than in the preceding period. The second indicator, on the other hand, only takes into account periods with a higher turnover than the preceding period. The use of these methods usually boils down to determining the moment of intersection of the values of the indicators with the average calculated on their basis, searching for divergence, or identifying trends formed in the graphs of the indicators (Kaufman, 2021; Peterson, 2003).

The indicators discussed so far, which are popular with investors, take into account the volume of trading in a given time interval. The so-called volume profile, which is the subject of analysis in this study, represents a completely different approach. Obviously, trading volumes refer to the price at which they were executed. It is for this reason that it is presented on the chart as a histogram, but plotted as a level. This means that the longer the line corresponding to a given price is, the more trading took place at that price. Figure 1 shows an example of a volume profile plotted on a candlestick chart, with the key elements labelled. The Value Area (VA) is the price area in which 70% of the trading took place and the Value Area High (VAH) and Value Area Low (VAL) points indicate the upper and lower price levels bounding the VA area respectively.

**Figure 1**

*Example of volume profile*




Source: Own compilation on the basis of stock market quotations of the WIG20 index using the online platform.bossa.pl/webtrader and (Chutka & Rebetak, 2021).

The red horizontal line marked as Point of Control (POC) is a very important level, as this is the price at which the highest number of trades in terms of volume were executed, in other words, the price at which the POC level was the highest volume traded in a given period. In this way, the trader can clearly see at which price levels there was interest in trading and, conversely, at which price levels market participants were not willing to execute their orders. Low-volume areas located above the VAH level and below the VAL level represent reversal areas, when the price is not accepted by a large number of traders and only a small percentage of trades are executed here. The market tends to reject these areas. The price either bounces back or quickly moves to another value area (Ante, 2020).

The use of the POC by investors very often comes down to treating this level as support and resistance. Needless to say this is not the only strategy in this respect, however, due to the subject matter of this paper, the authors will only focus on this aspect.

Both support and resistance are important levels, attracting the attention of traders, and turnover is noticeably higher at these points. Support is a level that stops prices from falling further, the price bounces off it and starts to rise. Resistance, on the other hand, is a level that blocks prices from further increases, and once the price reaches it, it changes direction and begins to fall. Knowing the potential locations of support and resistance can be expected to be local turning points in the market (Kahn, 2011).

**Methodology and research**

Overall, this study focuses on determining the reaction of the WIG20 index in relation to the volume profile of the session immediately preceding the day under analysis. The study used the WIG20 index from January to June 2024.

Details of the study methodology:

- a volume profile indicator was superimposed on the one-hour interval of the index for each trading session, as shown in Figure 1;

- it was analyzed how the values of the WIG20 index evolve during the study trading session in relation to the volume profile distribution of the previous day's session;
- on the basis of daily observations, seven general patterns were distinguished in the behavior of the index values in relation to the volume profile from the previous day's session.

Value out of the previous day's range – meaning that trading on a given day is entirely above the maximum value or below the minimum value of the preceding session.

Value within the previous day's range does not reach the POC – meaning that during a given trading session, the index values have not reached the POC of the preceding session.

Consolidation around the POC – meaning that the index value during the trading session tended to remain in an area close to the POC of the preceding session for a long time.

No reaction – value beats the POC area – meaning that the index value has beaten the POC level from the top or bottom without reacting with a consolidation or rebound typical of support and resistance levels.

Support/resistance rebound from the POC: up to 20 pts. – which means that the index value has moved less than 20 points away from the POC level, treating this level as local support or resistance.

Support/resistance rebound from POC: 20–40 pts. – which means that the value of the index, having reached the POC, moved away from it by a range between 20 and 40 points, treating this level as local support or resistance.

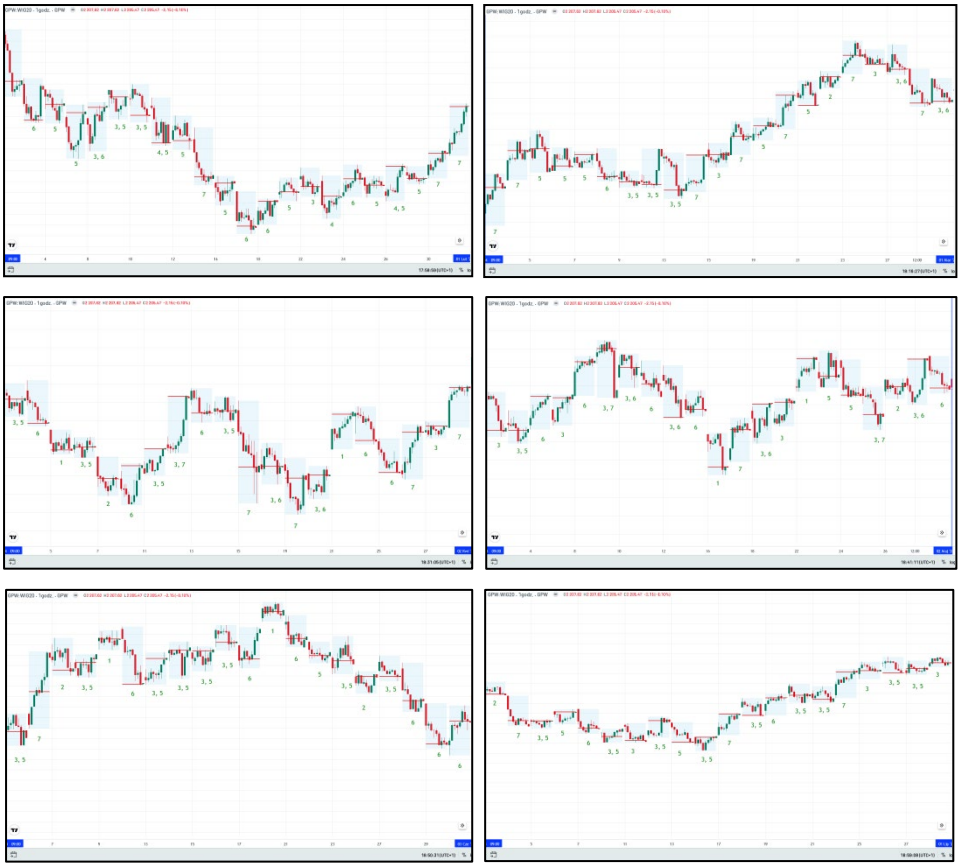
Support/resistance rebound from POC: + 40 pts. – which means that the value of the index has moved away from the POC level by more than 40 points, treating this level as local support or resistance.

In Figure 2, the numbers indicate the type of reaction of the WIG20 index value with respect to the volume profile from the preceding session. It is

worth noting that the behavior of the index in some sessions was subordinated to two patterns, e.g., consolidation and rebound by a specific number of points. Table 1 further summarizes the number of these reactions in subsequent months.

**Figure 2**

*WIG20 index in the period January –June 2024 with the volume profile indicator in the one-hour interval*



Source: Own compilation on the basis of stock market quotations of the WIG20 index using the online platform.bossa.pl/webtrader and (Chutka & Rebetak, 2021).

**Table 1**

*Number of WIG20 value responses for the extracted schemes*

| WIG 20 reaction to the POC of the preceding session | I | II | III | IV | V | VI | Total |
|---|---|---|---|---|---|---|---|
| 1. Value outside the range of the previous day | 0 | 0 | 2 | 2 | 2 | 0 | **6** |
| 2. The value in the previous day's range does not reach the POC | 0 | 1 | 1 | 1 | 2 | 1 | **6** |
| 3. Consolidation around the POC | 4 | 7 | 7 | 10 | 8 | 12 | **48** |
| 4. No response – value overcomes POC area | 3 | 0 | 0 | 0 | 0 | 0 | **3** |
| 5. Support/resistance rebound from POC: up to 20 points | 11 | 8 | 4 | 3 | 9 | 11 | **46** |
| 6. Support/resistance rebound from POC: up to 20 points | 5 | 3 | 7 | 9 | 6 | 2 | **32** |
| 7. Support/resistance rebound from POC: + 40 points | 3 | 7 | 5 | 3 | 1 | 3 | **22** |
| Number of reactions | **26** | **26** | **26** | **28** | **28** | **29** | **163** |

Source: Own elaboration based on Figure 1.

**Table 2**

*Share of WIG 20 value reactions for the identified schemes (%)*

| WIG 20 reaction to the POC of the preceding session | I | II | III | IV | V | VI | Total |
|---|---|---|---|---|---|---|---|
| 1. Value outside the range of the previous day | 0 | 0 | 8 | 7 | 7 | 0 | **4** |
| 2. The value in the previous day's range does not reach the POC | 0 | 4 | 4 | 4 | 7 | 3 | **4** |
| 3. Consolidation around the POC | 15 | 27 | 27 | 36 | 29 | 41 | **29** |
| 4. No response - value overcomes POC area | 12 | 0 | 0 | 0 | 0 | 0 | **2** |
| 5. Support/resistance rebound from POC: up to 20 points. | 42 | 31 | 15 | 11 | 32 | 38 | **28** |
| 6. Support/resistance rebound from POC: up to 20 points. | 19 | 12 | 27 | 32 | 21 | 7 | **20** |
| 7. Support/resistance rebound from POC: + 40 points. | 12 | 27 | 19 | 11 | 4 | 10 | **13** |
| Number of reactions | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

Source: Own elaboration based on Figure 1.

The figures presented in Tables 1 and 2, which are the result of the analysis, indicate that the volume profile, by determining the POC (point of control), facilitates the precise determination of support and resistance levels, which, in turn, enables the trader to set buy or sell orders at those points. A noticeable reaction of the index value during a given day to the POC determined for the preceding session took place in 61% of cases (see Table 2, sum of rows 5, 6, 7, column 'Total'). It is also worth noting that the consolidation around the POC point representing 29% of the observed value reactions (see Table 2, row 3, column 'Total') took place, except in a few cases only, always in conjunction with a rebound (reactions 5, 6, 7). This means that in approximately 90% of the cases, i.e., excluding reactions in the form of an opening outside the previous day's range or the failure to reach the previous day's POC (see Table 2, rows 1 and 2, column 'Total'), the value of the index under examination reaching the POC of the preceding session reacted noticeably in the form of a rebound from that level.

From a practical point of view, the results of the analysis carried out can be used by applying the POC from the preceding session to set buy or sell orders in the current session. If the opening is above the POC, this level can be considered as support. If the opening is below the POC, this level can act as resistance.

The analysis is based on the values of the WIG20 index and therefore refers to the portfolio of its constituent companies. In order to be able to apply the conclusions of the calculations to the actual stock exchange game, the volume profile must generally be calculated individually for each company.

## Conclusions

In the article, the authors hypothesize that the volume profile makes it possible to determine the turning points of a listed instrument and thus can be an effective tool in making investment decisions. According to the conducted analyses and calculations, a noticeable reaction of the WIG20 index value to the POC of the preceding session took place in approximately 90% of cases, which clearly indicates that this

level determined during a given trading session is of significant importance for the course of quotations in the following day's session.

During the adopted research period, the hypothesis was positively verified and the use of the volume profile appears to be an effective tool that can be used by investors when deciding to invest capital in the stock market. However, it should be borne in mind that the volume profile should not be the only decision-making tool for the investor, but the signals from its observation should be confirmed by other analytical methods.

The results obtained will undoubtedly provide a reference point for further research on the volume profile taking into account, in particular, a different amount of historical data, a change in time interval, or the use of other financial instruments. All of these will help investors to better understand and use the volume profile to make investment decisions.

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# STRATEGIES FOR FINANCING THE HOUSING NEEDS OF YOUNG POLES

**ABSTRACT**

**The purpose of the article**. Housing issues are the foundation of every economic system and they are frequently the subject of public debate. Young people are among the most interested participants of the residential real estate market, as they are just creating the framework of their future professional and private life. The aim of this publication is to identify the diversity of strategies for financing housing needs of young Poles as well as to assess the significance of factors influencing preferences in this area. To achieve this goal, the article formulates a research hypothesis stating that mortgage loans constitute the primary source of financing for housing purchases among young Poles. In order to verify this hypothesis a survey and statistical data analysis tools were used.

**Methodology**. The analysis was conducted on the basis of data collected through a scientific study in the form of a survey entitled "Strategies for financing housing needs among young Poles" containing single-choice and multiple-choice closed-ended questions. The study was conducted on a sample of 200 people using the CAWI method.

**Results of the research**. The analysis of the study results showed that the vast majority of respondents believe that it is not easy for young people to finance the purchase of a residential property. However, most of them intend to acquire their own one by the age of 35.

**Keywords:** housing market, real estate, financing, CAWI, young Poles

**JEL Class:** D14, R21, R31, G51, C83


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## Introduction

Issues related to housing are the foundation of any economic system, and at the same time they are very often the subject of public debate. Housing is a basic commodity of everyday use (Bryx, 2007) and plays a key role in the functioning of households around the world. It provides both physical and mental security and is the basis for personal and professional development (Kuśmierz et al., 2023). The importance of residential real estate is reflected in the most important legal acts applied both globally and locally. Pursuant to Article 25(1) of the Universal Declaration of Human Rights (UN General Assembly Resolution 217 A (III) of December 10, 1948), everyone has the right to a standard of living that ensures the health and well-being of himself and his family, including food, clothing, housing, medical care and necessary social benefits, and the right to unemployment insurance, illness, inability to work, widowhood, old age or loss of livelihood in any other way beyond his control. The Charter of Fundamental Rights of the European Union (OJ L C 326, 26.10.2012, pp. 391–407), Article 34 (3) states that, in order to combat social exclusion and poverty, the Union recognizes and respects the right to social and housing assistance in order to ensure, in accordance with the principles laid down in the Union law and national laws and practices, a decent existence for all persons who lack sufficient resources. The policy conducive to satisfying housing needs is also regulated in the Constitution of the Republic of Poland (Journal of Laws of 1997 No. 78, item 483) in Article 75 (1), where public authorities are ordered to meet these needs by counteracting homelessness, supporting the development of social housing and supporting activities aimed at obtaining one's own housing. Additionally, real estate is considered a primary asset class in the literature, essential for both developed and developing countries (Okunevičiūtė et al., 2025).

In Poland (as of 2020), there are an average of 392.4 dwellings per 1000 people (Samorek & Cichocki, 2023). Compared to Europe, this result is poor and is 26% lower than the average for EU countries and 19% lower than the OECD average. Nevertheless, in the case of Poland, the statistics on the intensity of construction of

new dwellings looks favorable (NBP, 2023). According to OECD data, dwellings completed in Poland accounted for 1.5% of the existing housing stock (2022). It is worth noting that the EU average in this aspect was only 0.9%.

The issue of demography in Poland is inextricably linked to the subject of the real estate market. According to the results of the report "Population forecast for 2023–2060" (Central Statistical Office, 2023):

- there will be a clear loss of population in Poland by 2060;
- there will be an aging process of the Polish population, which means an increase in the percentage of the population over 65 years of age, as well as a large decrease in the number of children and young people;
- forecasts show a decrease in the population in all voivodeships;
- in the years 2023–2060 a positive net migration will be maintained;
- there will be progress in suburbanization.

As a consequence, it should be pointed out that the demographic situation in Poland is deteriorating, and the housing stock in the country is increasing. According to Iwona Foryś (2013), future housing needs in Poland will be influenced by a low birth rate, upward shifting in life expectancy and a wave of demographic lows and booms entering the housing market, which strengthen or weaken the demand for housing.

One of the tools that enable the purchase of a residential property are mortgage loans. Financing transactions for both retail and corporate clients is a key factor in shaping demand and supply in the real estate market. Table 1 presents the key factors shaping demand and supply on the real estate market.

**Table 1.**

*Housing market – basic factors shaping the demand and supply of housing*

| Housing demand | Housing supply |
|---|---|
| 1. Income | 1. Existing Resource |
| Own income | 2. Renovations, modernizations |
| Transfers | 3. Losses, changes of purpose |
| Loans | 4. Housing |
| 2. Pricing | Prices |
| Rents | Costs |
| Housing prices | Land |
| Interest rates | Regulations |
| 3. Preferences | |

Source: NBP (2006).

Lending activity in Poland has been regulated in the Banking Law, while the issue of norms concerning loans has been included in the Civil Code and other acts (Dobosiewicz, 2003). In business practice, the term "mortgage loan" refers both to the form of collateral in the form of a mortgage, as well as its purpose related to the financing of real estate market and its characteristics in the form of long-term and high amount (Polish Financial Supervision Authority, 2012)

According to the data contained in the Polish reports on housing loans and real estate transaction prices AMRON-SARFiN, data from the Polish Bank Association, the Central Statistical Office and the National Bank of Poland, Table 2 presents the most important characteristics for the Polish residential sector.

**Table 2.**

*Key characteristics of the residential real estate market in Poland in 2020–2024*

| Position | Q3 2020 | Q3 2021 | Q3 2022 | Q3 2023 | Q3 2024 |
|---|---|---|---|---|---|
| Number of active loan agreements (in millions) | 2.467 | 2.539 | 2.438 | 2.292 | 2.267 |
| Total amount of debt due to housing loans (in billions PLN) | 467.809 | 500.117 | 510.381 | 482.661 | 493.210 |
| Number of contracts concluded | 48 782 | 68 353 | 21 218 | 40 749 | 45 897 |
| Value of contracts concluded (in billions PLN) | 14.141 | 23.229 | 7.007 | 15.843 | 19.315 |
| Average total loan value (in PLN) | 288 828 | 339 133 | 329 569 | 387 980 | 421 695 |
| Average transaction price of 1 m² apartment in Warsaw (in PLN) | 9 568 | 10 738 | 11 400 | 12 988 | 14 548 |
| Average monthly rent rate in Warsaw (in PLN) | 1 714 | 1 793 | 2 187 | 2 271 | 2 301 |
| Average transaction price of 1 m² apartment in Krakow (in PLN) | 8 132 | 9 249 | 9 714 | 11 027 | 13 676 |
| Average monthly rent in Krakow (in PLN) | 1 342 | 1 383 | 1 727 | 1 796 | 1 846 |
| Average transaction price of 1 m² apartment in Wroclaw (in PLN) | 7 286 | 7 932 | 8 863 | 9 955 | 11 946 |
| Average monthly rent in Wroclaw (in PLN) | 1 492 | 1 541 | 1 902 | 1 871 | 1 878 |
| Average monthly rent in Katowice (in PLN) | 937 | 951 | 1 083 | 1 221 | 1 254 |

Source: AMRON-SARFiN (2020, 2021, 2022, 2023, 2024).

The presented data indicates a high dynamic of changes in the price of real estate and an increasing average amount of the total value of the loan granted. The values for average transaction prices of 1 m² in large cities in Poland stand out in particular. In Warsaw, Kraków and Wrocław, the growth rate according to the constant base for 2020 in Q3 by 2024 Q3 amounted to over 150%. The value of the average monthly rent rate also increased in these cities, but not that dynamically. Despite

the data presented, some researchers do not find any evidence to confirm the hypothesis of the current real estate bubble forming (Trojanek et al., 2023).

The housing market has long been the subject of intensive economic analysis, particularly in the context of concepts such as speculative bubbles and changing patterns of demand. On the one hand, it involves the fulfillment of one of the most basic human needs — providing a place to live — while on the other hand, as in any capitalist market, it attracts entrepreneurs and investors seeking to maximize the value of their enterprises and increase returns on investment. The housing decisions of young households can be analyzed in the light of the life-cycle hypothesis (Modigliani et al., 2005), which assumes that consumption and investment patterns vary across different stages of life. At a young age, limited financial resources and employment uncertainty tend to favor renting over purchasing property. Closely related to this hypothesis is the wealth effect (Guren et al. 2018), according to which rising property prices increase household wealth and may stimulate consumption. The literature also emphasizes the importance of credit constraints (Landvoigt, 2014), which significantly affect the ability of young households to purchase housing. Additionally, the behavioral economics perspective suggests that young people's housing aspirations are shaped not only by economic factors, but also by social norms and the perceived significance of homeownership. An equally important issue is the phenomenon of speculative bubbles forming in the real estate market. This concept is often explained through expectations theories, which describe how market participants form their beliefs about future housing prices.

A critical analysis of the above-mentioned data allows us to conclude that the situation on the residential real estate market for young people may undoubtedly raise concerns, which, considering the specificity of everyday use goods such as a residential real estate, should be noticed by the authorities in Poland.

The aim of this publication is to identify the diversity of the strategies for financing the housing needs of young Poles and to assess the significance of factors

influencing preferences in this area. To achieve this goal, a survey and statistical data analysis tools were used. The results were compared with the previous studies.

***Methodology of the study***

For the purposes of the survey, the term "young generation" should be understood as people under 31 years of age who are entering independent adult life. Their opinions are extremely valuable due to the fact that they are likely to be the main consumers on the residential real estate market in the coming years.

In order to achieve the aim of the study a questionnaire was prepared. The survey was conducted using the CAWI (Computer-Assisted Web Interview) method using the Google Forms tool. This tool was chosen because it is the most common method of collecting data using questionnaires, and it is particularly commonly used by students. The questionnaire consisted of 15 (or in selected cases 16 questions) single-choice and multiple-choice and a metric.

The survey was conducted on a sample of 200 subjects meeting the conditions related to the respondent's age.

***Research sample***

Two hundred respondents took part in the scientific study via an online questionnaire. The majority (58%) of the respondents were women, while 40% of the respondents were men. The remaining 2% of the respondents did not want to reveal their gender. In the 2023/24 academic year, women accounted for 58.5% of students, indicating a sample close to representative (Central Statistical Office, 2024).

The study was focused on young people, so only people aged 18–30 were selected for the analysis. The largest part of the respondents were people aged 22–25 and, as a rule, this is the period at the turn of the decision to continue studying at the master's degree, which correlates with the distribution of respondents in terms of the year of study. In these groups, slightly more than 40% of people are students in the first, second or third year, another 42% are students in the fourth and fifth year (or the first and second year of supplementary master's studies). 15.5% of the re-

spondents have completed their studies (30 people) or have not started them. In the sample, as many as 98% of respondents are people who are in the process of obtaining or have obtained higher education.

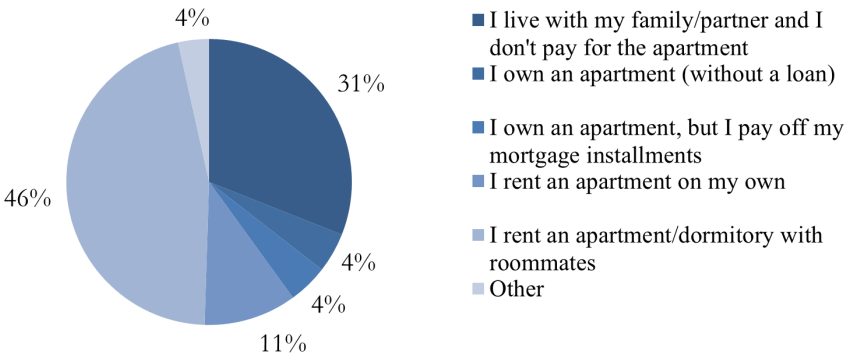
The vast majority of respondents are students, so the structure of residence is very diverse, which is related to frequent studies in a city other than the place of residence. The best educational centers are located in the largest Polish cities, and some older students stay in larger places due to greater employment opportunities and higher earnings.

***Results of the study***

Firstly, it was necessary to characterize the current housing situation of the respondents (chart 1). The most common answer to the question "Where do you currently live?" was "I rent an apartment or dormitory with roommates" (92 people). A declaration regarding living with a family and a partner and not paying rental costs was expressed by 62 people. The third place was taken by the answer related to renting an apartment on one's own, which was selected by 21 respondents. The remaining answers and the answer "Other answer" accounted for 12.5% of the sample.

**Chart 1.**

*Structure of the answers to the question "Where do you currently live?"*

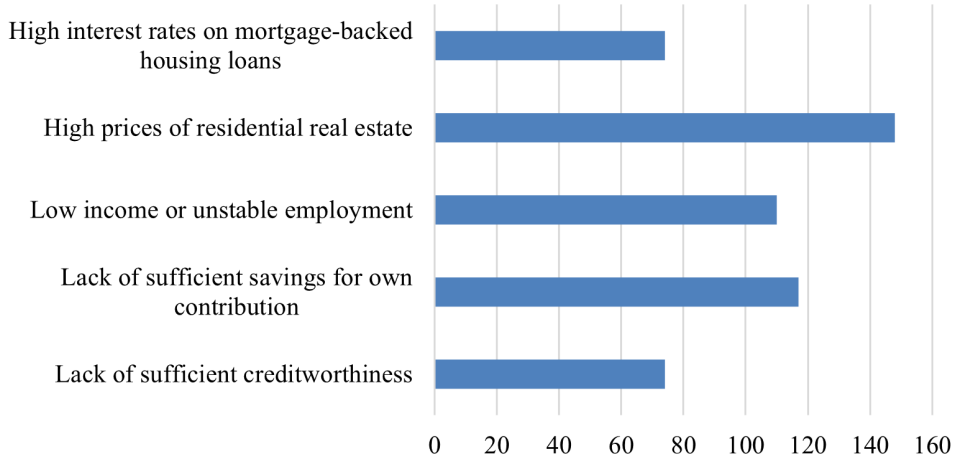



Source: Own study based on the conducted research.

Young people entering the housing market face many barriers (chart 2). When asked about the factors that constitute the biggest barriers to obtaining financing for the purchase of residential real estate, the respondents expressed particular emphasis on the answer "High prices of residential real estate", which was declared by almost 3/4 of the respondents.

**Chart 2.**

*The biggest barriers to obtaining financing for the purchase of real estate in the opinion of respondents*




*multiple answer closed-ended question

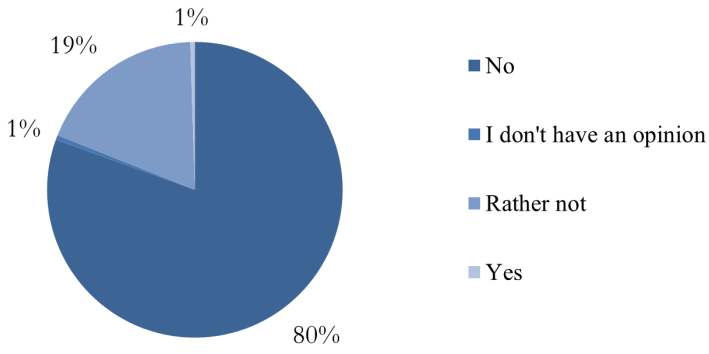
Source: Own study based on the conducted research.

The answers indicated by more than half of the respondents were also "Lack of sufficient savings for own contribution" and "Low income or unstable form of employment". Exactly 74 people indicated the options "Insufficient creditworthiness" and "High interest rates on mortgage-secured housing loans". It is worth noting that the respondents more often indicated the answer regarding high prices of residential real estate than high interest rates on mortgage-secured housing loans. This question was a multiple-choice question, so respondents could select more than one answer.

Barriers to obtaining financing or difficulties are subjective issues and show varying intensity among the respondents (chart 3). When asked "Do you think that in the current market situation it is easy for young people to finance the purchase of a residential property?" in accordance with the common belief, most of the answers were negative – in total, the answers "No" and "Rather not" were indicated by 99% of the respondents, which clearly emphasizes the concerns of the young generation about the situation related to the purchase of their own apartment or house.

**Chart 3.**

*Respondents' opinion on the statement that "in the current market situation, it is easy for young people to finance the purchase of a residential property"*



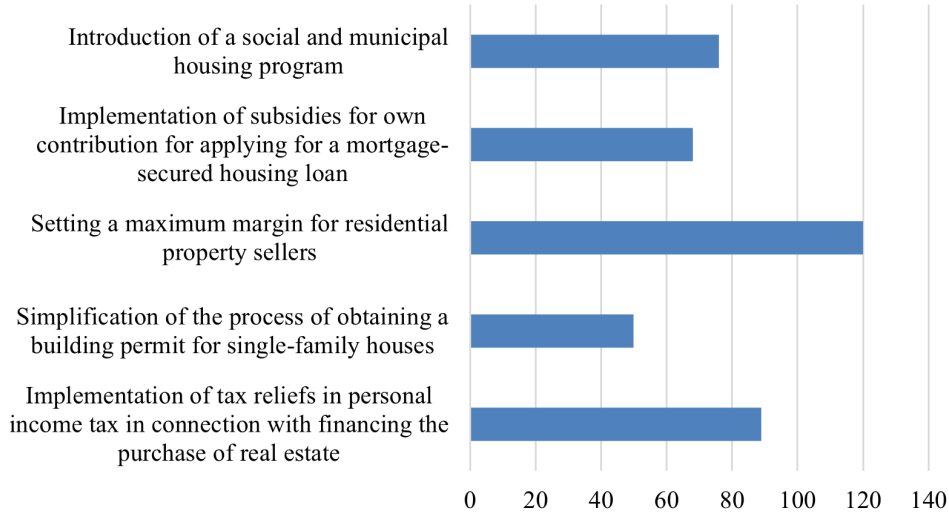

Source: Own study based on the conducted research.

The subject of state interference in the housing market is often raised in the public opinion. The Constitution and the Treaty on the Functioning of the EU indicate that the basis of the economic system of the Republic of Poland is a social market economy based on the freedom of economic activity (Journal of Laws of 1997 No. 78, item 483), and within the framework of the single European market it is even obliged to comply with the principles of a free market economy (Journal of Laws No. C 326, 26.10.2012). When asked about the actions that the Government should take to

make it easier for young Poles to finance their housing needs (chart 4), the most frequently chosen answer was to set the maximum margin for sales contracts (60%), which is an action that significantly interferes with the market, which may lead to the withdrawal of some developers and a reduction in supply. The remaining answers were, e.g., the implementation of tax reliefs in PIT (44.5%), the introduction of a social and municipal housing program (38%), the implementation of subsidies to own contribution for applying for a mortgage loan (34%) and the simplification of the process of obtaining a building permit for single-family houses (25%).

**Chart 4.**

*Respondents' expectations regarding the necessary actions to be taken by the government to facilitate the financing of housing needs for young Poles*




*multiple answer closed-ended question

Source: Own study based on the conducted research.

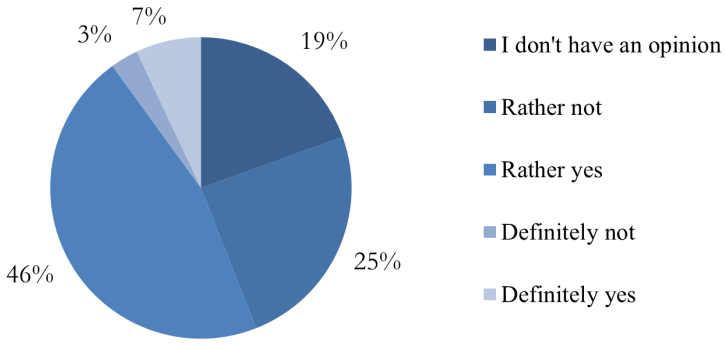
In addition, the question included a "Different answer" option, where respondents could enter their own suggestions. With the help of this field, they suggested actions related to the introduction of a cadastral tax, the introduction of taxation of

excess profits and the restriction of activities consisting in "flipping" apartments, i.e., buying real estate and then selling it after prior renovation.

One of the means, often necessary, to finance a residential property is a mortgage-secured housing loan. When asked whether they believe that a mortgage-backed housing loan is a beneficial form of financing the purchase of residential real estate (chart 5), 53% of respondents spoke positively about a mortgage loan as a form of financing the purchase of residential real estate, while 27.5% spoke negatively. Almost 1/5 of the respondents said that they had no opinion on this subject. Poles, despite their aversion to debt, if they decide to make a commitment, it is most often due to high amounts that take many years to collect (National Debt Register Economic Information Bureau S.A., 2018).

**Chart 5.**

*Respondents' opinion concerning the statement that "a mortgage-secured housing loan is a beneficial form of financing the purchase of residential real estate"*



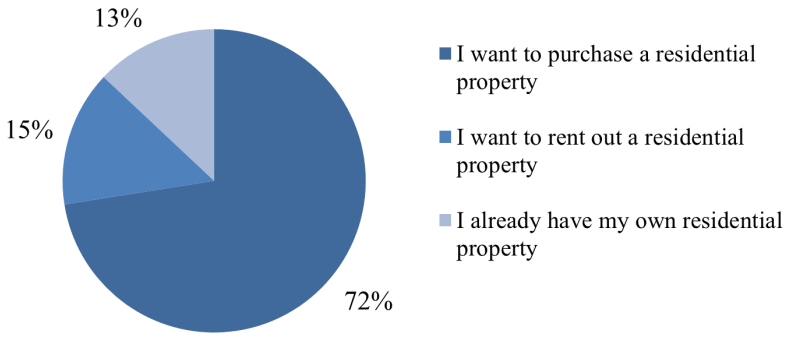

Source: Own study based on the conducted research.

Young people faced with the choice of financing their housing needs have two basic options: rent or buy a residential property. When asked about the way in which they intend to finance their housing needs until the age of 35 (chart 6), the respondents in the vast majority of 145 people (72.5%) indicated the answer related

to the purchase of a residential property. It should be emphasized that among men the percentage of answers agreeing with this statement was slightly higher than among women (77.5% compared to 71.55%). Only 14.5% of respondents chose renting. The results of the answers of the oldest people participating in the survey (26–30 years old) were also interesting, as only two out of 26 people decided to give an answer related to renting. Slightly fewer people, 13% to be exact, said that they already have their own residential property. It was crucial from the perspective of the further survey, because depending on the answers, it referred to separate sections with questions.

**Chart 6.**

*Planned method of financing the housing needs of respondents up to the age of 35*[1]




Source: Own study based on the conducted research.

The most common motives for buying flats among buyers aged up to 35 are primarily (Strączkowski, 2013):

1) insufficient existing housing conditions (1.87 points);
2) family growth (1.43 points);

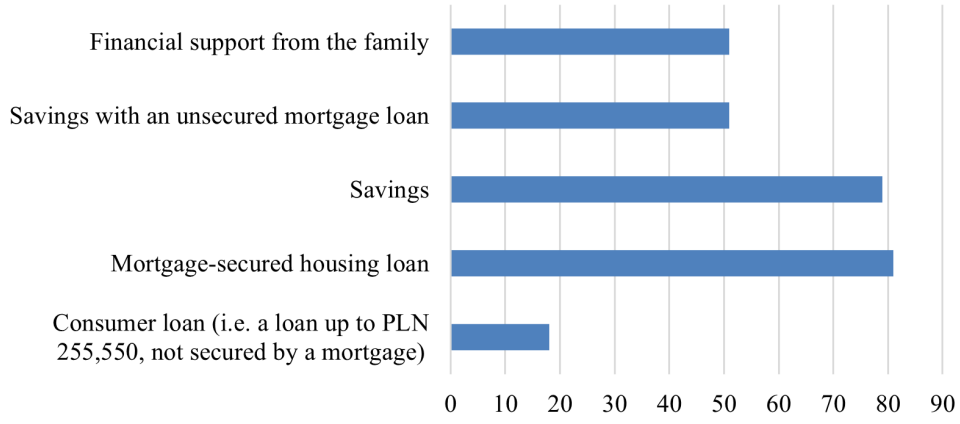
[1] age (35 years old) was selected based on the comparable study in the literature.

3) marriage (1.23 points);
4) the willingness of one of the parties to the relationship to buy an apartment before marriage (0.6 points).

Respondents who indicated the purchase of a residential property up to the age of 35 were asked to indicate three factors that had the greatest impact on their choice of owning an apartment. Three most frequently indicated factors were: increased stability and financial security (131), the ability to adapt the apartment to one's own needs (116) and building one's own assets (112). Two less frequently chosen options were the expectation of an increase in the value of the property in the long term and the lack of problems with the landlord.

**Chart 7.**

*Intended method of financing the planned purchase of real estate among the respondents*




*multiple answer closed-ended question

Source: Own study based on the conducted research.

The main planned ways of financing real estate by the respondents (chart 7) are savings together with a mortgage-secured housing loan (18%). Some of the respondents also count on support from their families, and a smaller part intends to

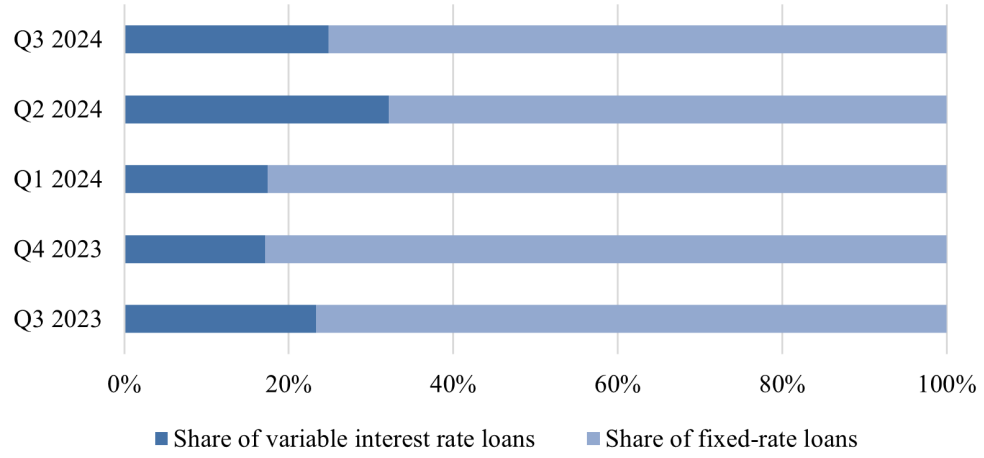
take advantage of alternative loans. Financial support from the family, except for one case, has always accompanied other forms of financing, which means that there are few people who, not having a guaranteed property now, expect such a large support in the foreseeable future, and who have not yet benefited from it. At this point, it should be recalled that some of the respondents (13%) at the time of completing the survey declared that they owned a residential property, regardless of whether it was inherited, purchased with their own funds or mortgaged.

Most often, the debt period for newly granted housing loans is in the range of 25–35 years and this is the characteristic for 60.49% of loans (Polish Bank Association, 2024). Respondents asked about the preferred loan period in large part, because as many as 37% do not yet know what period will be sufficient, but an interesting situation is taking place among people who have a plan. Namely, few people (6%) are determined to take out a loan under 10 years, most people, almost 20% are thinking about a loan for a period of 10–15 years, and then fewer and fewer people are interested in a longer commitment. Compared to reality, these are very optimistic assumptions.

When asked about their preferred interest rate, the vast majority (69%) prefer a fixed interest rate. This option is not necessarily more economically beneficial, but it certainly gives a greater sense of stability. Among the respondents, 19% do not have the appropriate knowledge to present their preferences. The distribution of respondents' answers is very similar to the current structure of the value of newly granted loans by interest rate type (chart 8). It is worth noting that a few years ago in Poland there were actually no fixed-rate loans at all.

**Chart 8.**

*Value of newly granted housing loans in Poland by type of interest rate in 2023–2024*




Source: Polish Bank Association (2024), AMRON-SARFiN (2024).

Then, when asked about the preferred location for buying real estate, the respondents largely chose the largest cities. However, there is quite an important part that plans to buy real estate in smaller towns and in the countryside. This corresponds to the previous question, where respondents were asked whether location and prices in local markets have an impact on purchase decisions. At that time, 94% of the survey participants ticked the "Definitely yes" and "Rather yes" options.

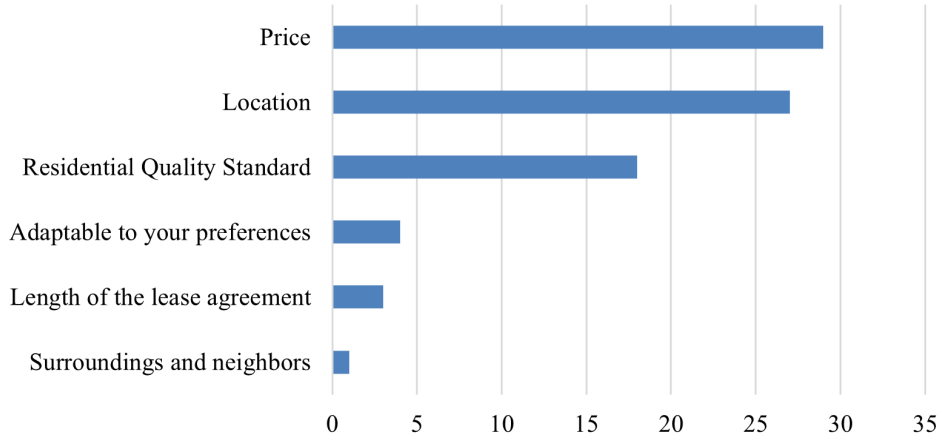
Some of the respondents who intend to rent a residential property up to the age of 35 in the planned future were asked about their reasons for doing that. Among the most frequent answers were: lack of funds for own contribution to a mortgage-secured housing loan (83%), lack of sufficient creditworthiness (76%) and flexibility in choosing a place of residence (69%). A smaller percentage of people, as in the case of owning real estate, treat it as an investment decision, and more as a specific life need. The content of the answer indicates that it is more often an economic decision and a kind of necessity than a choice. The next question, as in the section devoted to property ownership, was the issue of location. In the case of

renting, the vast majority prefer larger towns. This is in line with the capabilities of young people entering the market and the availability of apartments for rent.

The choice of residential property for rent and purchase does not differ significantly from each other. When asked about the most important criteria when choosing an apartment for rent (chart 9), the respondents in their answers primarily pointed to the price and while the cash equivalent is a measure of value, it is important that it is to some extent correlated with the quality of the premises, which was indicated by only 62% of respondents. The second most frequently chosen answer was location, which was indicated by 93% of people. Marginal answers were: the possibility of adaptation according to one's own preferences, the length of the lease agreement, the surroundings and neighbors. Similar results were found in a survey on a sample of 513 adult residents of new housing estates/investments that were built in the last two years in the five largest cities in Poland: Warsaw, Krakow, Tricity, Wrocław and Poznań (about 20% of respondents in each city) when looking for a property to buy, by far the most important criteria influencing the decision were price, location and size of an apartment or house (Otodom, 2018).

**Chart 9.**

*Key criteria when choosing an apartment for rent in the opinion of the respondents*

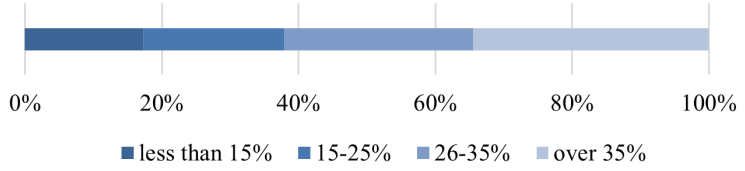



Source: Own study based on the conducted research.

Choosing an apartment is inextricably linked to social issues such as the choice of roommates. When asked about their preference in this area, the respondents most often indicated that they do not know yet (34%), partner (24%) and friends (31%). The other options were: family and living alone.

**Chart 10.**

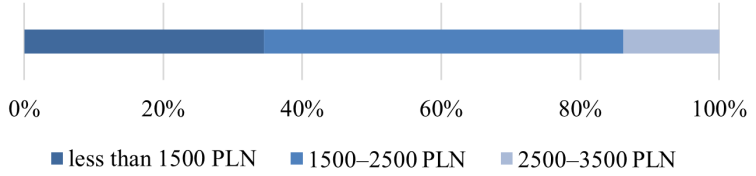
*Maximum costs of renting a residential property in the opinion of the respondents (% of income, without utilities)*




Source: Own study based on the conducted research.

**Chart 11.**

*Maximum costs of renting a residential property in the opinion of the respondents (in PLN, without utilities)*




Source: Own study based on the conducted research.

Respondents who intend to rent a residential property until the age of 35 were also asked about the part of their income that they are able to pay for rent (Chart 10&11). The answers were different, but the majority of respondents intend to allocate more than 25% of their income for this purpose. When analyzing the share of minimum wage income spent on rent, it varies across Europe, ranging from 35% in

France to 56% in the Netherlands (Yanatma, 2024). Asking a similar question, but asking about specific amounts, it is very diverse, with a predominance of the range of PLN 1500–2500. It can be observed that among people who spend smaller amounts, this often accounts for a large part of income.

**Summary**

The current situation on the residential real estate market in Poland undoubtedly raises a lot of controversy. As E. Gołąbeska (2018) points out, the real estate market is an imperfect market in many respects, so it is difficult to expect that it will always function in a fully rational manner. The results of the survey clearly confirm that young people feel anxious about the situation related to the purchase of their own apartment or house. Despite this, it is mostly one of their life goals. Even in the case of people who intend to rent a residential property until the age of 35, there is a long-term preference for owning their own apartment. The majority of respondents consider high prices of residential real estate to be a barrier to obtaining financing for this purchase. Many young people express opinions about the need for government intervention in this strategic sector by means of tools such as, inter alia, setting a maximum margin for sellers and implementing tax breaks in connection with financing housing needs.

Solving housing problems is becoming an important task for society, government and institutions (Konieczna, 2025), and further development of research in this area is expected. When formulating conclusions, however, it should be noted that the selected CAWI research technique has some limitations. These limitations include, among others, the fact that an online survey is not a social situation, which may result in lower engagement of the respondent (Przewłocka, 2009). In surveys, there is also a risk that respondents will give answers that do not fully reflect their opinions or poorly report the facts they are being asked about. During the completion of the questions, the respondents must interpret the questions themselves, not being able to ask for help. In addition, the sample size itself in the conducted study should also be properly assessed.

This topic is crucial, as housing is the foundation for improving the quality of life and building more sustainable societies. The findings of the study confirm the research hypothesis formulated in the article, indicating that mortgage loans indeed constitute the primary source of financing for housing purchases among young Poles. The results highlight the crucial role of access to mortgage credit in shaping housing opportunities for younger generation.

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# IMPORTANCE OF THE RELATIONSHIP BETWEEN THE INDEPENDENT FINANCIAL ADVISOR AND THE SMALL AND MEDIUM-SIZED ENTREPRENEUR

**ABSTRACT**

**The purpose of the article**. The purpose of the paper was to determine the importance of the relationship between the independent financial advisor and SMEs. No academic or practice-oriented research has been yet undertaken in this field in Poland. The presented study aims to reduce the identified research gap.

**Methodology**. The fulfillment of the research objectives will be based on the analysis of a survey conducted among SME entrepreneurs who reported a need for the services of an independent financial advisor.

**Results of the research**. The study, carried out in 2024, involved 50 participants from the SME sector from the Greater Poland voivodeship (province in Poland). Building a long-term relationship between an independent financial intermediary and an SME was primarily driven by trust and competence. The main benefits SMEs gain from working with an independent advisor are time savings and a safer arrangement of financing transactions. Long-term drivers in working with an independent financial advisor were important to SME sample, whereas short-term factors, including the cost of the advisory service itself, were relatively less important.

**Keywords:** independent financial advisor, SMEs, business relations, trust building, survey, Poland

**JEL Class:** G23, G29, G41


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## Introduction

Independent financial advisors are intermediaries that support small and medium-sized entrepreneurs (SMEs) in obtaining operating and investment finance from both banks and, to a lesser extent, non-bank institutions. The first independent financial advisory firm was established in Poland in 2000. The development of the industry accelerated with Poland's accession to the EU in 2004 (Waliszewski, 2010).

The starting point for defining the concept of an independent financial advisor is the International Organization for Standardization standard No. 22222:2005, which distinguishes between dependent (sales) advice and independent financial advice (ISO, 2025; *see more:* Waliszewski & Welch, 2021). In the EU law, the MiFID II Directive sets out the rules for the provision of investment services and introduces a distinction between dependent and independent advice. It imposes an obligation to disclose the structure of the adviser's remuneration and prohibits the charging of hidden commissions in the case of independent advice. It also introduces the principle of acting in the best interests of the client (fiduciary duty), which significantly redefines the advisory relationship (Directive, 2004). Another legal act, the Mortgage Credit Directive, regulates the rules for granting mortgage loans and specifies the requirements that must be met by entities offering credit advice. It emphasizes the transparency of the advisory process, the obligation to assess the customer's creditworthiness and to present recommendations in a way that allows the customer to fully understand the financial consequences of the decision being made (Directive, 2014). In addition, the Insurance Distribution Directive applies to the distribution of insurance products and establishes qualification standards for insurance advisors. It introduces a requirement to identify and manage conflicts of interest and an obligation to present offers in an objective manner focused on the customer's needs rather than on the financial institution's sales results (Directive, 2016).

The main research problem of this paper is to answer the question: *To what extent does the relationship between entrepreneurs and financial advisors matter for*

*the cooperation of these entities*? In correlation to the main problem, the following specific research questions were identified:

1. How do entrepreneurs perceive their relationship with a financial advisor?
2. What elements are important in building a relationship with a financial advisor?
3. What are the benefits of building a long-term relationship between a financial advisor and an entrepreneur?

In conjunction with the formulated objectives of the study, the main hypothesis and subsidiary hypotheses were also identified. The main hypothesis of this paper is: *The relationship between entrepreneurs and financial advisors is of great importance*. The following subsidiary hypotheses were formulated in relation to the main hypothesis":

1. It is believed that relationships with a financial advisor are important for entrepreneurs.
2. It is assumed that many elements are important in building a relationship with a financial advisor.
3. It is assumed that a long-term relationship between an entrepreneur and a financial advisor based on trust is beneficial and preferred on many levels of cooperation.

The arguments for verifying the above hypotheses will be established through the analysis of the answers given to the individual questions in the questionnaire[1]:

- Hypothesis 1 – Questions Nos. 11, 12, 16, 17, 21 and 22.
- Hypothesis 2 – Questions Nos. 13, 14, 15, and 20.
- Hypothesis 3 – Questions Nos. 18, 19, 23, 24, and 25.

[1] The survey questionnaire has been added as additional source material to the paper.

## Literature review

The subject of academic analysis in the independent financial advice industry is primarily the activity in the area of intermediation in granting mortgage loans. Between 2010 and 2024, the share of mortgage brokerage exceeded 60% to 90% of the financing value obtained through financial advisory industry. Funding obtained for SMEs constitutes a small part of the market, not exceeding 5% of the credit financing granted to the financial advice industry in the years 2014–2024 (Waliszewski, 2019; ZPF, 2025).

Until recently, the Polish financial advisory model was in its initial phase, dominated by commission-based remuneration and the dependence of advisors on financial institutions (Waliszewski, 2016). This form of commercial financial intermediation often meant that financial intermediaries did not always act in the client's best interests and often focused on selling financial products (Podedworna-Tarnowska, 2010). On the other hand, financial advisors support households in a situation of progressive financialization and in the context of the still insufficient economic and financial knowledge of the population (Waliszewski, 2016). It should be emphasized, however, that the financial intermediation sector in Poland is still evolving and developing. Clients are less and less interested in the sale of specific financial products and increasingly expect a holistic approach and a comprehensive offer tailored to their situation and needs (Waliszewski, 2017).

Table 1 shows the values of granted financing obtained with the support of seven largest financial advisory firms that are active in this segment of the financial market. Table 2, on the other hand, sets out the structure of this market.

**Table 1**

*Total value of financing agreements concluded by ZPF members between 2020 and 2024 (PLN million)*

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| Mortgage loans | 30,850 | 50,220 | 32,370 | 40,680 | 62,610 |
| Consumer loans | 1,695.45 | 2,597.47 | 2,570.66 | 2,320.32 | 3,430.94 |
| Business loans | 1,438.12 | 1,889.25 | 1,733.19 | 1,823.07 | 1,804.46 |
| Leasing agreements | 168.44 | 277.7 | 282.36 | 356.08 | 312.33 |
| Factoring agreements | 34.95 | 40.56 | 36.97 | 68.51 | 38.17 |
| Total funding | 34,187 | 55,023 | 36,993 | 45,247 | 68,196 |

Source: ZPF (2025).

**Table 2**

*Total share of the value of financing contracts in the activities of ZPF members between 2020 and 2024 (as a percentage)*

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| Mortgage loans | 90.2% | 91.3% | 87.5% | 89.9% | 91.8% |
| Consumer loans | 5.0% | 4.7% | 6.9% | 5.1% | 5.0% |
| Business loans | 4.2% | 3.4% | 4.7% | 4.0% | 2.6% |
| Leasing agreements | 0.5% | 0.5% | 0.8% | 0.8% | 0.5% |
| Factoring agreements | 0.1% | 0.1% | 0.1% | 0.2% | 0.1% |
| Total funding | 100% | 100% | 100% | 100% | 100% |

Source: ZPF (2025).

Between 2020 and 2024, the share of funding from the financial advice industry to SMEs has never exceeded 6% of total funding[2]. As a result, considerations regarding financial consulting for SMEs constitute only a marginal part of academic studies and analyses in the area of financial advice. Most of the academic analysis in the area of independent financial advice in Poland focuses almost exclusively on of-

[2] It should be noted that these calculations exclude sales – made by financial advisors – of investment products and insurance to consumers. If these were included in the calculation, the SME sector's share of funding raised by independent advisors would be one to two percentage points lower.

ferings to consumers, particularly in the area of mortgage lending (See: Wyszkowska-Kaniewska & Dębniewska, 2011; Stawska, 2015; Waliszewski, 2024).

Most academic research on the importance of the relationship between a financial advisor and a client has been conducted in the most developed financial market of the United States of America. An interesting study conducted by Schoar and Sun (2024) provides significant conclusions regarding the differences in the importance of trust for passive and active investing. Another study examined the impact of financial education on the decision to use financial advice before and during the COVID-19 pandemic in the United States (Rabbani, Heo & Grable, 2021). Compared to the current article, very similar issues were analyzed in a survey conducted by the American College of Financial Services with the participation of an association of independent financial advisors in the US (ACFS, 2022). Other interesting insights are provided by Canadian studies. The authors examined the determinants of financial advisory quality, in particular the impact of which recommendations an advisor chooses and presents to a client (d'Astous et al., 2024). Another study contains an assessment – based on a large panel sample – of the costs and benefits of using financial advisory services (Foerster et al., 2014). Although the academic studies from the North American market discussed the issues addressed in this article, they reviewed the attitudes and behaviors towards financial advice primarily of private individuals (consumers). Enterprises, in particular small and medium-sized ones, constituted only a marginal part of the research samples in the above studies, or were not even included in the scope of the analysis.

No study that analyses the relationship between the independent financial advisor and SMEs, has been identified in the Polish literature. The presented study aims to reduce the identified research gap. The fulfillment of the research objectives and the verification of the hypotheses set out above will be based on the analysis of a survey conducted among SME entrepreneurs who reported a need for the services of an independent financial advisor.

**Methodology of the survey**

This study was conducted using a research procedure that took about six weeks in 2024. The number of participants in the study has been determined to include at least 50 entrepreneurs that were customers of the XYZ company. Ultimately, the same number of respondents also took part in the survey. The Poznań-based company, XYZ provides independent financial advisory services in the Greater Poland region (Wielkopolska voivodship). The authors decided on a non-representative purposive sampling of approximately 200 clients of the aforementioned company. These 200 clients had contacted independent financial advisor XYZ for external financing in the six months prior to the research. In order to obtain a sufficient number of questionnaires, the authors contacted 118 entrepreneurs, of whom 50 eventually returned full questionnaires (42% of them). All companies – recruited to the sample – were based in the Wielkopolska voivodeship. They also belonged to the small and medium-sized enterprise sector.

The survey questionnaire used in this work consists of 31 closed-ended questions and a metadata sheet. The questionnaire was addressed exclusively to entrepreneurs and was anonymous, in order to obtain honest answers. For this reason, a filter question was asked at the beginning of the survey and concerned having an entrepreneurial status.

**Table 3**

*Methodology of the survey*

| | |
|---|---|
| **The study population** | SMEs that are clients of an independent financial advisor based in Poznań, Poland |
| **Geographical area** | Wielkopolska voivodship, Poland (all entities originated from this region) |
| **General population selection** | Purposeful. SMEs that have contacted an independent financial advisory firm for help in obtaining financing in the preceding six-month period (approximately 200 companies) |

| | |
|---|---|
| **Sample participation in the general population** | 50 out of 118 respondents (42%) returned the questionnaire after being contacted. |
| **Method of conducting the survey** | CAWI (43 surveys), supplemented by CAPI (7 surveys) |
| **The period of the study's implementation** | 2024 (6 weeks – survey collection period) |
| **The number of questions in the survey** | 31 questions, including one filter question and 13 opinion questions |

Source: Own elaboration based on research design.

The authors decided to carry out the survey using a CAWI method. The questionnaire was made available to respondents in the form of an active link to a Google form. Using the Google form made the work much easier and accelerated many procedures. The ease of use and the possibility of using it on many platforms and operating systems had a big impact on the respondents' participation in the survey. Initially, the collection of responses went smoothly, but in the final phase of the survey, obtaining the last seven questionnaires became problematic. This issue was resolved by a direct contact with entrepreneurs at a time convenient for them and filling out the questionnaire live with the respondent (the CAPI method). The discussion of the methodology so far is summarized in Table 3.

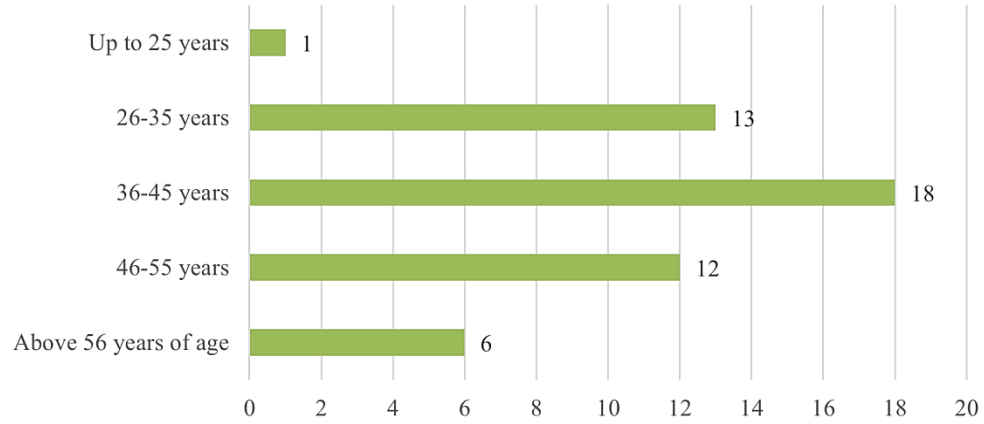
## General description of the respondents

The respondents were differentiated by gender, age and education. Among the entrepreneurs surveyed were 23 (46%) men and 27 (54%) women, so the division was very even and neither group was numerically superior to the other one. This increases the reliability of the research. Among the pollees in the survey, the largest group included people aged between 36–45 (18–36%), followed by 26–35 years old (13–26%), and 46–55 years old (12–24%). The fourth place was taken by people aged 56 and over (6–12%), while people aged 25 and under (1–2%) were the least numerous group. The age

characteristic proved to be sufficiently diverse. The results correspond to the average professional activity of the society. The large number of people aged between 36–45 is the result of two factors. People of this age are currently the best educated and have a relatively high level of experience in a given field. This significantly affects the profitability and security of the companies in question.

**Figure 1**

*Age of respondents*

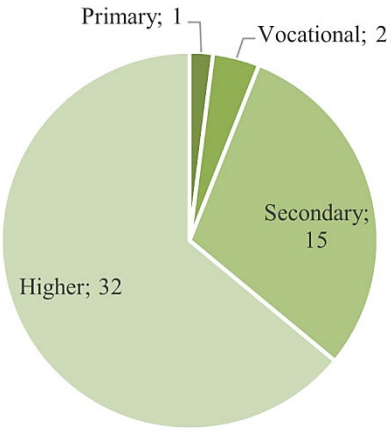



Source: Own elaboration based on survey results, n = 50.

The largest group among the interviewees included those with higher education (32–64%), followed by people with secondary education (15–30%). The least numerous groups were those with vocational education (2–4%) and primary education (1–2%). A large group of people with higher education also corresponds to the largest age group, i.e., 36–45 years. These are people born at the turn of the 1980s and 1990s, who gained education and entered the labor market in the reality of the free market economy. Due to high competition and unemployment at that time, a large percentage of them decided to continue their education after school.

**Figure 2**

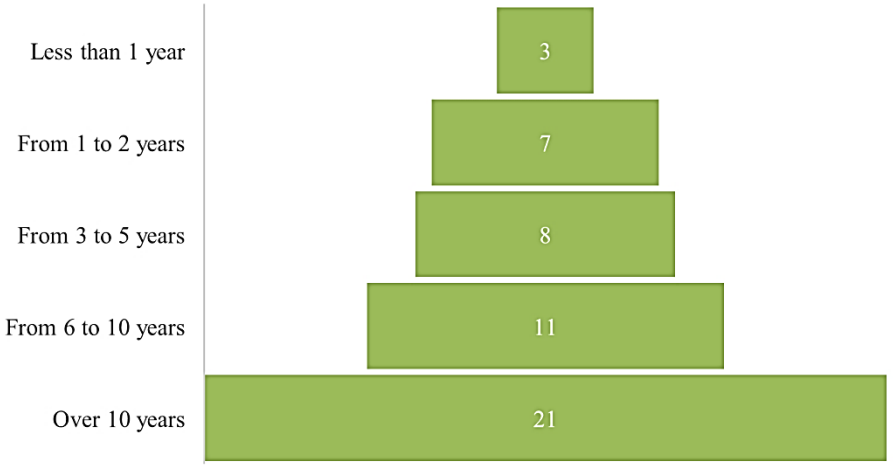
*Respondents' education*




Source: Own elaboration based on survey results, n = 50.

**Figure 3**

*Time of running the business by respondents*




Source: Own elaboration based on survey results, n = 50.

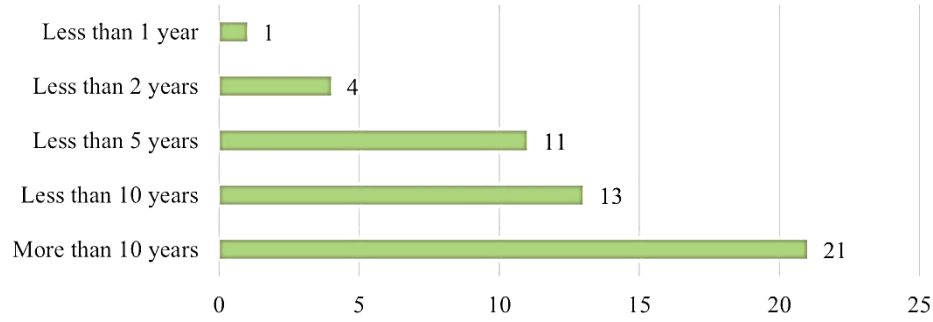
Companies that have been in operation for over ten years (21–42%), are the largest group and the second one – those active for six to ten years (11–22%). Together, they make up more than half of all respondents. These are companies with a well-established market position and the greatest experience in their field. Then there was a group of three to five years (8–16%), one to two years (7–14%) and less than one year old (3–6%). These are groups characterized by low resistance to market fluctuations and not having a strong position among competitors. This is especially true for two groups with the shortest tenure, as the vast majority of economic ventures fail to survive the first two years of operation and have the highest percentage of bankruptcies (Majzel & Byczkowska, 2021).

**The use of financial services**

The largest group of companies is the one that declares using banking services (45–90%). The opposite group is the one that does not use banking services (5–10%). The result may be surprising, especially because of the lack of cash settlements for most tax liabilities in present times. This group of respondents may not recognize bank account management as a banking service, understanding it mainly as a credit service, and that is why their answers were of that nature.

**Figure 4**

*The time of cooperation of respondents with the bank they use most often*



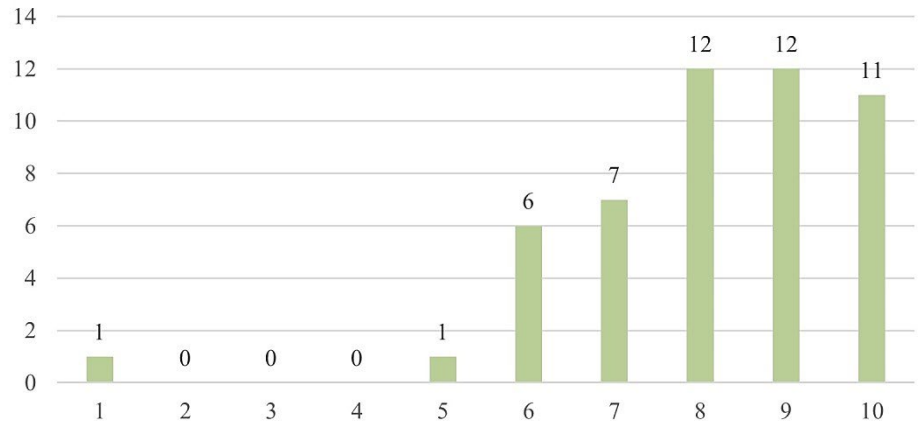

Source: Own elaboration based on survey results, n = 50.

Another issue that respondents were asked about was the time of cooperation with the bank they use most often. The largest group is the one declaring cooperation time of over ten years (21–42%), the second is the group cooperating for less than ten years (13–26%), and the third is the group cooperating for less than five years (11–22%). Then, successively, less than two years (4–8%) and less than one year (1–2%). These results correlate with the question about the period of running a business, which suggests that entrepreneurs very often remain loyal to their first choice of a bank that serves their company. They also indicate that entrepreneurs rarely decide to change the bank that handles their company's accounts. The most important factor that encouraged interviewees to establish cooperation with a given bank was the speed of order execution, followed by factors such as efficient service, qualified and experienced staff, and a favorable offer. The third most important factor was the availability of a consultant, the second was recommendations from other people, and the least important was a convenient location.

Satisfaction with the use of banking services was assessed on a ten-point opinion scale. The results clearly show that 35 (70%) of the respondents rated their bank satisfactorily (ratings 8, 9 and 10). Next, 14 (28%) of the respondents rated their bank sufficiently (ratings 5, 6 and 7), which suggests that some aspects of the relationship should be improved. Only one (2%) respondent gave their bank a low rating (rating 1). The results can be described as reliable, as the majority of respondents completely ignored the ratings from 2 to 4 when evaluating on a scale from 1 to 10. If the given assessment does not express complete dissatisfaction, i.e. 1, the respondents usually start with 5 on the scale for any positive gradation.

**Figure 5**

*Satisfaction with the service provided by their bank*




Source: Own elaboration based on survey results, n = 50.

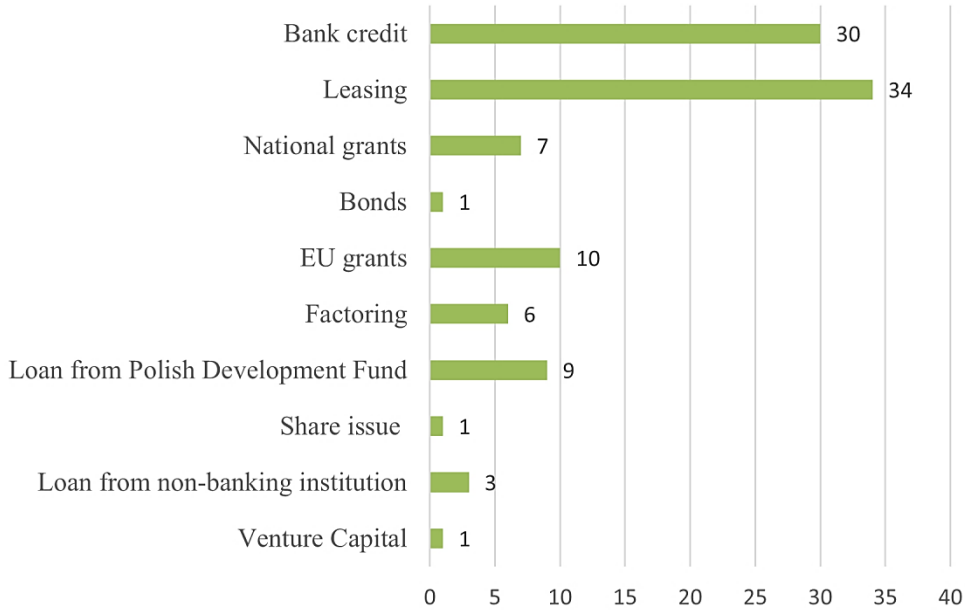
Then, the interviewees were asked to identify which banking products are helpful in running a business. The most important product, according to 44 (88%) of the respondents, was a current account. The other products that were indicated as important are: credit (29–58%), credit line (25–50%), and deposit machine (23–46%). Products with an average level of importance were defined as a currency account (11–22%), additional services such as accounting or consulting (10–20%), and a credit card (8–16%). Investment/brokerage products (7–14%) and currency exchange services (4–8%) were considered least important.

The respondents were also asked if their company used external sources of financing. 35 respondents (70%) answered affirmatively, 14 respondents (28%) denied it, and 1 (2%) had no opinion. Interviewees indicated that they overwhelmingly use leasing (34–68%) and credit (30–60%). These are the easiest products to obtain of those listed, and they also allow for the fastest and most effective acquisition of funds. Other sources indicated by respondents are EU subsidies (10–20%), a loan from the Polish Development Fund (9–18%), national subsidies (7–14%) and factoring (6–4%). These do not represent popular funding avenues. The reason for

this is certainly more formalities required not only in raising capital, but also in accounting for its use. The only exception in this group is factoring, the position of which indicates that it is relatively rarely perceived as a product that can bring capital to an enterprise, as the formality of its acquisition is easily not at all inferior to that of credit or leasing, and in some cases can surpass them (For more details, see Korenik, 2022). Three respondents (6%) indicated that they had taken a loan from a non-bank institution, which proves how limited the participation of non-bank institutions is in the financing of SMEs. The least popular sources of financing were bonds, venture capital and share issue. This is not surprising, as these are the most difficult pathways for raising capital.

**Figure 6**

*External sources of financing used by companies*



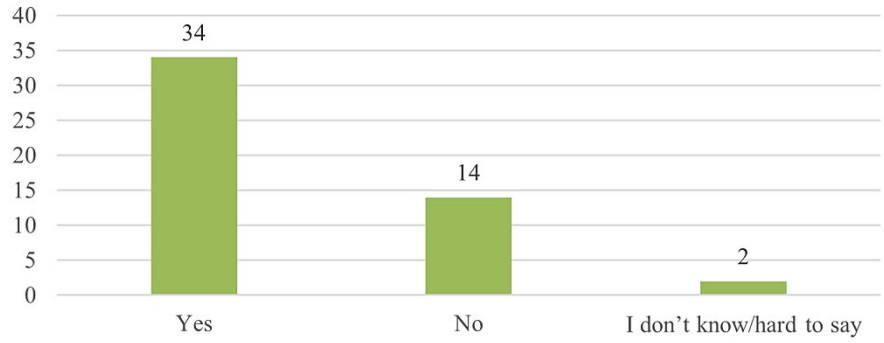

Source: Own elaboration based on survey results, n = 50. Multiple choice question.

**Financial advisor relationships as perceived by entrepreneurs**

In this part, the survey began with verifying whether the respondents have a permanent dedicated financial advisor to handle the company. More than half of the respondents answered affirmatively (34–68%). There were 14 respondents (28%) who do not have a financial advisor, and 2 (4%) do not have an opinion. This may mean that entrepreneurs know what scope of services a financial advisor can provide and what advantages can result from this.

**Figure 7**

*Percentage of companies with a permanent financial advisor*



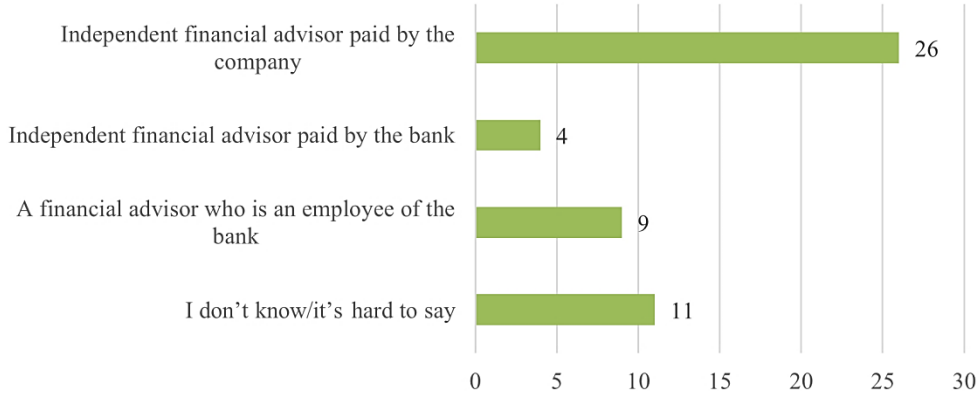

Source: Own elaboration based on survey results, n = 50.

Almost all respondents indicated that a financial advisor in cooperation with a bank is necessary (45–90%). Only two (4%) answered negatively, and three (6%) had no opinion. The results confirm that the vast majority of entrepreneurs are aware of the impact of a financial advisor when working with a bank. Another issue raised was the assessment of whether an independent financial advisor participating in negotiations with the bank is important. Again, the vast majority of respondents answered affirmatively to the question, with 16 (32%) respondents answering "Definitely yes" and 27 (54%) respondents answering "Yes". Seven of pollees (14%) had no opinion, while none of them answered negatively.

Then, in the expansion of the previous questions, it was verified which financial advisor better represents and takes care of the company's interests. The largest group consisted of people who claimed that the best advisor is an independent one paid directly by the company (26–52%), the second group (11–22%) had no opinion on this question. The third largest group are those interviewees who believe that a better financial advisor is a bank employee advisor (9–18%). The fewest respondents were in favor of an independent advisor paid by the bank. Although some respondents found this question confusing, it is safe to say that entrepreneurs are aware of a certain conflict of interest that the question was intended to reveal. Respondents know that for their relationship with a financial advisor to be reliable and based on transparent principles, no one should mediate in it, especially in financial matters.

**Figure 8**

*Assessment of the type of financial advisor in the context of representation and concern for the company's interests*



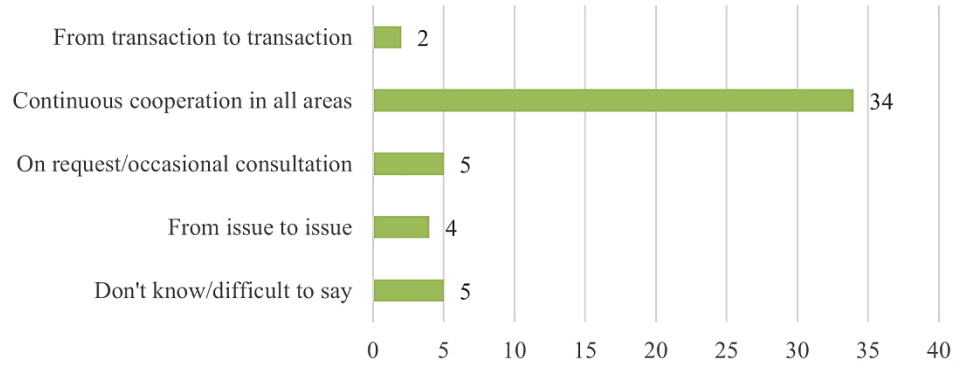

Source: Own elaboration based on survey results, n = 50.

The vast majority of respondents described the nature of the expected relationship with an independent financial advisor as "continuous cooperation in all areas" (34–69%). This group recognizes the need, advantages, and benefits of continuous cooperation with a financial advisor in order to constantly monitor their financial situation.

In the second place, five (10%) interviewees described the expected relationship as "occasional consultation", i.e., concerning the assessment of the financial situation, in which they would like to find themselves of their own volution but need a support in the form of knowledge or solutions. Next, four respondents (8%) indicated that their relationship with a financial advisor was "from issue to issue," meaning that it was *ad hoc* and dictated by a negative and unexpected financial event. The smallest group consists of people who treat the independent financial advisor service on a "from transaction to transaction" basis (2–4%). They use the advisor's services only in specific situations, always related to carrying out a specific, single transaction. Five interviewees (10%) expressed no opinion, which suggests that they may have never had any opportunity to use the professional services of financial advice and do not represent any expectations from the nature of the relationship with an independent advisor.

**Figure 9**

*Character of the expected relationship with an independent financial advisor*




Source: Own elaboration based on survey results, n = 50.

The relationship with an independent financial advisor should be built on the basis of partnership. In most cases, respondents believe that a long-term relationship should be built on the concept of partnership (21–42%). A third of interviewees (17)

strongly believe that the concept of partnership should be preserved. Only four respondents (8%) considered that partnership in a relationship with a financial advisor not important. No one strongly expressed an opinion that partnership is not important. Eight of those interviewed (16%) indicated that it is difficult to assess this aspect.

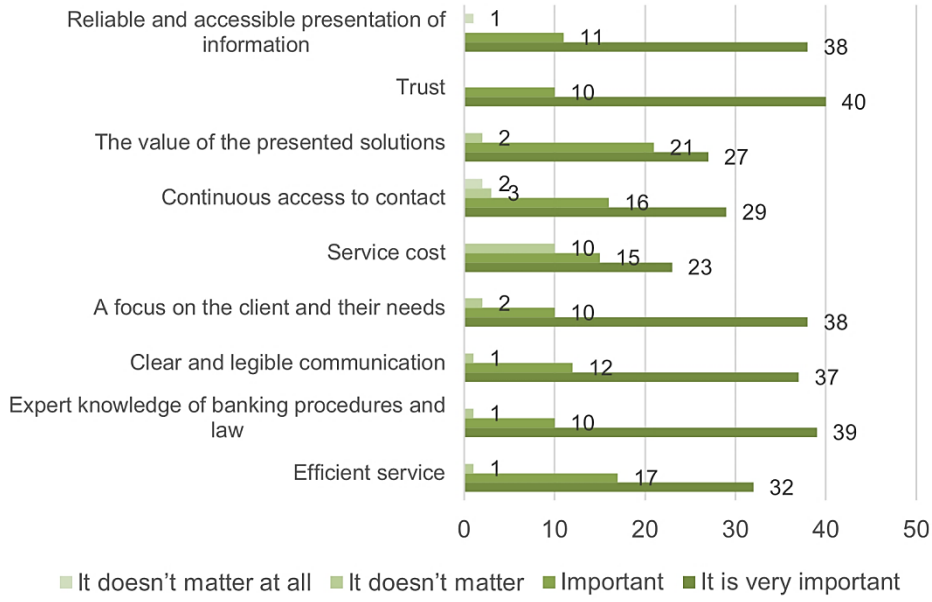
**Elements that are important in building a relationship with a financial advisor**

At the beginning of this part of the questionnaire, respondents were asked to evaluate the importance of individual elements in building long-term relationships with a financial advisor. The most important element, according to the respondents, was trust, followed by: fluent knowledge of banking procedures and law, transparent and clear communication, customer-focused attitude and needs, and reliable and accessible presentation of information. They ranked efficient customer service third and the value of the solutions presented fourth. The constant access to a counselor was not a significant element for the respondents. However, the least important factor for respondents is the cost of service. It can be inferred that surveyed entrepreneurs consciously prioritize elements of greater significance in the long term, with a more lasting impact on the cooperation with an advisor, than to short-term, superficial elements and those that will not be decisive in the long-term relationship.

In order to deepen the research, the respondents were asked about their opinion on how many years of experience a good financial advisor should have. Most of them defined the ideal experience period for a good financial advisor as 3–5 years (27–54%), followed by 11 (22%) who indicated that such a period should last between 6–8 years. Six interviewees (12%) believed that one year would be sufficient experience, and four (8%) that two years would be enough. Only two surveyed entrepreneurs (4%) expect a good financial advisor to have more than 10 years of professional experience.

**Figure 10**

*The importance of individual elements in building a long-term relationship with a financial advisor*



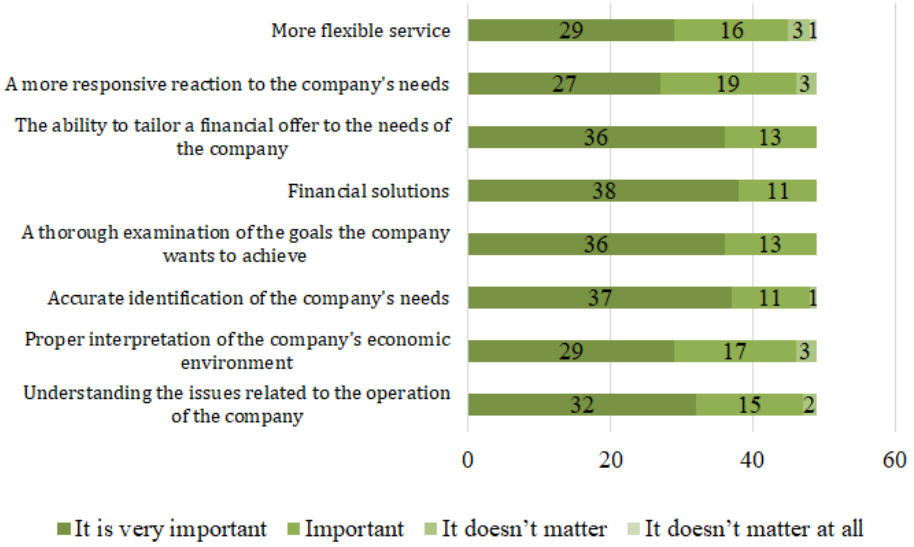

Source: Own elaboration based on survey results, n = 50. 'Don't know/difficult to say' responses were excluded.

Respondents were also asked to evaluate the importance of factors in the cooperation of an independent financial advisor with a company. The interviewees gave the highest ratings to the following elements: accurate identification of the company's needs, thorough examination of the company's goals, favorable financial solutions, and the ability to tailor the offer to the company's needs. The second most important factors are: understanding the company's operations, followed by proper interpretation of the company's economic environment, a more responsive reaction to the company's needs, or more flexible service. The results of the survey were fairly evenly distributed, indicating the most important issues in cooperation, but in a non-conclusive manner. The next groups in the order achieved fairly similar results. This may mean that all the indi-

cated elements are important for the cooperation of an independent financial advisor and SMEs, with the recognition of the priority of one group over the rest.

**Figure 11**

*Key factors for an independent financial advisor to work with SMEs*



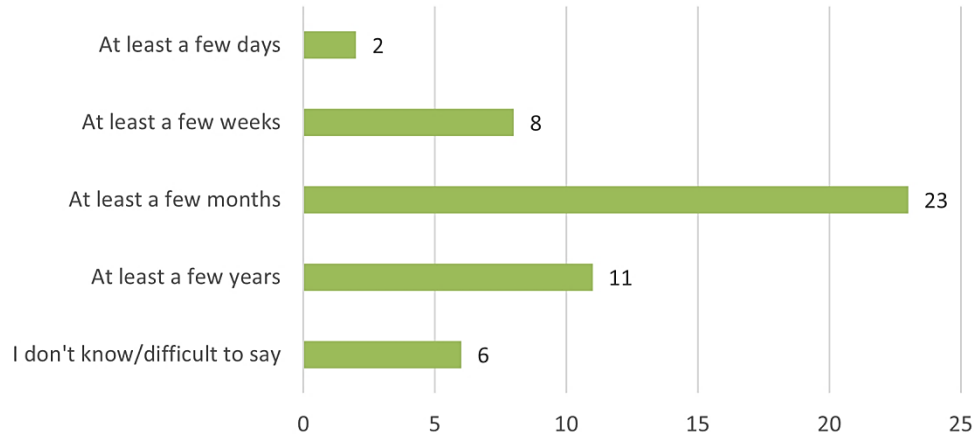

Source: Own elaboration based on survey results, n = 50. 'Don't know/difficult to say' responses were excluded.

In a subsequent question, the respondents were asked to determine whether the long-term relationship of an independent financial advisor with a company affects the quality of service. The vast majority of respondents answered the question in the affirmative. Twenty-nine pollees (58%) believe that the duration of the relationship affects the quality of service. Sixteen interviewees (32%) believe that time decisively affects the quality of service. No one gave a negative answer. Therefore, there is no one who would say that the duration of the relationship does not play any role. However, five respondents (10%) indicated that it was difficult to assess. They have no opinion on this matter, which may be due to a lack of experience in this area.

To delve deeper into the issues raised in the previous question, respondents were asked to express their opinion on how long it should take to build a satisfactory relationship with an independent financial advisor. Most of them chose the answer that the relationship should last at least a few months (23–46%). The second largest group consists of people who believe that such a relationship should last at least a few years (11–22%). Eight respondents (16%) indicated that for a satisfactory relationship, the duration would be at least a few weeks. The smallest number of respondents indicated a period of at least several days (2–4%). Six interviewees (12%) found it difficult to assess this aspect. The study indicates that the subjects consciously understand the meaning of building satisfaction resulting from the relationship and that this period cannot be shorter than a few months.

**Figure 12**

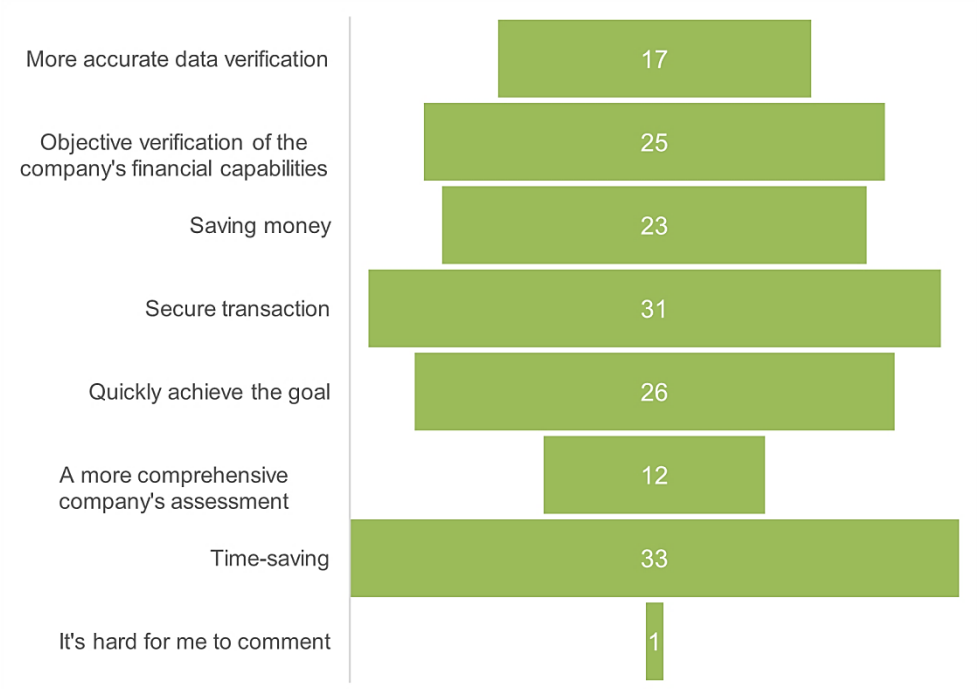
*The duration of the relationship with an independent financial advisor to be considered satisfactory*




Source: Own elaboration based on survey results, n = 50.

**Figure 13**

*The company can achieve benefits by using the services of an independent financial advisor*




Source: Own elaboration based on survey results, n = 50. Multiple choice questions.

The highest ratings were given for saving time (33–66%) and safer transactions (31–62%). The respondents then pointed to such factors as: quick achievement of the goal (26–52%), objective verification of the company's financial capabilities (25–50%), and saving money (23–46%). The lowest ratings were given to more accurate data verification (17–34%) and more comprehensive company's assessment (12–24%). Only one of those surveyed (2%) refrained from expressing an opinion on the matter. Despite the fairly even distribution of votes, the interviewees divided their answers into three groups. It cannot be unequivocally stated that certain factors are irrelevant, but certainly some of them should be taken into consideration first.

In a further question, the respondents were asked about the importance of maintaining a relationship with an independent financial advisor despite the lack of financing for the company. Most respondents confirmed that the relationship with the advisor is important for their company despite the lack of funding (31–62%), while one surveyed entrepreneur (2%) considered such a relationship irrelevant. Ten of them (20%) strongly supported the possibility of maintaining a relationship with an advisor despite the lack of funding. Eight respondents (16%) considered the issue too difficult to resolve.

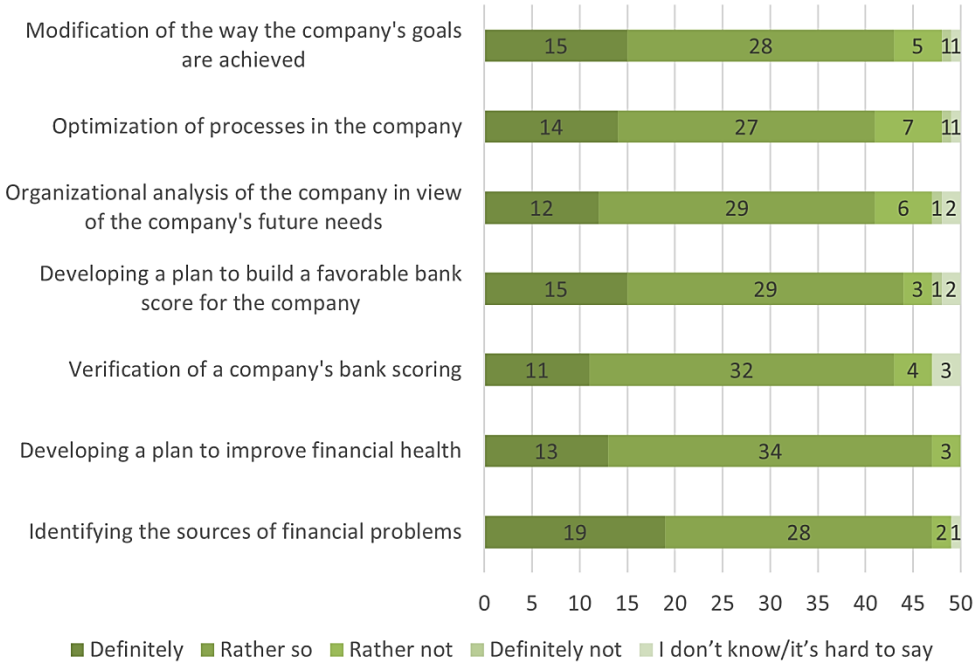
In the second aspect of this question, respondents were asked to assess the usefulness of contact with an independent advisor despite the lack of funding. SMEs surveyed rated an identification of the sources of financial problems the highest in this regard. They then pointed out two equivalent issues: developing a plan to improve the financial situation and developing a plan to build a beneficial bank scoring for the company. These three aspects express the desire to understand their current financial situation, its continuous development and improvement in a conscious and organized manner. Another group of factors is the verification of the company's bank scoring and the modification of the way the company's goals are achieved. The lowest, although insignificantly, were the elements such as: organizational analysis of the company due to the company's future needs and optimization of the processes taking place in the company. This may indicate that entrepreneurs may not yet see the connection between these aspects and financial health. However, none of the factors was considered insignificant, and entrepreneurs regarded all of them to be quite important, but some issues were evaluated to be a priority.

The last issue discussed in the survey, is the assessment of the importance of the relationship with an independent financial advisor after obtaining financing. The largest group consists of entrepreneurs who believe that the relationship with the advisor after obtaining financing is important (33–66%). Eleven respondents (22%) were decidedly in favor of maintaining such a relationship. However, one of them

(2%) expressed the opinion that they do not need this form of cooperation. Nobody was definitely against such a relationship. Five interviewees (10%) did not take a stand on the matter. The respondents see the advantages of maintaining a relationship with an advisor after obtaining financing and it can be assumed that they understand the benefits that come with it, including the advisor's assistance in handling a given financial product. This may significantly affect the ease of cooperation and the full use of the potential of financial opportunities.

**Figure 14**

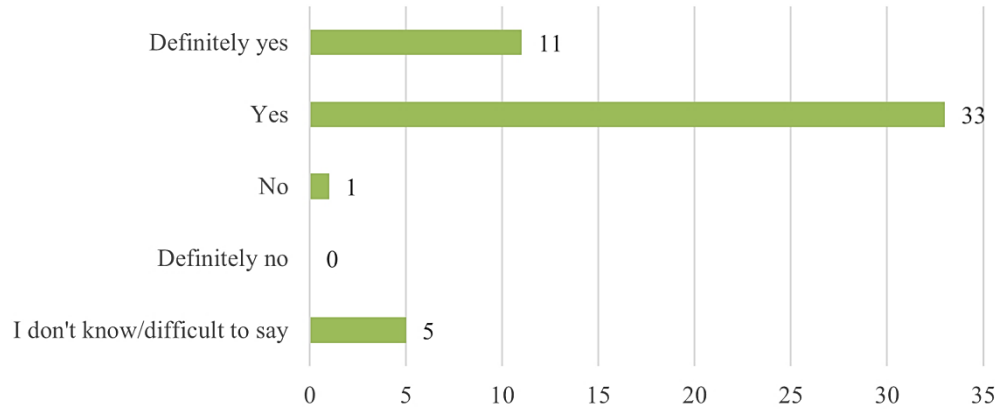
*Assessment of the usefulness of contact with an independent advisor despite the lack of financing*




Source: Own elaboration based on survey results, n = 50.

**Figure 15**

*Assessment of the importance of the relationship with an independent financial advisor after obtaining financing*




Source: Own elaboration based on survey results, n = 50.

**Conclusions**

At this section, it is necessary to verify the research hypotheses set out earlier. The first subsidiary hypothesis i.e., '*relationships with a financial advisor are important for entrepreneurs*', was positively verified. The study showed that entrepreneurs understand the essence of the entrepreneurial spirit as well as the importance of the financial advisor It was possible to identify the key point that entrepreneurs understand the core of their interests in the financial market and at the same time the benefits that result from constant cooperation with an independent financial advisor.

The second subsidiary hypothesis stating that *'many elements are important in building a relationship with a financial advisor'*, was partially positively verified. Respondents felt that the most important element in building a good relationship with a financial advisor is trust based on honesty and integrity. On a number of occasions, interviewees indicated in their answers that factors that take on a higher value in the long term are much more important to them. The results additionally showed that this

is especially a strong characteristic of respondents with long business tenure and higher education.

The third subsidiary hypothesis i.e., '*a **long-term relationship** between an entrepreneur and a financial advisor based on trust is beneficial and preferred on many levels of cooperation*', has been fully confirmed. In terms of satisfaction and quality of service, the length of the relationship is important. Again, the results show that respondents prefer a longer time horizon and therefore expect permanence and constancy in their relationship with their financial advisor. In particular, it demonstrated that entrepreneurs prioritize time over money. The responses in this respect were very consistent. It can therefore be concluded that the main hypothesis of the paper stating that '*relationship between entrepreneurs and financial advisors is of great importance*', has been overall validated. At the same time, it is important to note the multidimensionality and multifaceted nature of the relationship between the small and medium-sized entrepreneur and the independent financial advisor.

The research, in addition to verifying hypotheses, also showed areas where financial advisors should focus their attention in order to respond to customer needs even more effectively. First and foremost, it is about expanding knowledge and spreading awareness among clients of unpopular financial opportunities. It also involves financial advisors understanding that in the financial market, alongside entrepreneurs with a longer or higher level of experience, and broader education, there are also businesspeople with less experience in the corporate financial world. They are also participants in the financial market, and the professional service of affordable financial advice is equally important, and may even be decisive in certain aspects for the future of their business. Another issue that was verified by the research results is the position of an independent financial advisor whose remuneration remains exclusively in the sphere of the relationship between them and the client. The survey showed that respondents were aware that a relationship with an independent financial advisor should be free of conflict of interest. At the same time, a certain group of interviewees considered it too difficult to express their opinion in this regard. Thus,

the role of the advisor is to protect their independence, being free from the conflict of interests. To achieve this, an independent financial advisor must possess high personal and ethical culture, strong moral backbone, honesty, sincerity, purity of intentions, objectivity, and independence in evaluation and judgments.

The main limitation of this work is the small research group, as it only involved customers of the XYZ company. Hence, the results obtained cannot be directly transferred to a wider population of small and medium-sized enterprises. The small sample size meant that statistical tests, including independence and significance of individual quality variables obtained from the survey, were not carried out. The second issue had been the significantly limited time for conducting the research (six weeks). If the research group were expanded and its size increased, the results would certainly be more reliable and trustworthy. However, the research tools itself have been sufficiently detailed and precise to address most of the issues raised by the study.

The results of the survey may be useful primarily for companies providing independent financial advice. In addition, the results of the survey can be used to assess the current philosophy and strategy of relationship building and management, by numerous organizations providing professional services to entrepreneurs, not only in the field of finance. This research study will perhaps provide a small starting point for a larger, but also a more extensive discussion of building and managing a complex, multi-level relationship with SME entrepreneurs.

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# IMPACT OF EXTERNAL SHOCKS AND MACROECONOMIC INSTABILITY ON THE SECURITY AND PROFITABILITY OF THE COOPERATIVE SECTOR IN POLAND AND THE EUROPEAN UNION COUNTRIES

**ABSTRACT**

The beginning of the 21st century was a period of significant economic transformation, which changed the existing order of economic processes, thereby exerting a strong influence on the real economy, but also on the security and efficiency of the financial system. As a consequence of the 2007–2009 crisis, many credit institutions had to cover losses from insufficient capital and lost their solvency. Some of them underwent compulsory restructuring and, in some cases, nationalisation. The crisis caused by the COVID-19 pandemic and the geopolitical turmoil resulting from Russia's attack on Ukraine had less severe consequences for the banking sector in Europe. Based on a review of the literature and other research, the article assesses the impact of these events on the safety and profitability of cooperative banks operating within selected banking groups in Europe. In this context, based on an analysis of statistical data, it is argued that the impact of external shocks on the cooperative sector was limited. As part of a case study, using the example of one of the Polish cooperative groups, shocks were identified which, however, did not have a negative impact on profitability and stability. A correlation was also demonstrated between the level of security of individual banks and the fact that they operate within the structure of the Institutional Protection System.

**The purpose of the article.** The purpose of this article is to indicate the impact of macroeconomic shocks on the security of cooperative banks operating in the European Union, as well as to examine the relationship between the level of integration of cooperative banking groups and the level of financial stability of individual cooperative banks.

**Methodology**. Literature review, statistical analysis, case study.

**Results of the research**. The high level of integration of cooperative banking groups in the European Union helps build resilience to external macroeconomic shocks.

**Keywords:** literature review, statistical analysis, case study

**JEL Class:** G21


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## Introduction

The beginning of the 20th century was characterised by numerous turbulences in global financial markets, which frequently led to national and, at times, global crises in the banking sector. The instability of financial markets, associated with successive phases of crisis, had a pronounced impact on the global real economy, with the automotive cluster being particularly affected (Mitręga Niestrój, 2012, pp. 169–170). However, the consequences of disruptions in the banking sector varied across different periods. Distinct outcomes were observed during the global financial crisis of 2007–2009, which led to the spectacular collapse of major international financial institutions, and during the destabilisation of the financial system following the global COVID-19 pandemic. Yet another set of effects stemmed from the geopolitical turmoil caused by military actions initiated by Russia. The impact of the latter is arguably the most difficult to define, and its consequences are expected to continue unfolding for a considerable time. In this context, it is therefore justified to assess the resilience of various types of credit institutions, taking into account not only their operational scale but also the nature of their activities and ownership structure. Against this backdrop, cooperative banks in Europe stand out due to their distinctive relationship-based business model, which plays a significant role in enhancing their capacity to absorb the adverse effects of changes in the economic and geopolitical environment. This resilience may be shaped by the strategies adopted by smaller, locally oriented financial institutions, which do not focus exclusively on short-term financial performance (Folwarski, 2023, p. 104). Instead, their objectives are guided by long-term strategies that take into account the interests of small and medium-sized enterprises. These strategies also encompass support for local economic and social initiatives (Grabowski & Skorwider, 2012, p. 69). Consequently, the business models of cooperative banks are often centred on serving a relatively narrow group of customers through a dedicated portfolio of services (Kura & Płonka, 2023, p. 160).

The method of financing cooperative banks is also of considerable importance, as its dispersed nature may foster the integration of owners – members –

around the bank, manifested in the form of direct business relationships. The literature on the subject highlights the crucial role of local communities in financing the operations of cooperative banks. Empirical studies indicate a correlation between the determinants shaping the sources of financing and the level of security of credit institutions (Iwanicz-Drozdowska, et al. 2021, pp. 35–37).

Cooperative banking, in its decentralised form, represents an alternative model to the highly integrated international financial institutions that were more severely affected by the financial crisis of 2007–2009 (Iwanicz-Drozdowska, et al. 2021, p. 160). While the increasing concentration within the cooperative banking sector may enhance efficiency, it can also lead to reduced competition and a heightened propensity for risk exposure (Iwanicz-Drozdowska & Nowak, 2024, p. 30). The local character of cooperative banking operations, and above all the sector's avoidance of high-risk and often excessive risk-taking practices, enabled cooperative banks in Poland to mitigate the impact of crisis events, including those arising from the COVID-19 pandemic. In the immediate post-pandemic period, the Polish cooperative banking sector also experienced a reversal of the traditional pattern in which commercial banks exhibited higher profitability (Iwanicz-Drozdowska & Nowak, 2024, p. 7). Furthermore, cooperative banks actively participated in initiatives aimed at mitigating the effects of the COVID-19 pandemic on enterprises and the agricultural sector (ZBP, 2020). The following sections of this article present the operating models of cooperative banks in Europe and analyse the relationship between the degree of integration and financial stability. In addition, a case study will examine the impact of macroeconomic shocks on the security and profitability of the largest cooperative banking group in Poland.

**Models of cooperative bank operations in Europe**

The macroeconomic consequences of the 2007–2009 financial crisis were a key driver of structural changes within cooperative banking groups. Although the destabilisation of financial markets had numerous adverse effects on the banking

sector, cooperative banks in Europe were, in general, relatively unaffected – with the exception of the Italian system, where the post-crisis period was marked by an escalation of credit risk and a decline in profitability. Nevertheless, these developments prompted integration initiatives that took various forms, extending beyond direct mergers. Some cooperative groups opted to centralise their business models, a process that produced differing outcomes across countries (Kurkliński & Miklaszewska, 2017, p. 7). In the Netherlands, a fully centralised model was adopted, while in Germany, Spain, and Poland, cooperative banks implemented models based on Institutional Protection Scheme (IPS).

The specific organisational structure of cooperative banks plays a crucial role in shaping their market position and financial security. Within the European framework, they operate in several countries under institutional protection systems (Regulation (EU) No 575/2013). The institutional protection systems operating in Europe are characterised by varying degrees of vertical integration of processes, while consistently maintaining a certain level of autonomy for participating entities (cooperative banks), particularly in the sphere of business operations.

Integration has enabled many cooperative banks in Europe to adapt their operations to a range of extensive prudential regulations. It has also had a significant impact on their ability to continue operating effectively during the emergence of previously unknown areas of risk, which materialised in the financial sector in the post-pandemic phase (WIB, 2021, p. 7).

The main principle underlying IPS activities is mutual support in terms of participants' solvency and liquidity. These tasks are carried out using various tools, including uniform risk identification and control mechanisms. However, the foundation of participant security support is solidarity funds, whose purpose is to directly support participants in difficult economic and financial situations, in the event of a threat of illiquidity or insolvency (SSOZ BPS, n.d.). In the European context, five countries have decided to integrate into the IPS model, with a total of eight protection schemes in operation. These countries are Poland, Germany, Italy, Spain, and Austria (BVR, 2021).

Cooperative banks play a crucial role in the European financial market. Their market share, measured both by lending volume and deposit volume, has been steadily increasing. Also noteworthy is the number of cooperative bank branches, whose average share in national markets exceeded 34% in 2022 (EACB, 2022). A comparison of the number of operating units and the value of accumulated assets clearly indicates that the cooperative banking model aligns with a strategy of focusing on local markets and is characterised by a high level of customer engagement. Cooperative banking groups in France and Germany operate at the largest scale. According to the most recent data, the total value of assets accumulated in these systems represents approximately 70% of the total assets held by members of the European Association of Cooperative Banks, which brings together cooperative banking groups across Europe, including non-EU countries (EACB, 2023). The scale of operations of groups in the Netherlands, Austria, Italy, Denmark, and Finland should also be regarded as relatively significant.

**Table 1.**

*Value of assets of the largest cooperative groups in Europe in 2023*

| Country | Cooperative banking group | Asset value in millions of EUR |
|---|---|---|
| France | Credit Agricole | 2 467 099 |
| France | Credit Mutuel | 1 142 593 |
| France | BPCE | 1 544 100 |
| Germany | Co-operative Financial Network | 1 597 180 |
| Netherlands | Rabobank | 613 796 |
| Austria | Österreichische Raiffeisenbanken | 399 874 |
| Austria | Österreichischer Volksbanken | 30 482 |
| Italy | Federcasse (BCC) | 257 694 |
| Poland | IPS – BPS | 27 161 |
| Poland | IPS – SGB | 17 327 |

Source: own study based on: EACB, 2023; UKNF 2023.

Cooperative banking groups in Europe are characterised by varying degrees of integration. In addition, platforms for cooperation between individual cooperative banks are used. Partially integrated models operate in countries such as Germany and Austria (WIB, 2022, pp. 13–16). These models focus primarily on business cooperation, leveraging economies of scale while simultaneously optimising group-level risk management costs. The model operating in Poland for the past decade can be considered less integrated, and, according to some economists, even unintegrated (Migliorelli, 2018 in: WIB, 2022, p. 12). It is characterised by a relatively high level of autonomy for individual association members and IPS, alongside uniformly organised risk control and monitoring mechanisms. A distinctive feature of the Polish system is that internal audit functions for banks participating in the system are performed by the IPS Management Unit. Another notable characteristic of the Polish model is that some large cooperative banks operate outside the structures of associations and IPS (Kotliński, 2022, p. 210).

A different approach to integration characterises cooperative groups in France and the Netherlands. These groups have developed extensive central institutions which, in addition to providing business support and strategic consulting, have assumed risk management functions. In some cases, they have also taken on responsibilities related to the direct supervision of individual group members (Mckillop, 2020, p. 3).

In an attempt to systematise the integration of European cooperative banking groups, three levels of solutions can be identified:

1. institutional integration, in which the autonomy of individual group members in the risk management process is limited, exists in such countries as the Netherlands, Bulgaria (CCBank, n.d.), and France;
2. advanced integration, characteristic of such countries as Germany and Austria, where the level of process integration is quite significant, but individual banks have autonomy in shaping not only their business strategies,

but also determine (within certain limitations resulting from participation in the group) their willingness to take risks;

3. limited integration characterised by the lowest level of integration. It has been adopted by cooperative banking groups in Poland, Spain and Italy. Banks operating under these solutions almost always function within IPS structures. Within this model, exceptions exist in which non-affiliation with associations is permitted. This approach is observed in Poland, where eight cooperative banks remain outside the protection systems (UKNF, 2024).

The internal structures of IPSs vary. Although their activities are based on the same assumptions and legal framework, the manner of interaction with participants and the range of tools used to enhance security often differ. In Europe, a distinctive solution exists whereby IPSs not only act as institutions supporting liquidity and solvency but also function as deposit guarantee institutions (DGS – Deposit Guarantee Scheme). Such arrangements have been implemented in both Germany and Austria, where the funds contributed by participants within the IPS are not solely solidarity-based but also, in part, constitute a deposit guarantee fund (PE, 2022).

**Situation of selected cooperative banking groups during periods of external shocks**

The impact of various models of cooperative bank integration on their ability to absorb the negative effects of macroeconomic changes and on their level of profitability has been the subject of numerous studies in the literature. The findings of these studies indicate a correlation between the degree of centralisation and efficiency. Institutions operating within highly structured and fully integrated models tend to achieve higher profitability, likely due to the economies of scale in asset management at the central level. At the same time, institutional integration facilitates cost optimisation (Desrochers & Fischer 2005 in: WIB, 2022, pp. 10–11). The studies further suggest that a higher level of integration enhances the participation of cooperative banks in the domestic bank-

ing market, with more centralised groups achieving a larger market share than those operating within looser structures (WIB, 2022, p. 23).

The early 2020s were marked by numerous social and geopolitical shocks, along with the resulting macroeconomic turbulence. In some countries, this manifested as recession or economic crisis. The COVID-19 pandemic introduced uncertainty and unpredictability into economic processes. Moreover, shortly after the immediate effects of the pandemic subsided, financial markets faced additional risks stemming from Russia's aggression against Ukraine. This not only heightened the direct risk of conflict escalation but also affected commodity prices and, consequently, inflation, which in turn influenced interest rates.

To illustrate the situation of cooperative banking groups, the most recent data published by the European Association of Co-operative Banks for the years 2020–2023 was used.

A key measure for assessing resilience to external shocks is the level of capital adequacy, expressed by the Total Capital Ratio (TCR). It is also a crucial indicator of a cooperative bank's capacity to expand its banking activities. The TCR represents the relationship between a bank's own funds and its total risk exposure.

**Table 2.**

*Value of the consolidated TCR ratio in selected cooperative groups affiliated with the EACB in 2020–2023*

| Country | Cooperative banking group | TCR 2020 | TCR 2021 | TCR 2022 | TCR 2023 |
|---|---|---|---|---|---|
| France | Credit Agricole | 20.4 | 21.4 | 21.6 | 21.1 |
| France | Credit Mutuel | 21.8 | 22.6 | 21.3 | 21.4 |
| France | BPCE | 18.1 | 18.7 | 17.9 | 18.2 |
| Germany | Co-operative Financial Network | 16.2 | 15.8 | 15.7 | 16.2 |
| Netherlands | Rabobank | 24.2 | 22.6 | 21.6 | 21.7 |
| Austria | Österreichische Raiffeisenbanken | 15.5 | 13.9 | 17.3 | 18.2 |

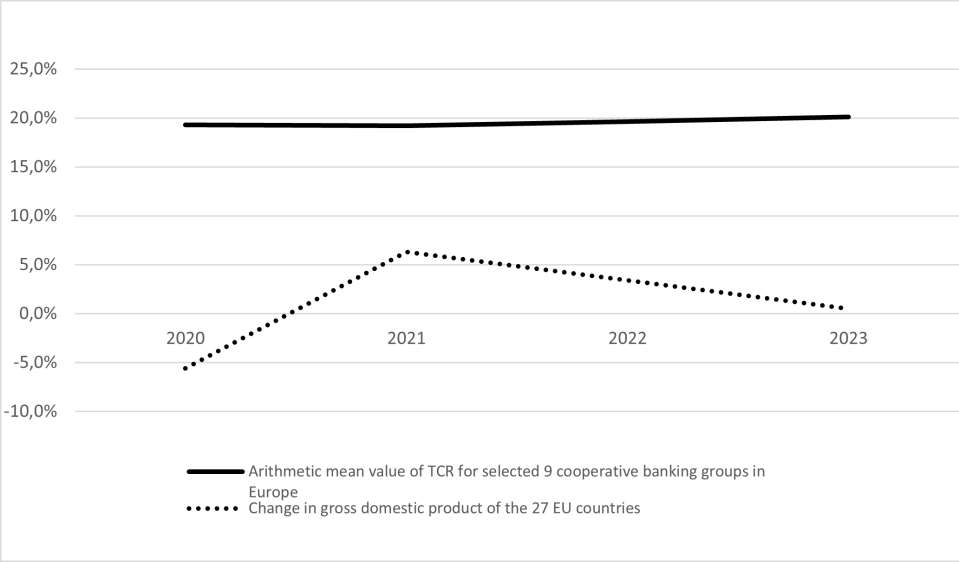
| Country | Cooperative banking group | TCR 2020 | TCR 2021 | TCR 2022 | TCR 2023 |
|---|---|---|---|---|---|
| Austria | Österreichischer Volksbanken | 19.2 | 19.3 | 18.7 | 18.9 |
| Italy | Federcasse (BCC) | 19.6 | 19.6 | 23.4 | 24.4 |
| Poland | KZBS member banks – excluding affiliated banks | 18.9 | 18.6 | 19.2 | 20.7 |

Source: Own study based on: EACB 2023.

Observation of the TCR, based on the most recent published data, does not indicate a significant impact of external shocks on the solvency of individual cooperative banking groups. This finding applies to both highly centralised organisations and those operating with limited integration. Furthermore, the data suggests a more dynamic improvement in capital adequacy among banks operating within loosely integrated structures.

**Figure 1.**

*Arithmetic mean value of TCR for selected nine cooperative banking groups in Europe in relation to GDP changes in EU countries in 2020–2023*

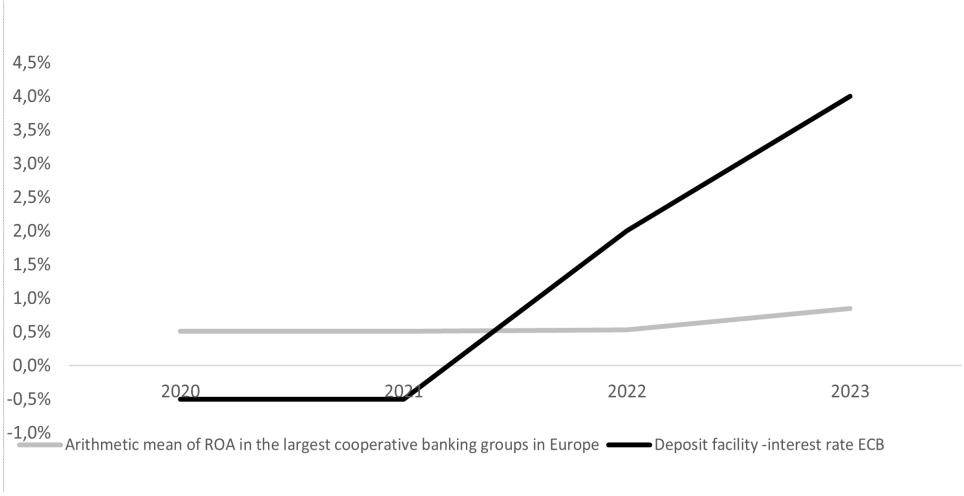



Source: Own study based on: EACB 2023, Eurostad 2025.

A direct comparison of GDP changes in European Union countries with the arithmetic mean of the TCR, calculated from the data in Table 2, indicates that deterioration in macroeconomic conditions did not directly lead to a reduction in solvency. The accumulated capital resources provided sufficient protection against risks arising from banking activities. Furthermore, an analysis of the volatility of profitability among selected banking groups in the post-pandemic period reveals positive trends in financial performance, contributing to an increase in operational security as measured by solvency ratios.

**Figure 2.**

*Variability of the arithmetic mean of the ROA ratio in the five largest cooperative banking groups against changes in the European Central Bank's deposit rate in 2020–2023*




Source: Own study based on: EBC n.d., EACB 2023.

Chart 2 illustrates the variability of profitability among the five largest cooperative banking groups in the European Union in relation to changes in one of the European Central Bank's key interest rates (Deposit Facility). One of the primary drivers of increased profitability in European cooperative banking groups was the rise in interest margins, indirectly influenced by interest rate

hikes by the European Central Bank (in eurozone countries) and by national central banks (in other countries), which contributed to a widening of the interest rate spread. Over several years, the rise in the inflation rate – generally considered detrimental to macroeconomic stability – had a positive impact on banking sector profitability, including within the cooperative sector. However, in some countries, this situation negatively affected lending, which may, in turn, reduce the stability of banking sector revenues.

In summary, European cooperative banking groups did not experience the crisis events of the early 2020s to an extent that would threaten their long-term operations. However, they may face an escalation of risk in the future, particularly credit risk, which could arise from a deterioration in the corporate sector.

**Economic situation of cooperative banks participating in IPS BPS during a period of rapid macroeconomic change – a case study**

The effects of the global financial crisis of 2007–2009 had a limited impact on the Polish banking sector, including its most dispersed segment, cooperative banking. The specific nature of the cooperative business model, based primarily on traditional lending activities, provided a degree of protection against the external crisis. This resilience was largely due to the limited involvement of these institutions in complex financial instruments, which could have exposed them to the crisis through asset revaluations or the bankruptcy of other banks (Kozak, 2010b, p. 252). In the long term, however, the crisis influenced central bank policies, ultimately contributing to a reduction in market interest rates (Kozak, 2018, p. 6). This development had a significant effect on the functioning of cooperative banks in Poland, whose main source of income remains interest revenue (Kozak, 2018, p. 14). Under these conditions, smaller cooperative banks in particular faced challenges in maintaining adequate levels of efficiency. In the case of cooperative banks with a larger scale of operations, an increase in activity in the credit market was

observed after 2009, partly due to the exploration of new markets within large urban agglomerations. This expansion contributed to a higher level of risk, which continues to characterise larger cooperative banks today (Kozak, 2018, p. 13). Owing to their relational business model, cooperative banks did not restrict financing for households or businesses during periods of crisis, which also contributed, to some extent, to elevated operational risk (Folwarski, 2023, p. 107). Unlike commercial banks, they maintained or increased their credit exposure to businesses, thereby expanding their market share in this segment (Kil & Miklaszewska, 2015, p. 145).

Integration activities are characteristic of the entire cooperative banking sector in Europe. The drivers of these activities stem from the need to develop mechanisms for absorbing external shocks. In particular, the integration of risk management competencies is essential for building lasting resilience against the negative effects of macroeconomic crises. This integration can take the form of institutional consolidation, leading to the creation of large structures with a high level of solvency. Such initiatives are primarily driven by capital shortages. In Poland, for example, extensive mergers of cooperative banks were undertaken to ensure that these institutions met the minimum statutory requirements for own funds (Kozak, 2010a, pp. 140–141).

An alternative strategy involves measures that both support the development of common risk monitoring and control mechanisms and enhance the efficiency of individual banks through the integration of business processes. This model of cooperation is currently being implemented in Poland, where institutional protection systems operate within two associations of cooperative banks. The objectives of IPS include not only supporting the restructuring of participants and coordinating merger processes as part of restructuring efforts, but also directly improving the quality standards of risk management (Wilk, 2024, pp. 77–78).

Structural changes in the Polish cooperative banking sector were also determined by the entry of new legislative solutions into force. Under these solutions, cooperative banks were obliged to make a strategic choice between:

1. operating within the IPS;
2. operating within integrated associations;
3. conducting business as a non-affiliated bank.

However, it should be noted that the latter option has in fact been reserved in practice for the largest cooperative banks.

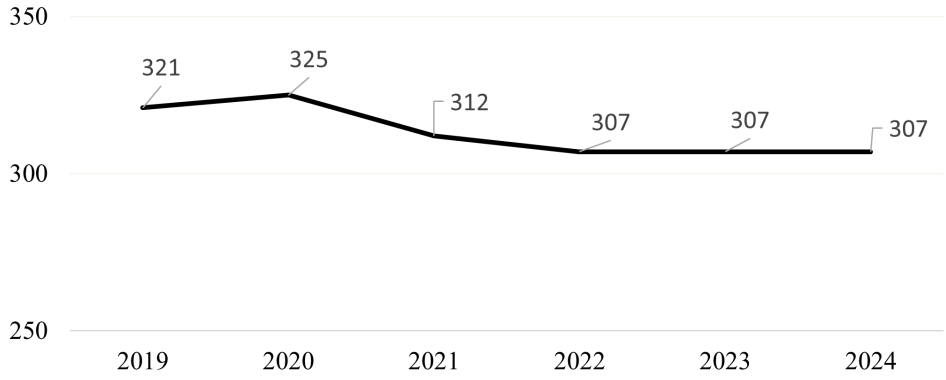
In the Polish cooperative banking, 2015 was a landmark year, marked by the establishment of two institutional protection schemes: the SGB Cooperative Protection Scheme and the BPS Association Protection Scheme. Most cooperative banks opted to sign agreements guaranteeing their participation in these IPSs. Some participants in the BPS association initially sought to create an integrated association, reflecting a degree of uncertainty and distrust toward the new IPS structure introduced by the financial security network institutions. The authorities of certain cooperative banks justified their caution in joining the protection system due to concerns about incurring additional financial costs (Dec & Masiukiewicz, 2019, p. 33). However, in the long term, these reservations did not produce the intended outcomes, ultimately leading the authorities of other banks to enter into agreements with the IPS.

The number of participants in Poland's largest IPS grew dynamically between 2016 and 2020. This growth was partly a consequence of the failure to finalise the integrated association project, and partly the result of a pragmatic assessment of the benefits of participating in the protection system. It was not until 2021 that the number of banks forming IPS BPS decreased, as a direct result of eight merger processes. Most of these mergers were motivated by the desire to improve operational efficiency under conditions of particularly low interest rates and, consequently, to enhance the business model[1].

[1] Data obtained from internal resources of the IPS BPS.

**Figure 3.**

*Change in the number of IPS BPS participants between 2019 and 2024*

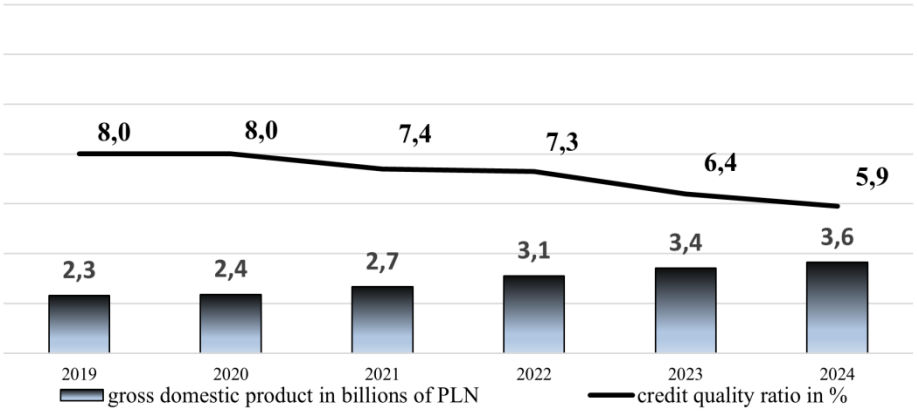



Source: Own study based on data obtained from the internal resources of the Cooperative of the BPS Protection Scheme Association.

The intensification of merger processes in 2020–2022 was indirectly influenced by the effects of the COVID-19 pandemic, which in its initial phase primarily impacted business operations. Only three merger restructuring processes were driven by the materialisation of credit risk. However, these cases concerned credit exposures originating in the pre-pandemic period and were therefore not a direct consequence of the macroeconomic destabilisation caused by the pandemic. The continuous development of credit risk assessment tools, based on uniform risk management mechanisms at IPS BPS, significantly enhanced the quality of pre-transaction credit risk evaluation, which may have played a key role in reducing the potential economic effects of the pandemic.

**Figure 4.**

*Credit risk level in IPS BPS against the backdrop of changes in Poland's GDP in 2019–2024*




Source: Own study based on data obtained from the internal resources of the Cooperative of the BPS Protection Scheme Association and bdm.stat.gov.pl (ESA 2010 national accounts).

The effects of the COVID-19 pandemic did not lead to an immediate contraction in economic growth in Poland, due to several factors. One key factor was the unprecedented flow of government support to the business sector. At the same time, a sharp increase in energy commodity prices contributed to an escalation of inflationary pressures (Folwarski & Kil, 2023, p. 110). These developments significantly altered the operating conditions of cooperative banks. On one hand, there was a decline in demand for credit products; on the other hand, the rise in interest rates had a positive effect on banking efficiency.

The factors indicated above contributed to the post-pandemic decline in risk levels, as measured by the credit portfolio quality indicator. Neither the effects of the COVID-19 pandemic nor the geopolitical instability resulting from Russia's invasion of Ukraine led to a deterioration in the economic situation of borrowers severe enough to escalate credit risk. Conversely, the

financial results generated by cooperative banks enabled the full absorption of current credit risk, as well as the coverage of non-performing exposures identified in previous years.

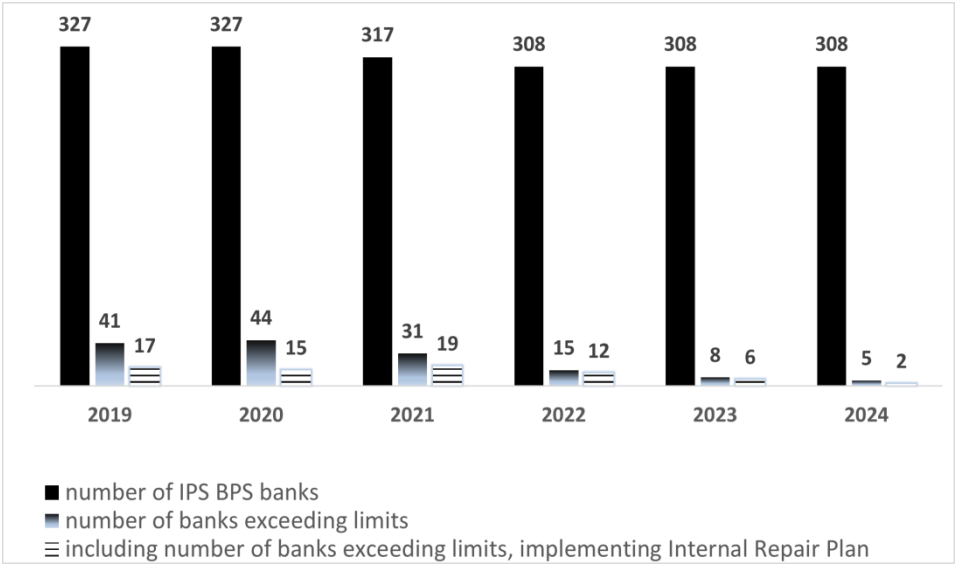
The sources of stability for cooperative banks and their resilience to macroeconomic shocks are not limited to external factors. The development of robust security structures within IPS BPS was facilitated by a range of tools outlined in the BPS Association Protection System Agreement. Beginning with uniformly organised risk control and monitoring mechanisms, the agreement provides for the use of various preventive instruments. It also grants the System Management Unit a range of powers to influence participants deemed to be excessively exposed to risk. In addition, the Agreement outlines a framework for restructuring banks experiencing financial difficulties, primarily arising from the materialisation of risk. As part of these recovery measures, banks may be required to develop and implement Internal Recovery Plans, the execution of which is monitored by the System Management Unit. A central component of the IPS BPS risk mitigation toolkit is the security fund, which provides direct support to participants in the event of an immediate threat to liquidity or solvency. The implementation of this set of tools has significantly improved the quality of risk management and enhanced banks' capacity to generate operational efficiency gains. Consequently, these measures have substantially strengthened resilience to the potential effects of external crises over the past decade.

The improvement of the security situation for IPS BPS participants is further illustrated by a retrospective projection of compliance with the limits established under the BPS Security System[2].

[2] The level of risk limits in IPS BPS is specified in Appendix 3 to the IPS BPS Association Agreement.

**Figure 5.**

*Compliance by participants with internal IPS BPS limits in 2019–2024*




Source: Own study based on data obtained from the internal resources of the Cooperative of the BPS Protection Scheme Association.

The scale of violations of internal limits restricting participants' risk at the beginning of IPS BPS's operation was quite significant, reaching approximately 12%. In each subsequent year, the number of events resulting in the limits being exceeded decreased. Moreover, in the first quarter of 2025, none of the banks violated the limit.

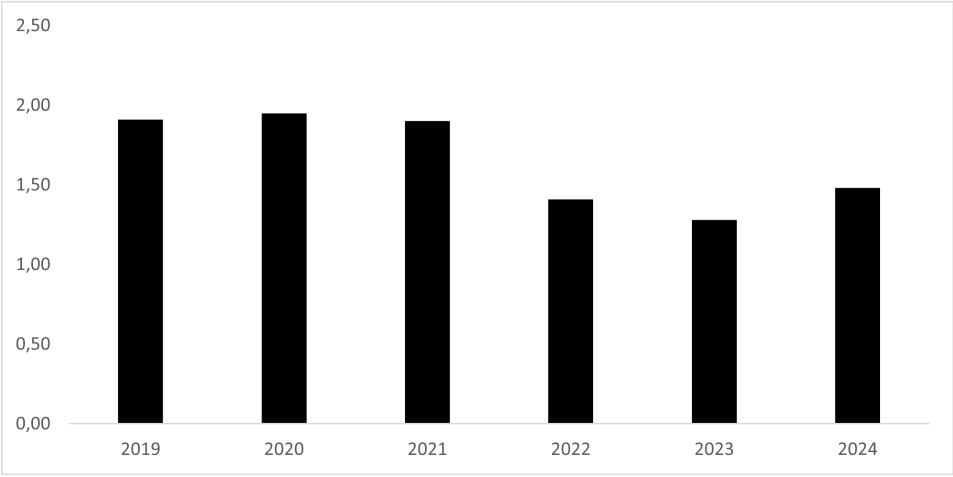
The gradual reduction in the risk level of IPS BPS participants had a direct impact on the results of the risk rating, which was carried out as part of a points-based assessment[3]. The average rating has been declining in recent years, but this decline is not linear. A significant improvement in the rating occurred in 2022, i.e., in the post-pandemic period. This can be attributed primarily

[3] *The scoring system is specified in Appendix 8 to the SOZ BPS Association Agreement. The scoring system uses a six-point scale, where 6 indicates the highest risk and 1 indicates the lowest risk.*

to the previously mentioned increase in profitability, which had a direct impact on the level of own funds and, consequently, on the solvency rating. This confirms the earlier thesis that the pandemic crisis did not cause a deterioration in the security of cooperative banks in Poland and, paradoxically (among other things due to high interest rates), contributed to a significant reduction in the level of risk of IPS BPS participants' activities.

**Figure 6.**

*Average score of IPS BPS participants in 2019–2024*

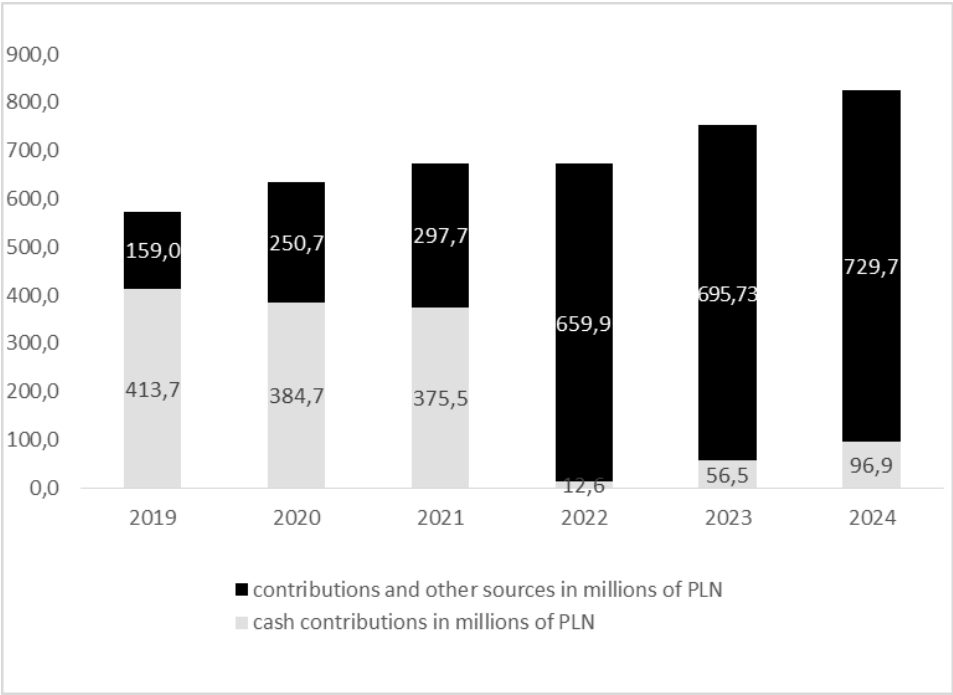



Source: Own study based on data obtained from the internal resources of the Cooperative of the BPS Protection Scheme Association.

The security fund plays a significant role in determining the level of security of the SOZ BPS. The fund is financed by participants' inputs and refundable cash contributions. In accordance with applicable regulations, its level should not be lower than 1% of the value of deposits guaranteed by the Bank Guarantee Fund. In this context, however, it does not constitute a source of deposit guarantee (DGS) but serves to provide direct support to banks in the event of a loss of liquidity or threat of insolvency.

**Figure 7.**

*Value and structure of the IPS BPS Security Fund in millions of PLN in 2019–2024*




Source: Own study based on data obtained from the internal resources of the Cooperative of the BPS Protection Scheme Association.

The capitalisation level of the Guarantee Fund increases every year. This also applies to periods when the Polish and global economies experienced shocks. It is important to note its structure, where the dominant value (exceeding 90%) is represented by direct contributions. In practice, this means that the possible release of aid funds for one participant will not require other cooperative banks to create reserves in their own balance sheets. At this point, it is also worth noting that the value of the funds accumulated in the Security Fund covers 89%[4] of the potential deficiency in specific provisions that might be necessary to cover the risk if all non-performing expo-

[4] *Data as of March 31, 2025 obtained from the internal resources of the IPS BPS.*

sures of SOZ BPS participants became permanently uncollectible (which is a kind of stress test scenario). In view of the above, it can be concluded that the Security Fund significantly increases the security and insures the risk of cooperative banks associated with IPS BPS.

When assessing the scale of risk and the level of security of cooperative banks operating within the SOZ BPS framework, against the backdrop of external shocks caused by the turbulent macroeconomic environment, it should be noted that neither the pandemic crisis nor the geopolitical crisis of the early 2020s posed a threat to the continuity of the group's operations as a whole, or to its individual members.

**Summary**

An assessment of data on cooperative banking groups confirms the author's thesis that macroeconomic shocks have a limited impact on the operational security of their participants. The increase in resilience to external shocks was related to the progressive integration of cooperative banks, which is particularly noticeable in Poland. Regulatory changes and interest rate hikes improved the profitability and stability of cooperative banks. However, it will only be possible to assess the sustainability of this phenomenon in the longer term. Due to the relatively short period of operation of cooperative banking groups in Poland under the new structural conditions, the impact of consolidation processes on the level of security has not been widely described in the literature on the subject. In this context, the research objective achieved may be used in the future as a basis for further research on the security and resilience of cooperative banks within various forms of cooperative banking group organisations in Europe.

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# EURO ADOPTION AND INFLATION STABILITY: EARLY EVIDENCE FROM CROATIA AND THE CZECH REPUBLIC

**ABSTRACT**

**The purpose of the article** is to explore the link between monetary policy regimes and inflation dynamics in small open economies. Croatia and the Czech Republic provide a natural experiment for examining how small open economies with different monetary frameworks respond to global and regional shocks, including euro adoption and other external disturbances. The analysis sheds light on how institutional arrangements affect the stability of inflation rates in the presence of global shocks.

**Methodology** includes a Vector Autoregression (VAR) approach with monthly data covering the period from 2000 to 2024 and is complemented by Granger causality tests, as well as a structural break analysis to account for major events such as the global financial crisis in 2008, the COVID-19 pandemic in 2020, the 2022 European energy shock, and Croatia's euro adoption.

**The results of the empirical analysis** reveal that euro adoption is associated with reduced short-term inflation volatility but weaker responsiveness to external shocks, while monetary independence allows greater policy flexibility at the cost of heightened inflation variability. These findings provide early evidence on the inflation-stabilizing role of euro adoption and contribute to ongoing policy debates on monetary integration within the European Union.

**Keywords:** Euro Adoption, Inflation Stability, Monetary Policy, Structural Breaks

**JEL Class:** C32 E31 E42 E52 F41 F45


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## Introduction

Monetary policy is a crucial tool to maintain price stability and support economic growth in any country, but it plays an even more important role in small open economies that are highly exposed to global market conditions. The European Union (EU) provides a unique and interesting case for comparing the effects and performance of different monetary policy regimes. EU member states face a trade-off between adopting the euro as a common currency and giving up control over monetary policy to the European Central Bank (ECB) or maintaining their national currency and full independence in terms of domestic monetary policy decisions. This institutional design has a significant impact on the ability of countries to control inflation, adjust interest rates, and react to economic shocks, with implications for their overall macroeconomic performance.

Croatia and the Czech Republic are two EU countries that have taken different paths in terms of their monetary policy framework. Croatia joined the euro area in 2023, replacing its national currency, the kuna, with the euro and ceding its monetary authority to the ECB. As a result, Croatia is now part of a centralized monetary regime that aims to maintain price stability in the euro area as a whole, and that does not necessarily reflect or react to the specific conditions of the Croatian economy. On the other hand, the Czech Republic has retained the Czech koruna (CZK) as its national currency and full control over its monetary policy through the Czech National Bank (ČNB). The Czech monetary authorities have more freedom and flexibility to respond to domestic inflationary pressures and external shocks by adjusting interest rates, exchange rate interventions, or other policy tools as they see fit.

Euro adoption is associated with several potential benefits, including eliminating currency risk and transaction costs, improving transparency, and facilitating financial integration with the rest of the EU. However, it also implies

giving up a key policy instrument that could be used to cushion against region-specific economic disturbances and maintain macroeconomic stability. On the other hand, an independent currency allows for more fine-tuning and adjustment of inflation and interest rates in response to changing economic conditions, but it also exposes the country to greater risks of exchange rate volatility, speculative capital flows, and inflationary spillovers from external shocks.

The purpose of this research is to examine whether euro adoption has been associated with greater stability of inflation in Croatia relative to the Czech Republic, which has maintained full monetary independence. The analysis is based on monthly data from 2000 to 2024 and incorporates several major global disruptions, including the 2008 financial crisis, the 2020 COVID-19 pandemic, and the 2022 European energy crisis, that provide a critical context for assessing inflation dynamics under different monetary regimes.

The central hypothesis of this study is that monetary regimes shape how small open economies respond to shocks and maintain inflation stability. Euro adoption is expected to contribute to reduced short-term inflation volatility through credibility and expectation-anchoring effects, whereas an independent monetary policy allows for more flexible responses to global and regional shocks but may result in greater variability. Because Croatia's post-euro experience is still limited, the findings are preliminary and should be interpreted as evidence of early transitional effects rather than definitive long-run outcomes. Accordingly, the study asks how Croatia and the Czech Republic differ in their inflation responses to global and regional shocks under distinct monetary frameworks, and whether these differences support the view that monetary regimes condition the stability and transmission of inflation dynamics. To answer this question, the analysis employs a Vector Autoregression (VAR) model, supported by Granger causality tests and structural break analysis, to evaluate the

relationships among inflation, monetary policy instruments, and exchange rate movements in both economies.

The paper is organized as follows: the next section provides a literature review on the relevant topics, while the second section describes the data. The third section discusses the methodology used in the research, while the fourth section presents the empirical results and their interpretation. The study concludes with research limitations, and potential policy implications.

## 1. Literature review

Inflation behavior across Central and Eastern European (CEE) economies is driven by institutional variations in the design of monetary policy frameworks, exchange rate regimes and central bank credibility. In this respect the region offers a natural experiment for comparative research, as it CEE member states have followed significantly different paths since the early 1990s. On the one hand some have given up their monetary sovereignty and adopted the euro, while on the other hand a set of countries opted to keep their own currency, backed by an inflation-targeting regime. This creates scope for studying the consequences of institutional design on the behavior of inflation in small open economies, which are typically more exposed to external forces.

A significant portion of the literature has emphasized that CEE economies cannot be analyzed in isolation from international factors. Jiménez Rodríguez, Morales Zumaquero and Égert (2010) is one of the first studies that present some stylized facts of how inflation in the region is very responsive to external shocks such as changes in commodity prices, euro area and US developments. The authors show the dilemma that these small open economies face in that they need to address the problem of domestic price stability, but at the same time they need to accommodate some shocks that they cannot influence. Their contribution, which also contains important information on import-

ed inflation, has become particularly relevant during times of global uncertainty, such as the COVID-19 pandemic or the 2022 European energy crisis. The study lays the groundwork for understanding the interaction between international factors and the domestic monetary policy framework in determining inflation in the region.

Croatia's journey to euro adoption provides a compelling illustration of how structural changes influence inflation behavior. Prior to accession, Perović (2015) explored Croatia's pre-euro inflation patterns, emphasizing the role of the kuna as a nominal anchor and assessing its impact on expectations. He argued that credibility was anchored in exchange rate stability and that the supranational shift would alter monetary policy transmission dynamics. This observation proved prophetic. At the time of euro adoption in January 2023, Croatia experienced an initial inflation uptick linked to rounding and adjustment effects. Sorić (2024) documents that these effects were transient, driven by technical adjustments rather than underlying demand. Falagiarda et al. (2023) corroborate this finding, confirming the temporary nature of rounding effects and highlighting a subsequent decline in volatility. Supporting evidence from Šokčević, Mišević, and Milisavić (2024) reveals that inflation expectations and investor confidence improved under ECB-led monetary policy, reinforcing the stabilizing impact of supranational credibility.

The institutional basis for such results is strongly established in the existing literature. Clarida, Galí and Gertler (2000) underline the significance of predictability and transparency of frameworks as prerequisites for anchoring expectations. By acceding to the ECB's rule-based system, Croatia adopted an institutional framework specifically engineered to promote stability and minimize uncertainty. Andrieș, Nistor and Sprincean (2020) further argue that transparency itself is a key determinant of resilience, demonstrating that credible

communication can reduce systemic risk and strengthen policy effectiveness. Therefore, Croatia's accession has contributed to improved macroeconomic stability, even in the absence of national policy instruments.

However, euro adoption does come with trade-offs. Berend and Prüser (2024) caution that while membership synchronizes inflation cycles with the rest of the euro area, it decreases the ability to tailor policy responses to domestic conditions. In similar vein, De Grauwe (2018) warns that monetary unification can exacerbate divergence when structural reforms do not keep pace with integration. These insights shed light on why Croatia, while benefiting from enhanced credibility and lower volatility, may now need to rely more on fiscal and structural policies to absorb idiosyncratic shocks.

The Czech Republic is in some sense the opposite case. There, full monetary independence has been maintained (through the Czech National Bank, or CNB). This has entailed a floating exchange rate and an inflation-targeting regime, which can be used to respond more directly to domestic economic conditions. Lesuisse (2019) notes both advantages and disadvantages of this approach. On the one hand, the CNB is able to adjust its interest rates quickly, which it did, for example, in 2021–2022 to counter pandemic-induced supply shocks and higher energy prices. On the other hand, the openness of the economy to trade and capital flows implies that spillovers from ECB policy will remain an important consideration.

The cost of this independence has been questioned by scholars. Wawrosz and Křížek (2025) point out that, while autonomy allows for timely interventions, it also heightens exposure to volatility through exchange rate pass-through. Ábel and Siklos (2023) argue that flexible regimes permit short-term stabilization but do not ensure sustained price stability. Taylor (2000) offers a theoretical foundation for these arguments, demonstrating that the pass-

through effect is mitigated in low-volatility environments but is significantly stronger during high-volatility periods. The Czech Republic's experience post-pandemic exemplifies this mechanism: external shocks, transmitted via the koruna, exacerbated inflation variability despite CNB interventions.

The research conducted by Baxa, Horváth, and Vašíček in 2013 demonstrates that inflation expectations within inflation-targeting countries react strongly to central bank announcements. The CNB's credibility has been enhanced by transparent signaling, enabling markets to anticipate policy moves more effectively. Pokorný (2023) offers an in-depth analysis of how communication strategies bolstered public trust and policy effectiveness, even during global disruptions. These studies imply that independence needs not just flexible instruments but also credibility and transparency to maintain stability.

The comparative literature also brings out the trade-offs involved in both countries' choices. Croatia's euro adoption has brought credibility and stability benefits (Falagiarda et al., 2023; Sorić, 2024; Šokčević et al., 2024), but at the cost of national discretion (De Grauwe, 2018; Berend & Prüser, 2024). The Czech Republic, on the other hand, has retained flexibility (Ábel & Siklos, 2023; Wawrosz & Křížek, 2025) but has faced higher volatility stemming from exchange rate pass-through (Taylor, 2000; Jiménez Rodríguez et al., 2010). Aksman (2005) argues that inflation convergence often lags behind monetary convergence when fiscal and structural reforms are lacking, a reminder that both cases depend on the broader institutional environment.

These debates have also been connected to methodological issues. Bai and Perron (2003) have shown how the structural break methodology can be employed to determine turning points in the inflation dynamics. Petrevski (2023), on the other hand, discusses the usefulness of VAR modelling and causality testing under uncertainty. These and other similar tools have by now be-

come part of a standard toolkit for analysis of how exogenous shocks and institutional arrangements are intertwined.

Before turning to the empirical findings, it is useful to recall the main structural differences between the two economies that shape how monetary policy operates. El-Shagi and Tochkov (2022) describe the Czech Republic as a highly open, manufacturing-oriented economy closely linked to European value chains, particularly with Germany, making it more sensitive to euro-area spillovers. Grabowski and Stawasz-Grabowska (2021) further demonstrate that European Central Bank policy measures exert measurable effects on financial markets in Central and Eastern Europe, reinforcing the Czech Republic's exposure to cross-border monetary dynamics. In contrast, Srdelić and Dávila-Fernández (2024) highlight that Croatia is a services-based economy heavily dependent on tourism, where seasonal demand patterns and exchange-rate management have historically influenced inflation dynamics. Radvan (2024) notes that the Czech National Bank's independent inflation-targeting regime has preserved domestic policy flexibility but also exposure to external shocks, whereas Szapáry and Vonnák (2024) find that Croatia's shift from a managed exchange-rate regime to full euro adoption in 2023 reduced monetary autonomy but enhanced credibility and financial stability. These contrasts clarify the rationale for comparing the two countries in the empirical analysis that follows.

The next section contains the empirical analysis which is based on comparing Croatia and the Czech Republic in the period 2000–2024 with a view to evaluate how euro adoption as opposed to monetary independence affected inflation stabilization.

## 2. Data

The dataset analyzed in this study consists of monthly observations from January 2000 through December 2024. This frequency offers a balanced approach: it captures medium-term inflationary dynamics and policy responses while filtering out short-term noise that might distort the identification of structural changes or monetary policy impacts. The 24-year window allows for an assessment of pre- and post-crisis periods, euro adoption effects, and recent inflation surges related to global shocks.

Data was sourced from reliable and publicly available institutions:

- **Federal Reserve Economic Data (FRED)**: Provided consumer price index (CPI) data for both Croatia and the Czech Republic, 3-month interbank lending rates, real GDP growth, and unemployment rates. The CPI data are harmonized (HICP) to ensure comparability across EU member states.
- **European Central Bank (ECB)**: Supplied the Deposit Facility Rate, which is used in this study as the primary policy rate proxy, as well as official exchange rates for the Croatian kuna (HRK/EUR) and Czech koruna (CZK/EUR). These series allow for consistent measurement of currency effects and monetary alignment.

The data was cleaned and transformed as necessary. The inflation and interest rate series were converted to percentage changes where appropriate. Log transformations were applied to the exchange rate and GDP series to improve stationarity. All time series were tested for unit roots using ADF tests prior to VAR estimation.

Preliminary inspection reveals that both Croatia and the Czech Republic experienced significant economic disruptions during the 2008–2009 finan-

cial crisis and the 2020–2021 COVID-19 period, with strong rebounds afterward. Despite recent inflationary spikes in 2022–2023, both countries have returned to moderate inflation levels by 2024, although volatility remains higher in the Czech Republic. These descriptive trends underscore the importance of evaluating not only inflation levels, but also the transmission of monetary policy across different regimes.

## 3. Methodology

To evaluate whether different monetary regimes are associated with differences in inflation stability, this study employs a Vector Autoregression (VAR) framework to analyze the dynamic relationships among inflation, exchange rates, interest rates, and GDP in Croatia and the Czech Republic. This approach is well suited to capturing the feedback loops and interdependencies that characterize small open economies.

The VAR model is complemented by two additional tools that directly support the research question. First, Granger causality tests are used to assess whether policy rates or exchange rate movements help predict inflation outcomes, shedding light on the strength of monetary transmission channels under each regime. Second, structural break analysis (Bai-Perron methodology) is applied to identify major shifts in inflation dynamics around global shocks (2008 financial crisis, COVID-19 pandemic, 2022 energy crisis) and institutional change (Croatia's euro adoption). Together, these methods provide a basis for assessing whether Croatia's transition into the euro area coincided with a change in inflation volatility, and how its experience compares with the Czech Republic's independent policy framework.

$$HR\_Inflation_t = c_1 + a_{11} \times HR\_Inflation_{t-1} + a_{12} \times CZ\_Inflation_{t-1} + a_{13} \times ECB\_Rate_{t-1} + a_{14} \times Exchange\_Rate\_HR_{t-1} + a_{15} \times Exchange\_Rate\_CZ_{t-1} + E_{1,t} \quad (1)$$

The 5-variable VAR(1) model includes one equation for each endogenous variable, with each specified as a linear function of its own lag, the lags of the other variables in the system, a constant term, and an error term. The remaining equations follow the same structure, with each endogenous variable appearing on the left-hand side. Variable definitions are provided in Appendix A: Variable Definitions. Each equation shows how the current value of a variable (for example, Croatia's inflation) is determined by its own value from the previous month, the previous month's values of the other four variables, a constant, and a random error term. This structure allows us to capture the dynamic interplay between inflation, interest rates, and exchange rates for both Croatia and the Czech Republic, as well as the influence of the ECB's policy rate.

The Vector Autoregression (VAR) model with a lag order of two, is selected based on the information criteria. This stands as a suitable methodology because of the macroeconomic variables' interconnected dynamics. The two-period lag structure shows that economic outcomes appear within two cycles in these economies while representing both direct and follow-up effects from policy adjustments and external disturbances. Multiple analytical techniques work together within this methodology to enable a thorough investigation of how monetary policies transmit through various currency systems. Granger Causality Tests evaluate how monetary policy and exchange

rate fluctuations influence inflation trends by uncovering causal links between these variables and the timing of policy transmission effects. The analysis also examines whether the ECB rate decisions and exchange rate movements can predict inflation developments in both economies with statistical significance. Two-sample t-tests combined with the Bai-Perron methodology detect substantial breaks in inflation time series related to significant economic events such as the 2008 global financial crisis and the COVID-19 pandemic in 2020 through to Croatia's euro adoption in 2023 and the 2022 energy crisis. This methodology allows researchers to detect inflation regime shifts and assess the statistical significance of structural changes within both monetary systems. Impulse Response Functions (IRFs) model the time-based impact of monetary policy and exchange rate shocks on inflation to demonstrate how individual economies react to such external disturbances along multiple timeframes. IRFs help visualize the magnitude and persistence of inflation responses to standardized shocks while showing their direction which enables direct comparisons between Croatia's euro-based monetary system and the Czech Republic's independent monetary policy framework.

In advance of VAR model estimation, a view of the basic relationships among the variables considered, as well as a preliminary check on multicollinearity, was obtained by examining pairwise correlations. Table 1 shows the descriptive correlation matrix for the five principal variables used in the model: inflation rates in Croatia and the Czech Republic, the ECB deposit facility rate and bilateral exchange rates. Correlations are in general quite low, offering no immediate hint of multicollinearity and permitting inclusion of all five variables in the VAR specification

**Table 1.**

*Descriptive Statistics of VAR Model Variables*

| | HR_Inflation | CZ_Inflation | ECB_Rate | Exchange_ _Rate_HR | Exchange_ _Rate_CZ |
|---|---|---|---|---|---|
| HR_Inflation | 1 | −0.166 | −0.033 | −0.216 | −0.054 |
| CZ_Inflation | −0.166 | 1 | −0.032 | −0.001 | −0.032 |
| ECB_Rate | −0.033 | −0.032 | 1 | 0.09 | 0.036 |
| Exchange_Rate_HR | −0.216 | −0.001 | 0.09 | 1 | 0.038 |
| Exchange_Rate_CZ | −0.054 | −0.032 | 0.036 | 0.038 | 1 |

*n = 288 observations

Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

## 4. Results

The study shows that Croatia achieved inflation stability through euro adoption while the Czech Republic faced increased inflation fluctuations because of its independent monetary policy. The analysis discovered distinct variations in monetary transmission mechanisms and structural breaks. To assess the performance and robustness of the estimated VAR models, several key statistics and diagnostic tests were conducted.

Table 2 summarizes the main results for Croatia and the Czech Republic, comparing key model diagnostics, correlation metrics, Granger causality tests, impulse response observations, and structural break tests.

**Table 2.**

*Summary of Results: Croatia vs Czech Republic*

| Statistics / Test | Croatia (HR) | Czech Republic (CZ) | Notes |
|---|---|---|---|
| Final Prediction Error (FPE) | 1.21e-32 | 1.21e-32 | VAR model fit (both countries) |
| Inflation Correlation (r) | 0.970 (with CZ) | 0.970 (with HR) | Very strong correlation |
| Exchange Rate vs. Inflation (correlation) | Significant negative | Significant negative | Exchange rate pass-through effects |
| Granger causality: ECB Rate → Inflation (lag 1) | $p > 0.45$ (not significant) | $p = 0.0836$ (marginally significant) | CZ sensitive to ECB decisions |
| Granger causality: Exchange Rate → Inflation | $p > 0.40$ (not significant) | $p > 0.10$ (not significant) | Limited pass-through in both |
| Impulse Response to ECB Rate Shock | Muted response | Pronounced response | CZ shows stronger, cyclical adjustment |
| Impulse Response to Exchange Rate Shock | Stable, muted | Initial negative, cyclical adjustment | |
| Structural Break: Financial Crisis (9/2008) | 1.2 ($p = 0.15$, not significant) | 1.5 ($p = 0.12$, not significant) | No major inflation regime shift |
| Structural Break: COVID-19 (3/2020) | 3.04 ($p = 0.0159$, significant) | 5.18 ($p = 0.0014$, significant) | Strong inflation surge in both |
| Structural Break: Energy Crisis (1/2022) | 5.65 ($p = 0.0000$, significant) | 7.68 ($p = 0.0000$, significant) | Major inflation surge |
| Structural Break: HR Euro Adoption (1/2023) | 3.77 ($p = 0.0462$, significant) | 4.61 ($p = 0.0741$, marginally significant) | Inflation jump at euro adoption |

Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

### *4.1. Inflation Co-Movement and Baseline Fit (VAR results)*

The VAR model exhibited an excellent overall fit through its extremely low Final Prediction Error (FPE) value of 1.21e-32 which demonstrated its strong explanatory power for the specified relationships and its effective capture of the underlying economic dynamics. There was a powerful link between Czech and Croatian inflation rates with a 0.970 correlation coefficient indicating similar inflation patterns which persisted despite their distinct monetary policy approaches. The strong correlation between the economies demonstrates that both respond similarly to external factors including global commodity prices and supply chain disruptions regardless of their distinct monetary policies which challenges the idea that different monetary regimes produce different inflation outcomes. The analysis showed significant negative correlations between exchange rates and inflation in both countries which points to exchange rate pass-through effects that cause currency depreciation to heighten inflation via increased import costs, yet these effects vary in strength between the two examined economies.

### *4.2. Transmission Channels: Policy Rates and Exchange Rates (Granger causality)*

The Granger Causality tests identified complex variations in the way monetary policy affected each country differently (Table 2). The ECB rate showed limited but statistically significant influence on Czech inflation in the short term (p-value = 0.0836 at lag 1) which demonstrates the Czech economy's sensitivity to eurozone monetary policy despite having its independent currency. The Czech Republic's significant trade and financial connections with the eurozone indicate that monetary policy impacts transmit across different currency systems. The Czech Republic (p-values > 0.10) showed no significant link between exchange rate changes and inflation trends which contradicts common

expectations about flexible exchange rate systems transmitting external shocks to domestic pricing. Research results demonstrate that neither the ECB rate nor exchange rate alterations have a statistically significant impact on Croatian inflation because both indicators show p-values above 0.45 and 0.40 respectively which implies Croatian inflation operates independently from eurozone monetary influences even after adopting the euro. The unexpected result may be attributed to underlying economic structures or the recent euro adoption which necessitates extended adjustment times before monetary policy mechanisms fully establish their effectiveness.

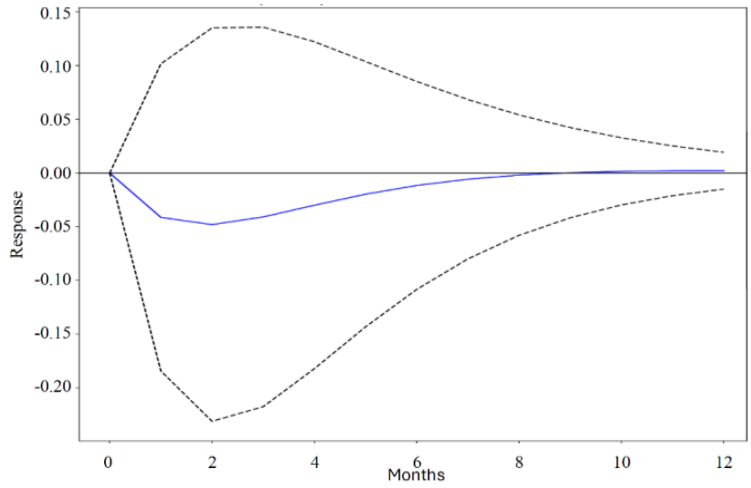
### *4.3. Adjustment to Shocks – Impulse Response Functions (IRFs)*

Impulse response functions illustrate how inflation in Croatia and the Czech Republic reacts over time to monetary and exchange rate shocks. This comparison highlights differences in stability versus flexibility between the two regimes. Through the analysis of Impulse Response Functions (IRF) the data depicted key findings about the temporal responses of different economies to monetary and exchange rate disturbances.

Figure 1 indicates that a one standard deviation increase in the ECB deposit facility rate causes a significant and immediate drop in Croatia's consumer price inflation. The impact is largest in the first 3 months and starts to fade away by month 6. This rapid response pattern is consistent with the efficient transmission of euro area monetary policy shocks to Croatia. It aligns with the country's financial integration and its adoption of the euro in 2023. The tight confidence bands around the response support the statistical significance of the initial impact.

**Figure 1.**

*Impulse Response – ECB Deposit Facility Rate Shock on Croatia Inflation*

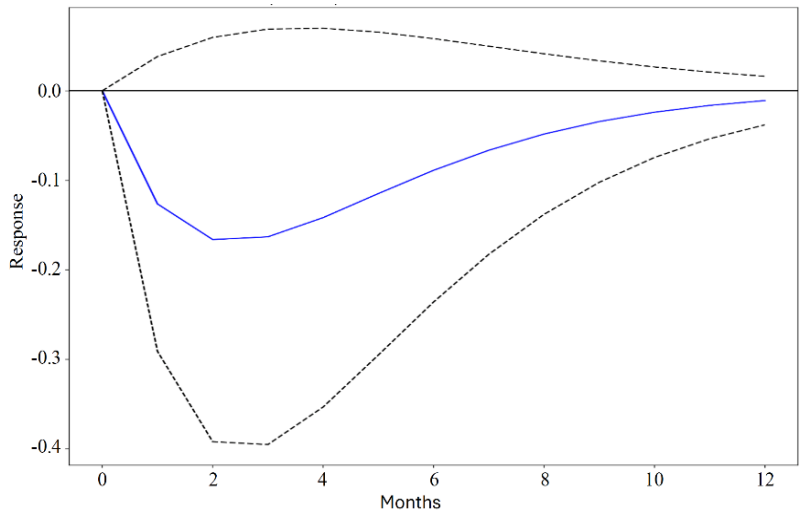



Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

In the Czech Republic, the estimated response of inflation to the same ECB deposit facility rate shock is distinctly different from the one in Croatia (Figure 2). First, the effect appears with a delay of about month 2 and then it gradually fades over time. The response is also much weaker, which is another indication of the Czech Republic's monetary independence and the more closed nature of inflation dynamics in this country, which features its own central bank and a flexible exchange rate regime. Also, note wider confidence bands surrounding this effect, which indicate greater uncertainty about the size of this effect.

**Figure 2.**

*Impulse Response – ECB Deposit Facility Rate Shock on Czech Inflation*

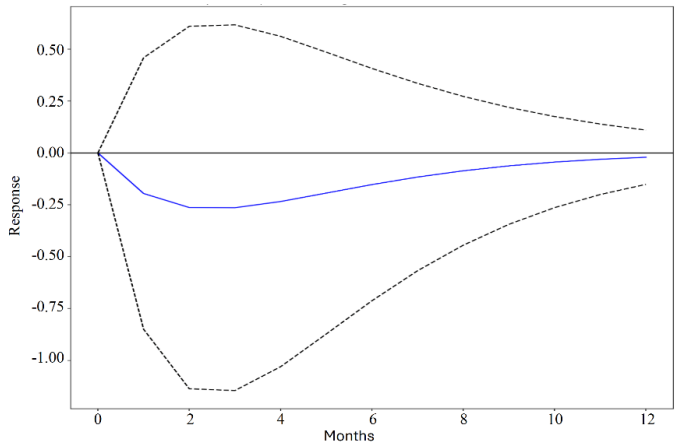



Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

Figure 3 reveals a brief and modest negative response of Croatia's inflation to an exchange rate shock. The response peaks negatively within two months and then converges toward zero. Given Croatia's euro adoption and the resulting limited role of the exchange rate in monetary transmission, the muted response is expected. The relatively tight confidence bands indicate that the observed reaction, though small, is statistically reliable.

**Figure 3.**

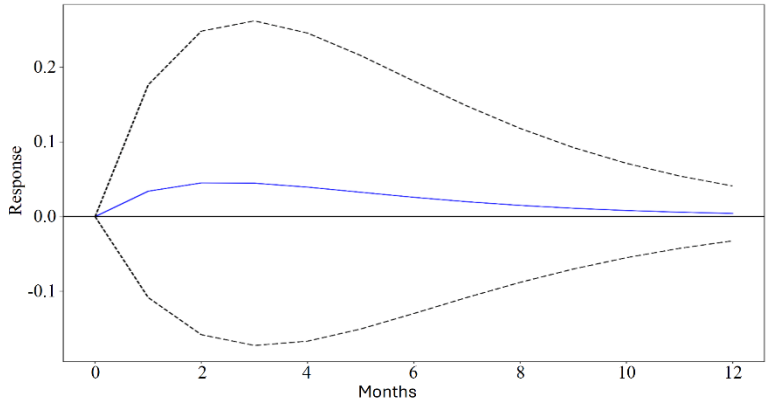
*Impulse Response – Exchange Rate Shock on Croatia Inflation*




Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

**Figure 4.**

*Impulse Response – Exchange Rate Shock on Czech Inflation*




*Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

The Czech Republic experiences a larger and more persistent response of inflation to an exchange rate shock, with significant effects observed for as long as 8–10 months (Figure 4). This finding reflects the central importance of exchange rate dynamics in the Czech Republic's inflation process, in line with its history of managed floating and the importance of currency fluctuations for import prices. The response is statistically significant in the short run and supports the argument that exchange rate shocks represent a primary channel of inflation volatility in the Czech context.

To further examine the relative importance of each structural shock over the forecast horizon, Table 3 presents the Forecast Error Variance Decomposition (FEVD) results for Croatia and the Czech Republic.

**Table 3.**

*Forecast Error Variance Decomposition (FEVD) Results for Croatia and Czech Republic*

| Variable | Horizon (Months) | Own Shock (%) | Exchange Rate Shock (%) | Other Shocks (%) |
|---|---|---|---|---|
| Croatian Inflation | 1 | 98.2 | 1.6 | 0.2 |
| Czech Inflation | 1 | 98.7 | 1.2 | 0.1 |
| ECB Rate | 1 | 99.7 | 0.3 | 0 |
| Croatian Exchange Rate | 1 | 99.6 | 0.2 | 0.2 |
| Czech Exchange Rate | 1 | 99.8 | 0.1 | 0.1 |
| Croatian Inflation | 6 | 87.1 | 11.2 | 1.7 |
| Czech Inflation | 6 | 92.1 | 6.8 | 1.1 |
| ECB Rate | 6 | 96.7 | 2.9 | 0.4 |
| Croatian Exchange Rate | 6 | 97.3 | 1.1 | 1.6 |
| Czech Exchange Rate | 6 | 98.2 | 0.7 | 0.7 |

| Variable | Horizon (Months) | Own Shock (%) | Exchange Rate Shock (%) | Other Shocks (%) |
|---|---|---|---|---|
| Croatian Inflation | 12 | 81.2 | 16 | 2.8 |
| Czech Inflation | 12 | 88.7 | 9.7 | 1.6 |
| ECB Rate | 12 | 95.1 | 4.3 | 0.6 |
| Croatian Exchange Rate | 12 | 96 | 1.6 | 2.4 |
| Czech Exchange Rate | 12 | 97.4 | 1 | 1.6 |

Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

The forecast error variance decomposition (FEVD) in Table 3 indicates that, at a 1-month horizon, the variance in each variable is explained almost entirely by its own shocks. Over time, we observe an increasing role for exchange rate shocks, particularly for inflation. At 12 months, exchange rate shocks explain 16% of the variance in Croatian inflation and close to 10% in Czech inflation. This finding implies that exchange rate dynamics become more significant in explaining inflation, especially in the Croatian context. This result complements our IRF results above: the IRF shows the direction and timing of the response of inflation, while the FEVD tells us about the relative importance of the shocks, which also change over time.

### *4.4. Inflation Regime Shifts During Crises and Euro Adoption (Structural break analysis)*

Research into the structural breaks found essential disruptions in inflation trends during important economic events that demonstrated how these shocks impacted price stability throughout different monetary systems as depicted in Table 4.

**Table 4.**

*Summary Statistics: Structural Break Analysis at Key Events*

| Event | Break Date | HR_Mean_ _Change | HR_pValue | CZ_Mean_ _Change | CZ_pValue |
|---|---|---|---|---|---|
| Financial Crisis | 9/1/2008 | 1.2 | 0.15 | 1.5 | 0.12 |
| COVID-19 | 3/1/2020 | 3.04 | 0.0159 | 5.18 | 0.0014 |
| Energy Crisis | 1/1/2022 | 5.65 | 0 | 7.68 | 0 |
| HR Euro Adoption | 1/1/2023 | 3.77 | 0.0462 | 4.61 | 0.0741 |

Source: Author's own calculations based on data from January 1, 2000, to December 1, 2024, retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org), accessed February 2, 2025.

The 2008 Financial Crisis did not result in statistically significant shifts in inflation means or variances for either nation (p-values exceeded 0.05) yet both countries faced major structural breaks during the COVID-19 pandemic in 2020. Croatia experienced a significant inflation increase averaging 3.04 percentage points which was statistically significant with a p-value of 0.0159 while the Czech Republic faced an even more pronounced inflation jump averaging 5.18 percentage points that reached statistical significance at a p-value of 0.0014. This research reveals how global supply chain shocks and fiscal responses during the pandemic impacted price stability in various monetary systems and demonstrates that independent monetary policy in the Czech Republic failed to shield its economy from these pressures despite having theoretical monetary independence benefits.

The severe consequences of Russia's invasion of Ukraine on European energy markets triggered the most significant structural inflation changes during the 2022 Energy Crisis while destabilizing broader economic conditions. The

mean inflation rate in Croatia rose dramatically by approximately 5.65 percentage points and the Czech Republic saw a more significant increase of about 7.68 percentage points both with extremely low p-values (0.0000) showing undeniable statistical significance. The Czech Republic's significant supply shock impact results from its high energy intensity and substantial energy import dependence while independent monetary policy fails to shield core economic inputs from such severe disruptions. Croatia became the 20th member of the Eurozone in 2023 as it faced a statistically significant break in inflation trends which resulted in an average increase of 3.77 percentage points (p-value = 0.0462). This evidence supports the theory that changes in currency regimes lead to modifications in how prices are set by businesses due to rounding practices, menu cost changes, as well as altered inflation expectations among market participants. The Czech Republic underwent heightened inflation averaging approximately 4.61 percentage points during the same time frame but presented a less definite statistical significance shown by a p-value of 0.0741 which indicates that external European inflation factors as well as Croatia's monetary transition affected inflation dynamics.

### *4.5. Policy Implications and Comparative Insights*

Taken together, the results reveal three central insights: (1) euro adoption coincided with modest reductions in inflation volatility, (2) independence allowed more immediate interventions but heightened exposure to external shocks, and (3) both regimes faced limitations during global crises. The Czech Republic shows greater synchronization with ECB monetary policy while keeping its currency, but Croatia's inflation rates show limited response to ECB decisions even after joining the euro. This indicates monetary policy transmission mechanisms require consideration beyond currency arrangements to include structural economic factors as well as financial system maturity and past policy credibility. Exchange rate movements transmit to inflation differently between both countries according to dynamics

analysis that reveals limited direct pass-through effects in both cases but reveals slightly stronger influence on Czech inflation compared to Croatian inflation. Croatia and its trading partner managed exchange rate pressures effectively through Croatia's currency board system which provided stability comparable to that of euro adoption. The different ways the ECB policy affects the Czech Republic and Croatia demonstrate that monetary policy cannot be uniformly applied to all nations because Czech economic conditions are more influenced by external money policy changes while Croatia's inflation remains mainly influenced by domestic factors which shows that individual national fiscal policies and structural reforms are necessary to manage each country's specific economic conditions and vulnerabilities. The empirical results provide essential data for discussions concerning optimal currency areas and European Union monetary integration tradeoffs while informing EU states considering monetary transitions about the complicated interaction between formal monetary setups and economic structures that shape macroeconomic results.

Overall, the findings support the central hypothesis that monetary regimes condition how small open economies respond to shocks and maintain inflation stability. Euro adoption appears to reduce short-term inflation volatility in economies like Croatia through greater credibility, but at the cost of limited responsiveness to external disturbances. In contrast, the Czech Republic's monetary independence allows for more flexible interventions, yet exposes the economy to heightened inflation variability.

**Conclusion**

This research reveals that Croatia and the Czech Republic, while having broadly similar inflation dynamics, differ significantly in the transmission of monetary policy and the response to exchange rate movements. Both countries have undergone changes in inflation regimes during the recent global crises, highlighting

the vulnerability of small open economies to external shocks. Croatia's adoption of the euro in 2023 brought about a structural break characterized by initial rounding and adjustment effects, followed by a decrease in volatility and an increase in credibility in expectation management. However, this transition also entailed a loss of flexibility, as monetary policy became the responsibility of the European Central Bank. The Czech Republic, by maintaining its national currency, has preserved its policy autonomy, allowing for rapid responses to domestic shocks through the Czech National Bank. Yet, this independence has come with increased inflation variability, as evidenced by the pass-through of exchange rate fluctuations.

The comparative analysis reveals the trade-offs inherent in these two monetary regimes: euro adoption can lead to stability and credibility gains, but at the expense of flexibility; independence can provide policy autonomy, but expose the economy to external volatility. For Croatia, the challenge going forward will be to use fiscal and structural policy tools more effectively to manage external imbalances, while the Czech Republic will need to continue building credibility and improving communication to contain volatility risks. While these findings offer early insight, they are constrained by the relatively short post-accession period following Croatia's euro adoption in 2023. The limited data horizon makes it difficult to fully capture longer-term adjustment dynamics. Future research will extend the analysis to include additional euro adopters such as Slovakia and other Central and Eastern European economies as more post-adoption data become available, enabling a broader assessment of inflation stability and convergence within the euro area. Beyond institutional contrasts, the key insight of this analysis lies in how each economy absorbs and transmits external shocks, illustrating that structural openness and policy flexibility are central to inflation resilience

In light of these limitations, future research could focus on several areas to build upon the findings of this paper. Empirically, it would be desirable to extend the data horizon as more post-accession data become available, and to apply time-varying and nonlinear econometric techniques to better capture the evolving nature of monetary and exchange rate regimes. The inclusion of fiscal and institutional variables in the model could also help to more fully capture the policy environment and its interaction with monetary regimes. Policy-oriented work could also explore how better coordination between supranational monetary policy and national fiscal tools could help mitigate vulnerabilities for new euro area members, and how independent regimes can most effectively communicate and anchor expectations in volatile and uncertain environments.

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## Appendix A: Variable Definitions

| Variable Name | Description |
|---|---|
| • HR_Inflation_t | Croatia's inflation rate at time t |
| • CZ_Inflation_t | Czech Republic's inflation rate at time t |
| • ECB_Rate_t | European Central Bank Deposit Facility Rate at time t |
| • Exchange_Rate_HR_t | Croatia's exchange rate at time t |
| • Exchange_Rate_CZ_t | Czech Republic's exchange rate at time t |
| • c_i | Constant terms for each equation |
| • a_ij | Coefficient parameters measuring the effect of variable j on variable i |
| • ε_i,t | Error terms (innovations) for each equation |
| • t-1 | One-period lag (previous month) |

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# INFORMATION POLICY OF THE FEDERAL RESERVE SYSTEM AND THE EUROPEAN CENTRAL BANK DURING AND AFTER THE PANDEMIC CRISIS

**ABSTRACT**

**The purpose of the article**. Since the 1990s, central banks have become more transparent about their monetary policy. The meaning of the communication was amplified by the global financial crisis, when central banks began to use non-standard monetary policy instruments on a broader scale. Further changes resulted from the COVID-19 pandemic and the period of high inflation, which lasted several months afterwards. The article aims to present and analyse the measures taken by the Federal Reserve System (FED) and the European Central Bank (ECB) during the pandemic crisis and the period of high inflation.

**Methodology**. The monetary policy instruments used by both central banks from 2020 to 2025, as well as the statements made by Jerome Powell (Chair of the Board of Governors of the FED) and Christine Lagarde (President of the ECB), were presented. The article also presents various opinions on the measures taken by both central banks, published in the press and the literature.

**Results of the research**. The results indicate that monetary policy instruments, used by both central banks, allowed them to mitigate the effects of the economic disruptions caused by the COVID-19 pandemic. However, after the pandemic crisis, both central banks had to raise interest rates and pursue a policy of Quantitative Tightening. The crises also highlighted the importance of communication policy. Although the actions taken by both central banks were the subject of criticism, the measures taken by the FED were considered successful, and the measures taken by the ECB allowed for mitigating the direct consequences of the high inflation.

**Keywords:** European Central Bank, Federal Reserve System, central bank communication, information policy, monetary policy, COVID-19

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## Information policy of the Federal Reserve System and the European Central Bank during and after the pandemic crisis

As part of the financial safety net, the central bank plays an important role in the economic system. It is the issuing bank, the central bank of the state and the banks' bank. However, since the 1990s, the role of central banks has started to evolve. These changes have been catalysed by the financial crises of the 21st century – the global financial crisis, the public debt crisis in the euro area, the pandemic crisis, and the period of high inflation. During these crises, central banks began to use non-standard monetary policy instruments extensively. In addition, there were significant changes in information policy and communication with the public.

The article analyses the measures and the information policy of central banks between 2020 and 2025, during the pandemic crisis and the period of high inflation. Particular attention is paid to the actions taken by the Federal Reserve System (FED) and the European Central Bank (ECB). Although this topic has been addressed in central bank publications, it has not been widely analysed in the Polish literature. The role of central banks is often studied in the context of the stability of the financial system, as well as in the context of the impact of central banks' decisions on the economy. However, the communication of central banks with the public is becoming equally important. Given the evolving information policy of the central banks, as well as the technological development, the need for an analysis focusing not only on the actions of central banks but also on their information policy has arisen.

To achieve the goal, changes in the information policy of the leading central banks – the FED and the ECB – have been presented, as well as the changes in their communication with the public initiated in the late 1980s and early 1990s. Particular attention was paid to the statements of the man-

agers of these central banks: Jerome Powell, who has been the Chairman of the Board of Governors of the FED since 2018, and Christine Lagarde, who has been the President of the ECB since 2019. For this purpose, selected press articles and transcripts of Jerome Powell's and Christine Lagarde's speeches, available on the websites of the Federal Reserve System and the European Central Bank, respectively, were used. The number of announcements published by both central banks between March 2020 and January 2022 is presented. The actions and instruments used by both central banks during the period of high inflation are briefly described, and predictions for further monetary policy actions are given.

The article verifies the hypothesis that major central banks took many measures to mitigate the impact of the financial crises and succeeded in stabilising the financial system and limiting the damage to economies.

**Changes in the information policy of central banks**

Information policy on monetary policy is regarded as a key tool for central banks to shape the expectations of financial market participants (Lamla & Vinogradov, 2019). This is a relatively recent view. Until the 1990s, it was believed that central banks should not communicate with the public about their actions and motivations in this area. Wesołowski and Żuk (2011) identified two motives for conducting non-transparent monetary policy:

- inconsistency of monetary policy over time;
- the fully transparent monetary policy would prevent the possibility of surprising the markets – as a consequence, the monetary policy would be less effective (Cukierman & Meltzer, 1986, as cited in Wesołowski & Żuk, 2011).

After 1990, the perception has shifted. One of the raised issues was the aforementioned inconsistency of monetary policy over time (Misztal, 2023)[1]. It has been observed that a balance between inflation and employment in the short-term perspective is achievable. Such a policy can be effective only if the central bank does not pursue a transparent monetary policy. However, if the public recognises the incentives upon which the central bank conducts the monetary policy, it can adjust the expectations. Thus, unexpected decisions cease to be effective.

Since the 1990s, central banks have begun to conduct a more transparent policy, communicating with the public. Initially, the focus was on those financial market participants who could be considered experts. However, later they started to address the rest of the economic community, both through social media activity and by conducting broad educational activities.

Central banks began to conduct monetary policy more openly and transparently to increase their independence from the state. The gradual implementation of inflation targeting regimes by central banks[2], as well as the introduction of flexible exchange rates, also became catalysts (Macklem & Vardy, 2023). The importance of central banks' information policy increased further after the global financial crisis, as the central banks gradually implemented forward guidance policies (Lamla & Vinogradov, 2019). This was particularly important as the expectations for good governance and transparency in public institutions increased. This has resulted in an increased demand for more comprehensible information policies that would simultaneously allow central banks to reach further diverse audiences (Macklem & Vardy, 2023).

[1] This issue has been raised by Finn Kydland and Edward Prescott (the 2004 laureates of the Nobel Memorial Prize in Economic Sciences), and later by Robert Barro and David Gordon.

[2] The Reserve Bank of New Zealand was the first central bank in the world to introduce an inflation targeting regime in 1990 (Lockyer, 2022).

A further change in information policy occurred during the COVID-19 pandemic, which put central banks back "into the limelight" (Blinder et al., 2022, p. 2) as during the 2007–09 financial crisis. The authors point out that the change in the mandate of central banks, as well as the use of more complex monetary policy instruments, required more explanation to external audiences. Finally, some of the tools used by central banks can be controversial, often making the decisions of these institutions the subject of public debate.

The change has also become evident as central banks have begun to be more active on social media. From June 2, 2008[3] until 2018, 113 central banks created a Twitter account (now: X), (Kyriakopoulou & Ortlieb, 2019). Korhonen & Newby (2019) list various reasons for central banks to use Twitter, such as sharing official statements, promoting publications and research, public speeches, or announcing job openings[4].

At the same time, Blinder et al. (2022) observed that it is possible to identify differences between central banks' accounts on social media. The analysis of central bank activity makes it possible to differentiate the topics of the content published by these institutions. It was observed by Masciandro et al. (2023), who analysed the activity of central banks of G20 countries on Twitter (now: X). The researchers noted that tweets announcing the issuance of new banknotes and coins generated significantly more reactions than tweets related to other topics. In addition, far more reactions, compared to other topics, were generated by posts about monetary policy decisions and operations undertaken in

[3] On that day, the Bank of Canada was the first central bank in the world to create a Twitter account (now: X).

[4] Korhonen and Newby (2019) additionally noticed that some central banks (e.g. the Bank of Slovenia) used Twitter in a traditional way – to publish, among other things, exchange rates and other official statements.

this area. Masciandro et al. (2023) noted that among ten posts that received the most reactions and that were retweeted, all of them were announcing the issuance of new notes and coins.

Public speeches by members of central banks' governing authorities have changed significantly. A statement made on July 26, 2012, by Mario Draghi, the President of the European Central Bank (ECB) from 2011 to 2019, has become somewhat "emblematic": "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough" (Draghi, 2012)[5].

This statement triggered not only reactions in the financial markets[6] but also numerous comments. Blinder et al. (2022) note that while the statements on Twitter towards Draghi became more subjective, diverse, and expressed stronger opinions, the statements regarding the ECB did not change significantly.

Another example can be found in the words of Ben Bernanke, the Chairman of the Board of Governors of the Federal Reserve System (FED) from 2006 to 2014. During a ceremony held to mark the centenary of the foundation of FED, Bernanke (2013) expressed that one of his personal goals for the term was to make the US central bank more transparent. Bernanke (2013) also noted that better communication by the FED with the public could improve the effects of the central bank's policies, including disclosing the results of bank stress tests or helping the public and market participants understand

[5] Stiefel and Vivès (2019) point out that this statement was made not during an ECB Governing Council meeting, but during an external event – the Global Investor Conference in London. Draghi was addressing these words to the participants of this conference (financial market participants).

[6] Blot and Hubert (2018) point out that, as a result of Draghi's speech, spreads on Italian and Spanish 10-year government bonds decreased significantly, even though Draghi did not formally use any monetary policy tool.

changes in monetary policy. However, the most important reason for increasing transparency and conducting transparent communication was to help build and ensure the FED's accountability to the American people and the representatives elected by Americans. Bernanke (2013) stated that "Clarity, transparency, and accountability help build public confidence in the Federal Reserve, which is essential if it is to be successful in fostering stability and prosperity."

Christine Lagarde took a similar position. When she ran for President of the ECB, Lagarde (2019) indicated that strengthening the relationship between the central bank and the public would be one of the priorities of her term in office (Lagarde, 2019). At the same time, she pointed out that the ECB must be understood by both the financial markets and the public[7]. The desire to improve the ECB's communication with non-expert market participants was also expressed by former members of the ECB Governing Council. They explicitly indicated that the central bank's communication with the public was inadequate, pointing out the opportunities for improvement (Ehrmann & Wabitsch, 2022, as cited in Masciandro et al., 2022).

Central banks have also started to organise events in which members of their authorities speak directly to the public. Blinder et al. (2022) mentioned the activities of the Bank of England, which organised Future Forums. During that event, representatives of the public shared their opinions, ideas or concerns. The Bank of Canada, the FED, or the ECB were also identified among other central banks that organised conversations with the public.

[7] „The ECB needs to be understood by the markets that transmit its policy, but it also needs to be understood by the people whom it ultimately serves. People need to know that it is their central bank, and it is making policy with their interests at heart. One of the priorities of my Presidency, if confirmed, will be to reinforce that bridge with the public" (Lagarde, 2019).

**Methodology**

The analysis aimed to present the actions taken by the Federal Reserve System (FED) and the European Central Bank (ECB) between 2020 and 2025, during the crisis caused by the COVID-19 pandemic and the period of high inflation that followed immediately after the pandemic crisis. Particular attention was paid to the statements of these banks' managers – Jerome Powell, Chairman of the Board of the Governors of the FED and Christine Lagarde, President of the ECB. Selected press articles, published between March 2020 and September 2025, as well as the transcripts of statements by Jerome Powell and Christine Lagarde, published between March 2020 and July 2022, were also analysed. The statements made by Powell and Lagarde were accessed on the websites of the Federal Reserve System and the European Central Bank. A study by Cantú et al. (2021), which compiles the announcements of monetary policy decisions of 40 central banks, was used to present the number of announcements published by the FED and the ECB between March 2020 and January 2022. Additionally, the comparison of measures taken by the FED and the ECB was based on the following:

- the number of announcements made from March 2020 to January 2022;
- the changes in interest rates between March 2020 and October 2025;
- other monetary policy instruments used between March 2020 and October 2025.

The article verifies the hypothesis that major central banks took many measures to mitigate the impact of the financial crises and succeeded in stabilising the financial system and limiting the damage to economies.

**Measures taken by FED from 2020 to 2025 and their evaluation**

To assess the perception of the measures and actions taken by FED during the pandemic crisis, it is important to remember that the shock caused by the COVID-19 pandemic was the most challenging for the US economy since the Great Depression of the 1920s and 1930s (Clarida et al., 2021). Only during the second quarter of 2020 did the GDP of the United States collapse by 30% at an annual rate, and 22 million jobs were lost in the first two months of the crisis. In a few weeks, the US unemployment rate went from its lowest level in 50 years (3.5%) to its highest level since the Second World War (almost 15%). As a result of the fall in aggregate demand, consumer price levels fell. The disruptions tightened financial conditions and disrupted credit and the flow of funds to American households and enterprises. The response of the American fiscal authorities (as well as the FED) to the effects of the pandemic crisis was "unprecedented in its scale, scope and speed" (Clardia et al. 2021, p. 147). Thanks to the laws passed by the US Congress, the economy received a total of $5.8 trillion in fiscal support, representing as much as 28% of US GDP[8].

Cantú et al. (2021) explain that the first decision taken as part of the FED's response to the pandemic crisis was to cut the federal funds rate on at an unscheduled Federal Open Market Committee (FOMC) meeting by 50 basis points – from a range of 1.5% – 1.75% to a range of 1% – 1.25%. Two weeks later, following the decision taken on March 3, 2020, the FOMC decided to further reduce the federal funds rate to a range of 0 – 0.25%. The changes in the FED's federal funds rate can be seen in Figure 1.

[8] The laws were passed in March and December 2020 and in March 2021.

**Figure 1.**

*The change in the lower and upper limit of the target range of the FED federal funds rate in March 2020*


Source: Board of Governors of the Federal Reserve System (US) (2020-2025) as cited in Federal Reserve Bank of St. Louis (2020–2025).

The FED (2020, as cited in Cantú et al. 2021; Milsetin & Wessel, 2024) also used other instruments such as:

1. reducing the reserve requirements ratio to zero (decision taken on 15 March 2020);
2. taking coordinated actions with the Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, and the Swiss National Bank to increase the provision of liquidity through the liquidity swap line arrangements in USD (decision taken on March 15, 2020);
3. establishment of new swap lines with the Reserve Bank of Australia, Banco Central do Brasil, the Bank of Korea, Banco de Mexico, the Monetary Authority of Singapore, and the Sveriges Riksbank, through

which the provision of U.S. dollar liquidity in amounts up to $60 billion was supported (decision taken on March 19, 2020);

4. establishment of new swap lines with the Danmarks Nationalbank, the Norges Bank, and the Reserve Bank of New Zealand, through which the provision of U.S. dollar liquidity in amounts up to $30 billion was supported (decision taken on March 19, 2020);
5. the debt securities purchase programmes – one of the important examples was the change of the objective of using the so-called "quantitative easing" (QE) to support the economy (Milstein & Wessel, 2024) and the simultaneous announcement of the purchase of at least USD 500 billion of Treasury securities and the purchase of at least USD 200 billion of state-guaranteed mortgage-backed securities (decision taken on March 15, 2020);
6. pursuing a „forward guidance" policy – an example of this policy was the announcement in September 2020 to keep the federal funds rate low "until labor market conditions have reached levels consistent with the Committee's assessments of maximum employment and inflation has risen to 2 percent and is on track to moderately exceed 2 percent for some time" (FED, 2020b).

While analysing the actions taken by the FED during the COVID-19 pandemic, the statement made by Jerome Powell on April 9, 2020 should also be noted. Powell (2020) indicated that the FED could help mitigate the effects of the pandemic crisis by providing stability during a period of reduced economic activity, as well as by instruments through which the recovery could be „as vigorous as possible" (Powell, 2020). Powell (2020) underlined that „emergency measures are reserved for truly rare circumstances", such as the COVID-19 pandemic, which will cease to be used "when the economy is well on its way back

to recovery, and private markets and institutions are once again able to perform their vital functions of channeling credit and supporting economic growth"[9]. These words indicated the willingness of the FED to continue to help the economy and to take emergency measures. A similar conclusion was reached by Rieder (2020, as cited in Rabouin, 2020), who compared Powell's words at the press conference held on April 29, 2020 with Mario Draghi's "whatever it takes" stance. A willingness to take further action to support the US economy was also expressed by Powell himself, who announced in June 2021 that the FED would take all necessary actions to support the economy until its recovery was complete (Powell, 2021)[10].

Indeed, the FED has taken several measures to mitigate the effects of the pandemic crisis. Table 1 presents the number of announcements issued from March 2020 to January 2022.

**Table 1.**

*The topics and number of announcements issued by the FED from March 2020 to January 2022*

| The topic of announcements | Number of announcements |
|---|---|
| Interest rates | 17 |
| Reserve policy | 1 |
| Lending operations | 39 |
| Asset purchases | 25 |

[9] "Our emergency measures are reserved for truly rare circumstances, such as those we face today. When the economy is well on its way back to recovery, and private markets and institutions are once again able to perform their vital functions of channeling credit and supporting economic growth, we will put these emergency tools away" (Powell, 2020).

[10] This statement was expressed during Powell's hearing before the House of Representatives' Select Subcommittee on the Coronavirus Crisis (COVID-19).

| The topic of announcements | Number of announcements |
|---|---|
| Foreign exchange operations[11] | 10 |
| Other | 2 |
| TOTAL | 94 |

Source: Own research based on FED (2020-2022) as cited in Cantú et al. (2021).

Some selected opinions published in the media throughout the pandemic are worth considering. As early as June 2020 Powell was named as the person with "the most humiliating job in America" (Gogoi, 2020). One of the examples is the statement of Peter Navarro, from 2017 to 2021, a Director of the Office of Trade and Manufacturing Policy. Navarro described Powell as a man with „probably the worst bedside manner of any Fed chairman in history" (Navarro, 2020, as cited in Gogoi, 2020). He was echoed in his negative assessments by Larry Kudlow, who from 2018 to 2021 was the Director of the National Economic Council. However, these opinions were not as harsh as the opinions expressed by Donald Trump, who was the President of the United States. Trump suggested that Powell is an enemy of the state[12], and referred to him as a man with "no «guts», no sense, no vision!" and "a terrible communicator"[13]. It should be noted that it was Trump who nominated Powell as Chairman of the Board of Governors of FED in 2018. Gogoi (2020) noted that despite the "White House insults" and the questions by journalists, suggesting being under political pressure, Powell has consistently indicated that he does not intend to succumb to it. Powell's actions have been regarded

[11] Mainly regarding the swap lines.

[12] „…My only question is, who is our bigger enemy, Jay Powell or Chairman Xi?" (Trump, 2019a). The tweet was published on 23 August 2019. Original spelling has been maintained.

[13] „Jay Powell and the Federal Reserve Fail Again. No «guts», no sense, no vision! A terrible communicator!" (Trump, 2019b). The tweet was published on 18 September 2019. Original spelling has been maintained. It is worth noticing that Trump has used the short form of Powell's name ("Jay"), rather than the full name (Jerome).

as “seizing the reins of leadership with a force that leaves almost every FED leader in the dust”. The tools used by FED were referred to as “a set of actions that far surpass anything that the central bank has ever done in its history”[14] (Gogoi, 2020). The most accurate description of the situation in which Powell not only had to face a difficult macroeconomic situation, but also political pressures, can be found in the last two sentences of the Gogoi’s (2020) article: “Powell wants to save America. And as he determinedly pushes forward to achieve his plan, the president continues to undercut him.”

Even though Powell has been criticised for part of his actions[15] and the response of the FED has been even compared to the „epic mistake” (Fisher, 2021, as cited in Taddonio, 2021), it is pointed out that the actions of the American central bank allowed it to „avert economic disaster” (Timiraos, 2022). However, this does not mean that the FED under Powell’s leadership did not make mistakes. Jakeman (2022) points out that in mid-2021, when inflation levels in the USA began to rise, Powell labelled it as a temporary phenomenon and that improving the labour market was more important. This goal was achieved, but inflation levels in early 2022 were the highest in 40 years. Timiraos (2022, as cited in Jakeman, 2022) points out that one of the reasons for this situation was a change in the role of the US central bank institution, which during the pandemic period ceased to be the “capital provider of last resort”, de facto becoming the “supporting lender to the whole world”[16].

[14] Full quote: „In recent weeks, Powell has seized the reins of leadership with a force that leaves almost every Fed leader in the dust. When the U.S. economy screeched to a halt because of the coronavirus, the Fed unleashed a set of actions that far surpass anything that the central bank has ever done in its history” (Gogoi, 2020).

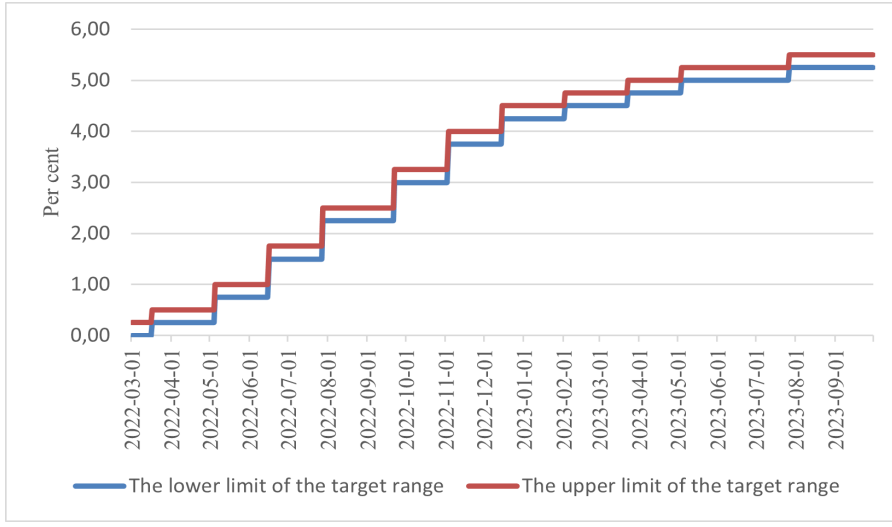
[15] One of the examples is the statement by Leon Copperman, a billionaire and head of consultancy Omega Advisors, who accused the FED of creating a speculative bubble as a result of the FED’s use of instruments to support the economy during the COVID-19 pandemic (Graffeo, 2020).

[16] Jakeman (2022) describes the change in the following way: “Long known as the lender of last resort, at the height of the pandemic it became «the backup lender to the entire world».”

The FED responded by starting a series of interest rate increases in March 2022, ending in July 2023. During this period, the federal funds rate rose from a range of 0–0.25% to a range of 5.25–5.50% (FED, 2025), (Fig. 2).

**Figure 2.**

*The change in the lower and upper limit of the target range of the FED federal funds rate from March 2022 to September 2023*




Source: Board of Governors of the Federal Reserve System (US) (2020–2025) as cited in Federal Reserve Bank of St. Louis (2020–2025).

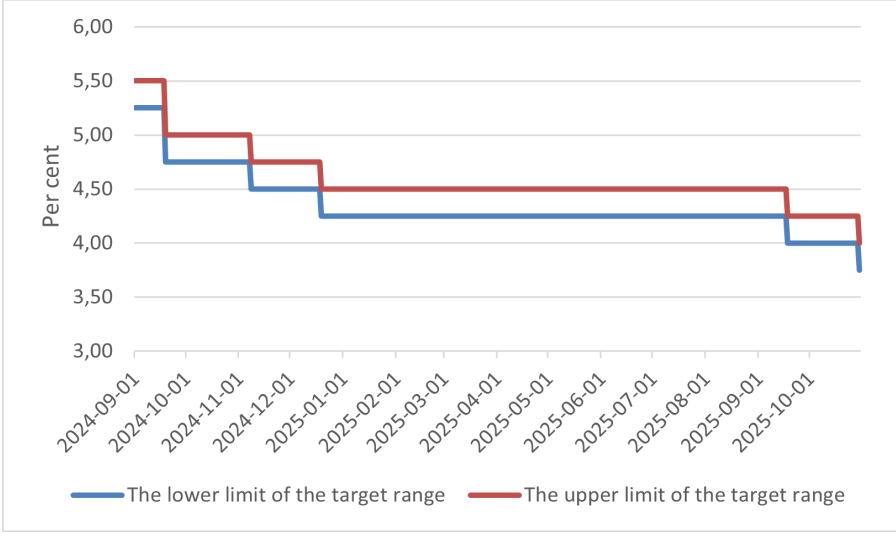
From June 2022, the FED began pursuing a policy of so-called "Quantitative Tightening" (QT). Powell (2022) warned that "While higher interest rates, slower growth, and softer labor market conditions will bring down inflation, they will also bring some pain to households and businesses. These are the unfortunate costs of reducing inflation. But a failure to restore price stability would mean far greater pain".

Indeed, the US inflation rate fell from 8.5% in August 2022 to 3.2% in July 2023, although unemployment remained at the same level. Nevertheless, many

observers considered the FED's actions under Powell's leadership as a success. According to them, by a series of interest rate hikes, the FED had managed to suppress further increases in inflation without causing a deterioration in the labour market or an economic slowdown (Wieczner, 2023). Further changes came between September 2024 and December 2024, when interest rates were cut three times – from a range of 5.25 – 5.50% to a range of 4.25 – 4.50% (FED, 2025). They were additionally cut in September 2025 and in October 2025 to a range of 3.75 – 4.00% (FED, 2025). Additionally, with the latest cut of interest rates, a decision to end the reduction of the purchases of the FED's assets has been announced. Therefore, from December 1, 2025, the QT policy will no longer be pursued (Cox, 2025).

**Figure 3.**

*The change in the lower and upper limit of the target range of the FED federal funds rate from September 2024 to October 2025*

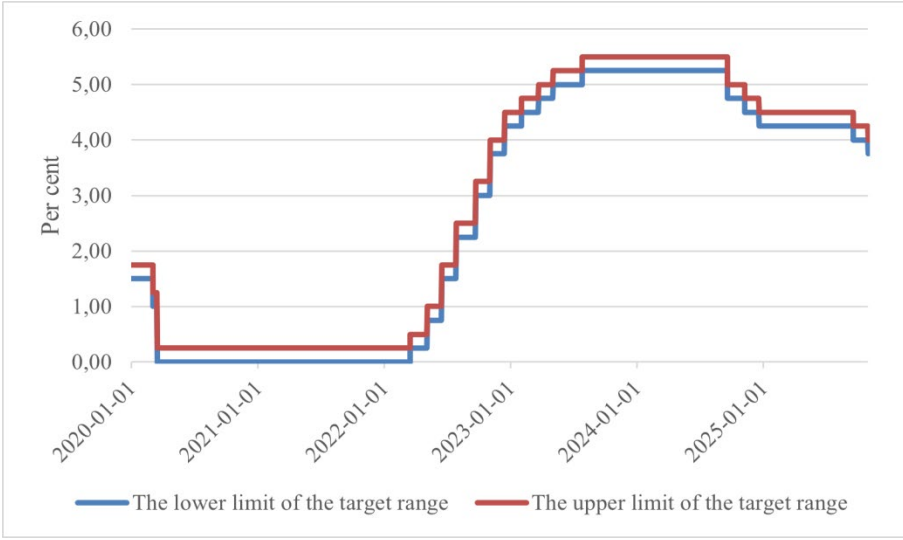



Source: Board of Governors of the Federal Reserve System (US) (2020–2025), as cited in Federal Reserve Bank of St. Louis (2020–2025).

Figure 4 presents the changes in the FED federal funds rate from January 2020 to October 2025.

**Figure 4.**

*The change in the lower and upper limit of the target range of the FED federal funds rate from January 2020 to October 2025*




Source: Board of Governors of the Federal Reserve System (US) (2020–2025) as cited in Federal Reserve Bank of St. Louis (2020–2025).

## The European Central Bank during the pandemic crisis and the period of high inflation (2020–2025)

The COVID-19 pandemic also proved to be a challenge for the European Central Bank, including Christine Lagarde, who began her term as the President of the ECB on 1 November 2019, taking over from Mario Draghi. Already at the beginning of the pandemic crisis, Lagarde announced that the ECB would support households as well as companies in the context of increased uncertainty and eco-

nomic disruptions (Lagarde, 2020b). For this purpose, the ECB used several monetary policy instruments, among which Quaglia and Verdun (2022) identified:

- maintaining interest rates at levels close to zero to keep low borrowing costs – it should be noted that the euro area economy has already been operating in a nominally zero and negative interest rates environment since 2016;
- the introduction of the Pandemic Emergency Purchase Programme (PEPP), by December 2020, securities of a total volume of €1,850 billion had been purchased;
- easing of the standards for collateral offered by banks in return for funding – it has been particularly visible during the round of the targeted longer-term refinancing operations (TLTRO III), conducted in 2020, as well as in the form of the pandemic emergency longer-term refinancing operations (PE-LTRO) – an instrument for long-term refinancing operations, introduced as a response to the COVID-19 pandemic. Its goal was to protect the liquidity of the banking system of the euro area.

Similar to the FED, the ECB used "forward guidance" in the subsequent months of the pandemic crisis. This was exemplified by Lagarde (2021b), who indicated that the ECB would aim to move closer to the 2% inflation target, stressing that the ECB was explicit about symmetry – a positive or negative deviation from the inflation target was undesirable. Table 2 presents the number of announcements issued from March 2020 to January 2022.

**Table 2.**

*The topics and number of announcements issued by the ECB from March 2020 to January 2022*

| The topic of announcements | Number of announcements |
|---|---|
| Interest rates | 15 |
| Lending operations | 10 |
| Asset purchases | 13 |
| Foreign exchange operations[17] | 20 |
| Other[18] | 1 |
| TOTAL | 59 |

Source: ECB (2020-2022) as cited in Cantú et al. (2021).

However, the analysis of the perception of the ECB's performance is ambiguous. Already at the onset of the pandemic crisis, Lagarde was criticised for the lack of an explicit announcement that she would defend the euro with all possible measures, as Draghi had done eight years earlier (Inman, 2020). Indeed, Lagarde pointed out that it was the responsibility of the Euro area governments to protect the highly indebted countries, not the ECB. Her words were perceived by Vistesen (2020, after Inman, 2020) as announcing a "catastrophic failure". Moreover, Lagarde's statement, in which she explicitly announced that the ECB was not going to take action to reduce spreads, was very badly received in Italy[19], to such an extent that a special statement was issued by the Italian President

[17] Mainly regarding the swap lines and the establishment of repo lines not only with the most important central banks but also with the central banks of non-EU members.

[18] The announcement of the ECB's new monetary policy strategy.

[19] The very negative reception of Lagarde's statement can be seen in the headline of the article, published on March 13, 2020: *Italy furious at ECB's Lagarde 'not here to close spreads' comment* (Fonte et al., 2020).

Sergio Mattarella. Mattarella (2020, as cited in Fonte et al., 2020), without explicitly naming a particular person or organisation, stressed that Italy, already severely affected by the pandemic crisis at that time, was entitled to expect expressions of solidarity, not obstacles from outside its borders.

However, Lagarde quickly admitted to her mistake. Just hours after her initial statement, she indicated that all available instruments would be used, including an asset purchase programme and a temporary abandonment of the capital key, to support the euro area (Lagarde, 2020, as cited in Clinch, 2020). In one of the other interviews, Lagarde apologised for her mistake (Arnold, 2020, as cited in Quaglia & Verdun, 2022). A kind of response to Lagarde's unfortunate statement of March 12, 2020 was the creation of the ECB Blog, with posts created by ECB staff and Executive Board members.[20] However, the most important response seems to be a tweet published by Christine Lagarde (2020a) the day after announcing the launch of the PEPP instrument: „Extraordinary times require extraordinary action. There are no limits to our commitment to the euro. We are determined to use the full potential of our tools, within our mandate."[21]

Lagarde's words were seen as a reiteration of Mario Draghi's "whatever it takes" stance. Moreover, shortly after Lagarde's statement, yield spreads on bonds (including spreads on Italian bonds) began to fall (Quaglia & Verdun, 2022). The PEPP instrument itself began to be described as a "game changer" and even as a "big bazooka" (*ECB and Bank of England deploy their big bazookas*, 2020). However, this instrument has caused much controversy and even

[20] The ECB Blog is still active. The most recent post (as of 31 October 2025) was published on October 20, 2025. More: ECB (2020-2025). *The ECB Blog.* www.ecb.europa.eu/press/blog/html/index.en.html

[21] The tweet has been published on March 19, 2020 on Twitter (currently: X). The original spelling has been maintained.

became the subject of a lawsuit, filed in March 2021 by a group led by Professor Markus Kerber (Wellink, 2023).

The other statements made by Christine Lagarde during the pandemic crisis should also be highlighted. For example, at the end of October 2020, Lagarde (2020c) announced that the Governing Council would adjust its instruments in December 2020 to be able to respond to developments and ensure favourable financing conditions, while at the same time supporting the economic recovery and counteracting the negative impact of the pandemic crisis on inflation forecasts. Benigno et al. (2022) noted that Lagarde's statement contrasted with the wait-and-see attitude proposed by the ECB Governing Council for the previous four months. Reasons cited for this announcement included uncertainty about the scale of the second wave of the COVID-19 pandemic or the negative economic outlook. In December 2020, an expansionary monetary policy was strengthened both through the monetary and credit channels. By contrast, in January 2021, Lagarde (2021a) announced that monetary policy instruments would be used to counteract the negative impact of a pandemic shock, provided this was required to maintain favourable financing conditions. In the same speech, Lagarde also indicated that the pool of funds allocated under the PEPP programme may not be fully utilised.

However, Benigno et al. (2022, p. 672) suggest that thanks to the enormous amount of liquidity provided by the ECB through the monetary channel, the risk of economic collapse and social problems has been significantly limited, particularly "in the most fragile euro area countries", which had to pursue an expansionary fiscal policy, despite the constraints. Moreover, it is believed that the emergency measures applied under the ECB's monetary policy have contributed to overcoming the crisis. The continuation of these policies in 2021, combined with centralised and expansionary fiscal policy (in the form of the Next

Generation EU facility), allowed euro area countries to mitigate the negative economic effects of the subsequent pandemic waves and allowed the start of economic recovery (Benigno et al., 2022).

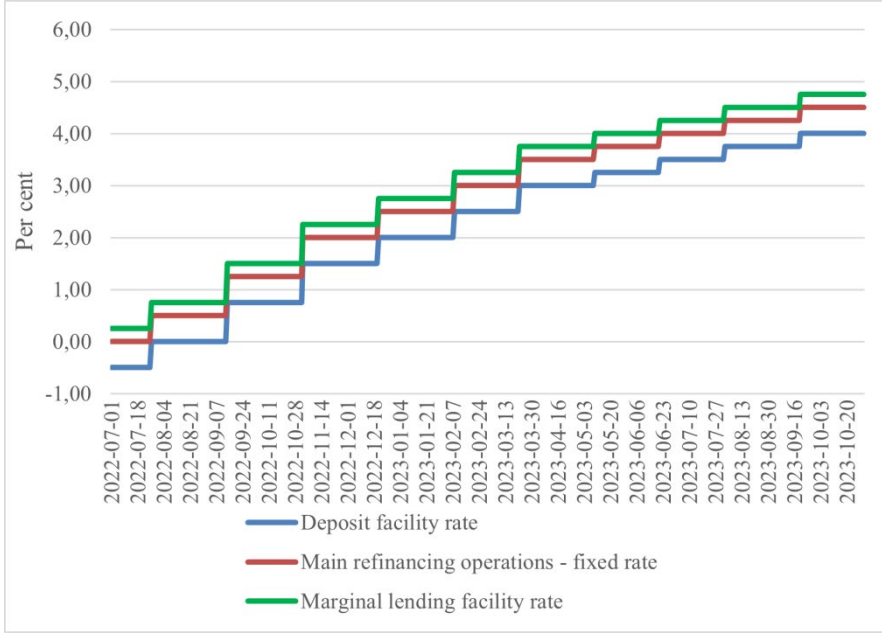
However, the ECB has not been immune to mistakes. Wellink (2023) points out that at the end of 2021, when the central banks of non-Eurozone countries started to raise interest rates, Lagarde indicated that the probability of an interest rates increase was low. Chahad et al. (2022) pointed out that the first underestimates of the value of inflation appeared as recently as Q1 2021. In Q1 2022, the error between the estimate and the actual value of inflation was two percentage points, relative to the December 2021 projection. This was the highest error since 1998, when inflation projections began to be conducted. In addition, for almost nine years in a row, the ECB used the forward guidance, under which the Governing Council "expected the key ECB interest rates to remain at their present or lower levels until it sees inflation reaching 2% well ahead of the end of its projection horizon […]" (ECB, 2022).

Changes started to be introduced only in March 2022, the first of which was the removal of the phrase „or lower" from forward guidance (Wellink, 2023). On July 21, 2022, the ECB changed the interest rates for the first time in three years. It was the start of a series of interest rate increases and the end of the policy of zero interest rates. During the press conference, held a few days after this decision, Lagarde (2022) stated that the ECB would make monetary policy decisions based on data and, in addition, the ECB would "operate month by month and step by step". Thus, after more than nine years, the ECB stopped using the forward guidance instrument. During the following months (July 2022 to September 2023), the following changes in interest rate levels occurred (ECB, 2025):

- the main refinancing operations rate was increased from 0% to 4.5%;
- the deposit facility rate was increased from -0.5% to 4%;
- the marginal lending facility rate was increased from 0.25% to 4.75%.

**Figure 5.**

*The changes in the key ECB interest rates from July 2022 to October 2023*




Source: European Central Bank (2020–2025).

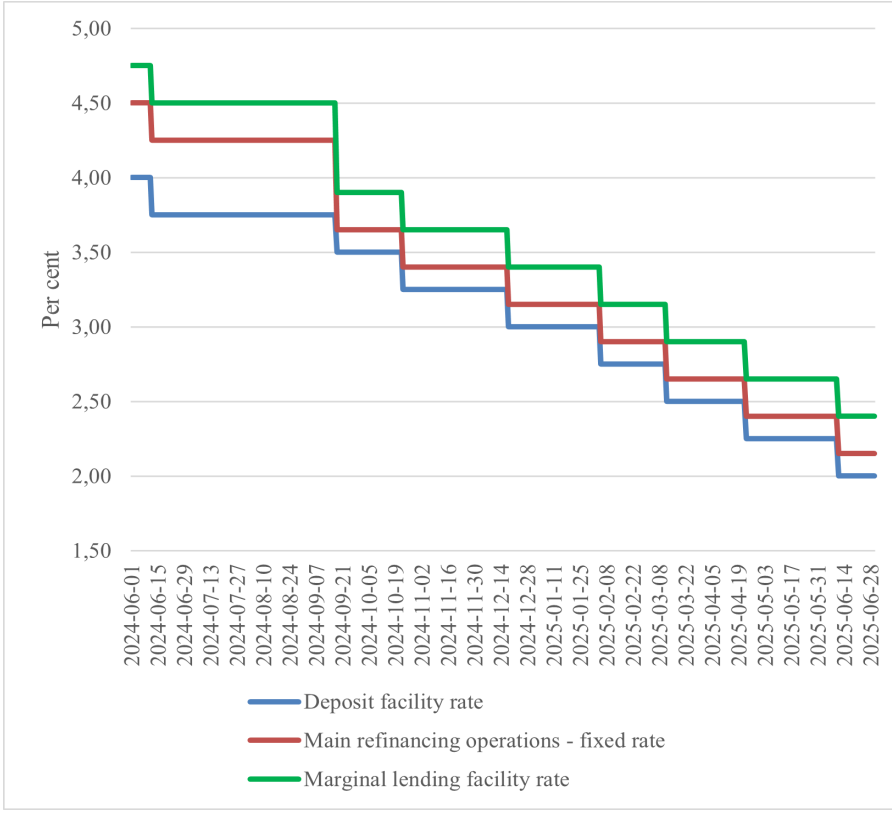
Although the immediate impact of the crisis was mitigated, the European Union (including the euro area) did not avoid stagnation. It was not until early 2024 that the period of "recession-stagnation in the euro area and the European Union as a whole" formally came to an end (Kolany, 2024). Eurostat estimated that annual GDP growth in the euro area in 2024 was 0.7%, while annual GDP growth in the whole European Union was 0.9% (Pawlonka, 2025). In Q1 2025, the estimated quarterly GDP growth for the euro area was 1.2% on

an annualised basis (Pawlonka 2025), which was higher than in the US, where GDP growth declined by 0.3% over the same period (Jaroszewska, 2025). It is also worth noting that from June 2024 to June 2025, the ECB cut interest rates eight times (ECB, 2025):

- the main refinancing operations rate was lowered from 4.5% to 2.15%;
- the deposit facility rate was lowered from 4% to 2%;
- the marginal lending facility rate was lowered from 4.75% to 2.40%.

**Figure 6.**

*The changes in the key ECB interest rates from June 2024 to June 2025*

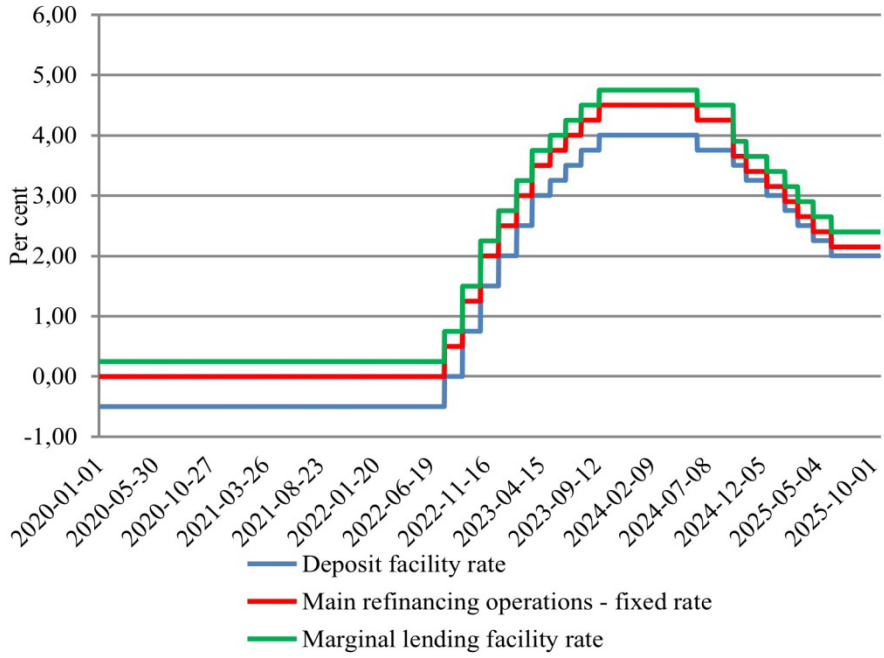



Source: European Central Bank (2020–2025).

Figure 7 presents the changes in key ECB interest rates during the analysed period.

**Figure 7.**

*The changes in key ECB interest rates from January 2020 to October 2025*




Source: European Central Bank (2020–2025).

Subsequent interest rate cuts have brought the ECB deposit rate close to the HICP inflation rate – meaning that the real interest rate in the euro area is now close to zero (Kolany, 2025). At the same time, the June interest rate cut was regarded as "the definitive end of an episode of mildly restrictive monetary policy in the euro area" (Kolany, 2025).

**The comparison of the FED's and the ECB's information policy**

The conducted analysis of the central banks' actions taken during the pandemic crisis, as well as during the period of the highest inflation rise in 50 years, which was also influenced by significant geopolitical changes, shows that central banks took many measures to mitigate the immediate impact of these crises. As the Bank for International Settlements (BIS) (2024) observed, central banks responded effectively and, through their actions, succeeded not only in stabilising the financial system but also in limiting the scale of the damage caused to economies. For that purpose, interest rates were lowered[22], and securities were bought up, increasing the balance sheet total of central banks.

However, at the end of the pandemic crisis, "central banks faced an enemy they thought they had long defeated for good – a global outbreak of inflation, in many cases well into double digits" (BIS, 2024, p. 43). The situation worsened with the rise in asset prices, caused by the Russian attack on Ukraine, which resulted in a further increase in inflation. Central banks, initially surprised, wanted to avoid a repeat of the situation in the 1970s, when high inflation became permanent. Therefore, they took decisive actions by tightening their monetary policy – they raised interest rates and started a policy of so-called "quantitative tightening" (QT), whereby they began to reduce their balance sheets.

The crises in the 21st century have unequivocally highlighted the role of central banks' communication with the public. Even before the global financial crisis, it was believed that communication could make monetary policy much more effective. Indeed, a more transparent monetary policy means greater predictability, better understanding, and clarification of policy objectives and strategies. This allows financial markets, companies and households to make better

[22] As long as this was possible – some central banks that kept nominal interest rates around zero before the pandemic crisis could not do so (e.g. the ECB).

decisions based on more information (Moschella & Romelli, 2022). At the same time, both Mario Draghi's "whatever it takes" stance in July 2012 and Christine Lagarde's statement in March 2020 show that central banks' communication with the public during crises plays an important role in mitigating the effects of economic imbalances, as well as in creating conditions for recovery.

However, it should be noted that the complete evaluation of the actions of the FED and ECB between 2020 and 2025 will probably be possible after the end of the terms of Jerome Powell and Christine Lagarde (2026 and 2027, respectively). Even before the pandemic, it was pointed out that Trump's tweets criticising the FED had altered markets' expectations of monetary policy and the perception of the FED as an institution not fully independent of the executive (Bianchi et al., 2022). Although the FED's actions under Powell's leadership during the pandemic crisis and the period of high inflation have been regarded as a success, the further actions by the FED are going to be heavily influenced by the political decisions of the Donald Trump administration. Just a few months after Trump started his second term as US President, Trump suggested that Powell should continue to cut interest rates. Trump also indicated that he understands interest rates much better than Powell, because "he has had to really use interest rates" (Trump, 2025, as cited in *Donald Trump says…*, 2025)[23]. The next actions of the FED could therefore affect not only the US economy, but also the perception and position of Jerome Powell himself, both in view of the approaching end of his term and the unpredictability of the Trump administration's actions.

The assessment of the actions of the European Central Bank and Christine Lagarde is similarly inconclusive. Currently, the ECB is pursuing a policy of quantitative tightening, and there are no signs of a desire to end this policy.

[23] The original quotation: "I think I understand interest a lot better than him because I've had to really use interest rates." (Trump, 2025, as cited in *Donald Trump says…,* 2025).

Unfortunately, in the context of the actions of Donald Trump's administration, the euro area is facing several challenges, such as international trade disruptions, geopolitical instability, and financial market tensions (Lagarde, 2025). The next steps of both the EU, euro area member states and the ECB itself, under the leadership of Christine Lagarde, will therefore be important. However, the repeatedly expressed criticism[24] of her leadership may affect not only the institution of the European Central Bank itself, including its credibility, but also indirectly the euro area economy and the EU.

Even before the pandemic, speeches by central bank representatives to the public were considered „an effective means of communication" (Blinder et al., 2008b, as cited in Bertsch et al., 2024, p. 23). Several phrases used by the representatives of central banks are still used in the public sphere today[25]. The pandemic and the period of high inflation have shown that central banks' communication with the public plays an important role when there is a loss of confi-

[24] In January 2024, the results of a survey conducted by the International and European Public Services Organisation (IPSO) – the ECB staff organisation – were published. According to this survey (IPSO, 2024, as cited in Mackenzie, 2024), 50.6% of respondents rated the first part of Lagarde's term as „poor" (30.5%) or „very poor" (20.1%). Only 20,3% of respondents rated the first half of Lagarde's term as „good" (12.3%) or „very good" (8%). Only 2.6% rated Lagarde's term as "outstanding". 1,089 respondents answered this question. For comparison, in a similar survey conducted at the end of Mario Draghi's term, 28.8% of respondents rated his term as „outstanding" and 46.7% as „good" (21%) or „very good" (25.7%). Only 8.9% rated Draghi's term as „poor" (6.9%) or „very poor" (2%). In a survey conducted after the end of Draghi's term, 735 respondents answered this question. Treeck (2024) cites the opinion of an ECB staff member who indicated that „Mario Draghi was there for the ECB while the ECB seems to be there for Christine Lagarde". Other respondents suggested that Lagarde wanted to use the ECB's position so that she could return to French politics. A few days after the publication of the results of this survey, Lagarde (2024) stated that, in internal surveys, the majority of staff were satisfied with their work at the ECB and that she was therefore proud and honoured to lead the institution. Referring to criticism, Lagarde (2024, as cited in Skiba, 2024) also indicated that as long as she heads the ECB, she does not intend to worry about criticism. Lagarde (2024) stated: "As far as I'm concerned, I am irrelevant as long as I deliver on leading this institution of talented people. Not just economists, but talented people who are driven to do their job and to deliver. The rest – me as a person – irrelevant."

[25] Bertsch et al. (2024, p. 23) quote such phrases as "irrational exuberance" (Alan Greenspan), "eighth inning" (Richard Fisher) or "whatever it takes" (Mario Draghi).

dence and economic uncertainty increases. Communication is also important when a compromise is needed between price stability and maintaining economic growth (Misztal, 2023). The importance of central bank communication also seems to be recognised by policymakers themselves. After finishing his term as Chairman of the Board of the Governors of the FED, Bernanke (2015) indicated that „monetary policy is 98 percent talk and only two percent action". A few years later, these words were echoed by Lagarde (2023), who also identified two significant challenges facing central bank managers – the increasing competition for attention and the risks associated with a general decline in trust. At the same time, the current ECB President identified two values, thanks to which the ECB's communication with the public will support the central bank's efforts – greater accessibility[26] and greater humility.

Macklem & Vardy (2023) point out that over the previous two decades, central banks have understood that economic crises affect different groups in different ways. Therefore, the key to maintaining trust during uncertainty is to listen, which is also evident in more direct communication with the public. This shift in communication can be crucial in the context of new challenges, among which are:

a) threats to independence (Kiley & Mishkin, 2024), as exemplified by various forms of political pressure on central bank managers, which have been seen in the US, Turkey, or Poland;
b) environmental protection and actions against climate change;

[26] An example of increased accessibility was the adoption of a new monetary policy strategy in 2021, the use of less complex language when announcing subsequent monetary policy decisions, or the publication of a "Monetary Policy Statement at a Glance", which "uses simpler language and is accompanied by illustrations […] and is available in all languages of the European Union." (Glöckler & Mee, 2022, as cited in Lagarde, 2023)

c) promoting gender diversity – Romelli (2024) points out that only a few central banks in the world have explicitly included gender diversity as one of their objectives (e.g. National Bank of Rwanda).

Romelli (2024) notes that a further expansion of mandates will mean that central banks will have to navigate through unfamiliar policy areas while pursuing their most important objective – preserving price stability. This is also confirmed by Kiley & Mishkin (2024), arguing that the need to operate in new areas may affect central bank independence, therefore also affecting economic stability, price stability, and financial stability. The implications of the change in mandate will certainly extend to the communication policies of central banks, which will seek to introduce and deepen stakeholder engagement activities (Macklem & Vardy, 2023).

**Summary**

The article aimed to present and analyse the measures taken by the Federal Reserve System (FED) and the European Central Bank (ECB) during the pandemic crisis and the high inflation period, between 2020 and 2025. The objective was achieved because the conducted analysis allowed for formulating conclusions on central banks' communication with the public and information policy during this period. The results suggest that central banks used various instruments, including non-standard monetary policy instruments, which confirms the hypothesis. At the same time, the role of central banks' communication with the public increased.

The research shows that at the beginning of the pandemic crisis, central banks cut interest rates sharply. Such a reduction was only carried out where it was possible, as illustrated by the example of the European Central Bank, which was pursuing a policy of nominal zero interest rates long before the pandemic.

The analysed central banks also pursued a policy of asset repurchases and established swap lines to support the provision of liquidity. FED and ECB conducted the „forward guidance" policy, signalling to the financial markets their willingness to keep interest rates low.

However, the survey also shows that central banks made mistakes in their forecasts and reacted with a delay to rising inflation, initially even considering it as a temporary phenomenon, as illustrated by Jerome Powell's statements. This also seems to show the essence of the central banks' information policy. Poor communication with the public may lower the credibility of the central bank. At the same time, it may imply a bad perception and even undermine monetary policy actions. This work also identifies other examples of actions for which central banks have been criticised – the lack of a firm declaration of willingness to protect the euro area, for which Christine Lagarde was criticised at the start of the pandemic, or the repeated criticism of the FED's actions by Donald Trump. It is worth noting that one of the consequences of Trump's actions was that financial markets perceived the FED as an institution not fully independent of the executive.

Although maintaining price stability remains the most important objective of central banks' activities, central banks can use both standard and non-standard monetary policy instruments to maintain this objective. However, the pandemic crisis and the high inflation period underlined the critically important role of central banks' communication with the public – especially in the context of technological development and the rise of social media. Additionally, other areas have begun to be identified in which central banks can become active, including the area of green transition.

It should be noted that there were limitations to the conducted study. Firstly, the comparisons were made between the actions of two leading central

banks - the Federal Reserve System and the European Central Bank. Moreover, the actions of the FED and the ECB were analysed only in the context of the pandemic crisis and a period of high inflation (2020–2025). Additionally, the article contained only an analysis of the statements made by the central bank managers. However, the perception of the statements and monetary policy decisions among the public has not been studied.

Therefore, the future research may include comparisons of the actions and communications of central banks in a larger number of countries. Thanks to that, a comparison of the responses of different central banks to the pandemic crisis and the period of high inflation will be possible. A comparison of central banks' communication with the public over a longer time horizon, as well as a comparison of central banks' reactions to other crises of the 21st century, can provide a broader perspective on changes in central bank communication. Meanwhile, a more in-depth analysis of documents, statements made by central bank managers, and content published on social media might help to better understand the impact of central banks' communication on other financial market participants, including consumers and their inflation expectations. Additionally, a study including a questionnaire might be helpful to understand the perception of central banks' decisions and statements made by central bank managers among the public.

Since the late 1980s and early 1990s, central banks have started to conduct policy more transparently, using, among other things, social media. In the context of the new challenges, in particular climate change, a further change in the mandate of central banks in the coming years seems certain. It will certainly also affect communication with the public. Therefore, the further research in this area becomes necessary.

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# TAX BASE ESTIMATION OF INCOME – THE PROPOSAL OF SELECTED CHANGES

**ABSTRACT**

**The purpose of the article**. One of the measures to combat tax fraud is estimation of the tax base. The provisions point out the reasons and rules of estimating of the tax base. Polish legislation provides tax authorities with a list of six tax base estimation methods they can use. In cases when none of these methods is applicable, tax authorities may use other methods serving the same purpose, but the law (the Tax Ordinance Act) does not indicate what these methods should be. The aim of the article is to propose the changes to the tax base estimation in the Tax Ordinance Act.

**Methodology**. The descriptive study including critical attitude to the legal acts and literature was used to solve the research problem.

**Results of the research**. It would be advisable to introduce legislative changes such as: specifying estimation methods in the regulation, applying the production method, amending regulations regarding exemptions from estimating the tax base, using the method of determining income based on incurred expenses versus undisclosed sources of income, procedural changes.The legislative forms of change were discussed.

**Keywords:** tax fraud, the estimation of tax base, income taxes, transfer prices

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## Introduction

Income taxes play an important role in the public finance system. Tax law provides for the possibility of estimating the tax base in situations specified by the tax ordinance. Income tax regulations allow the income determination by the estimation. The provisions point out the reasons and rules of estimating of the tax base. These regulations are intended to combat the effects of tax fraud. Polish law defines six methods for estimating the tax base. If these cannot be used by the tax authorities, the standards contained in the Tax Ordinance also allow for the use of methods other than those specified in the regulations.

The aim of the article is to propose the changes to the tax base estimation in the Tax Ordinance Act. The descriptive study including critical attitude to the legal acts and literature was used to solve the research problem. Comparative analysis of solutions in the German tax system, case study analyses taking into account administrative court rulings on the estimation of the tax base were used as well.

The article presents:

- issues related to estimating the tax base and the rules for estimating the tax base in the Polish tax system;
- the relationship between estimating the tax base and transfer pricing;
- proposals for changes in regulations regarding income estimation.

## 1. The issue of the tax base estimation

In the Polish tax system, regulations related to the the tax base estimation have been essentially regulated separately in the case of the lack of the data and the transfer pricing. The Polish literature on the subject distinguishes at least two legal constructs in the area of estimation, aimed at protecting the interests of the State Treasury. One structure is related to the possibility of reconstructing the actual state of affairs and the actual tax base, and is regulated in Article 23 of the Tax Ordinance. The second structure allows for the modification of the tax base in the case of income shifting by transfer pricing (Etel, 2025).

Tax regulations, in particular the Tax Ordinance and income taxes, allow the income to be determined by the estimation.

The rules for the tax base estimation are set out in the Tax Ordinance. This legal act specifies the detailed conditions for determining the tax base by the estimation. One of the reasons for the tax base estimation may be the lack of tax books or other data necessary to determine the tax base. The other reason may also be that the tax records are considered incorrect or unreliable. Another premise may be the fact that the data from the tax books does not allow for determining the tax base. The tax base may also be estimated due to the taxpayer's violation of the conditions entitling them to use the lump-sum form of taxation. The occurrence of the above-mentioned reasons does not always mean that an estimation must be conducted. According to the Tax Ordinance Act (the Tax Ordinance Act, art. 23 item 2) the tax authority shall refrain from determining the tax base by the estimation if the data from the tax records, supplemented by evidence obtained in the course of the proceedings, allows for the determination of the tax base (Act of August 29, 1997 Tax Ordinance art. 23 item 2).

Tax regulations explicitly list methods for the tax base estimation. The Tax Ordinance lists the following methods for the tax base estimation (Act of August 29,1997 Tax Ordinance art. 23 item 3; Etel, 2025):

- the internal comparative method;
- the external comparative method;
- the inventory method;
- the production method;
- the cost method;
- the type of income as a percentage of turnover.

At the same time, however, tax regulations allow for the use of methods other than those directly mentioned in the provisions (Kłosińska, 2020). In the literature, other estimation methods include, among others (Brzeziński et al., 2007; Schneider, 2007; Kosikowski, 2013):

- determination of the turnover figure from information sources;
- determination of the percentages of particular products in total production;
- analysing the formulas used to make particular products;
- estimation of business expenses in relation to turnover;
- examining the consumption of electricity;
- estimation of a taxpayer's incomes based on its expenses;
- utilising an econometric model of costs.

The application of tax base estimation may occur when determining a taxpayer's income for the purposes of both personal income tax and corporate income tax. The literature indicates that determining the tax base by estimation should be exceptional and should be used as a last resort. The estimation of the tax base itself should be carried out in accordance with the rules laid down in the Tax Ordinance (Mariański et al., 2012; Bartosiewicz & Kubacki, 2013).

In the literature, the issue of income estimation is analysed from various perspectives. One of them concerns legal issues related to the nature of estimation and interpretation of tax regulations (Dzwonkowski, 2012; Witczak, 2014c; Durczyńska, 2015; Kłosińska, 2020).

An important issue related to estimation are its premises, particularly issues related to the reliability and correcitons of tax records (Dzwonkowski, n.d.; Hudzicka, 2003; Bartosiewicz & Kubacki, 2008a; Bartosiewicz & Kubacki, 2008b; Iwińska et al., 2008).

The research also includes an assessment of the use of this instrument by tax authorities (Witczak, 2014b; Ginter, 2015; Witczak, 2015a; 2015b; 2016b; 2016c; 2017b; 2018b).

## 2. The relationship between the tax base estimation and transfer pricing

The tax base estimation is also related to the application of transfer pricing

Transfer prices should be understood as the value of goods and services sold within a plant, company or group of companies (Jaeger, 1987; Siegfried, 1992). The distinguishing feature of transfer prices is the existence of relation-

ships between the enterprises involved in the transaction (Klein et al., 1983; Cravens, 1997; O'Shaughnessy, 2003).

Transfer pricing can be used by related companies to reduce their tax burden. By structuring transactions appropriately, income can be shifted to a tax jurisdiction with a low level of tax rate. If transfer pricing is used to reduce tax liabilities, the tax authorities may adjust the transfer prices applied by the taxpayer, thereby changing the income (loss) reported by the taxpayer.

The income taxes regulations indicate the following methods for estimating income in cases where transfer pricing is used by related entities (Piekarz et al. 2019):

- comparable uncontrolled price method;
- resale price method;
- cost plus method;
- transactional profit split method;
- transactional net margin method;
- other methods.

Tax income estimation methods can be classified in various ways. Taking into account the method of adjusting the tax base declared by the taxpayer, the following should be distinguished (Ernst Young, 1998):

- transfer pricing adjustment methods;
- methods adjusting the company's income (transactional profit methods).

A characteristic feature of transfer pricing adjustment methods is the estimation of the appropriate transfer price. By determining it, the revenues or costs reported by the company are adjusted. Thus, the appropriate tax base is established (Żuk, 2001). Following transfer pricing adjustment methods, can be distinguished:

- comparable uncontrolled price method;
- resale price method;
- cost plus method.

Methods adjusting the company's income involve estimating the income earned by a company from transactions with a related entity. They rely on adjustment of the tax base, but only in the part determined by applying transfer pricing. The company's income is divided into two parts. One part is profits (losses) from operations carried out with independent economic entities. The other is income generated as a result of transactions with a related entity. As a result of using these methods, the correct amount of profit that the taxpayer obtains from transactions with a related company is determined, without the need to determine the appropriate transfer price (UNTACT, 1997). Following methods adjusting the company's income can be distinguished: transactional net margin, profit split.

The literature indicates that estimation in the case of transfer pricing serves to protect the interests of the state budget. The regulations allow for modification of the tax base and constitute a waiver of taxation of the actual course of events determining the tax base. Instead, the law adopts a different tax base model based on objective factors designed to counteract the phenomenon of income shifting (Etel et al., 1997). Undoubtedly, if the correctness of transfer pricing is questioned, the value of income (or one of its elements – revenue or costs) is estimated. The term 'estimation' is also used in the literature on the subject (Andrzejak et al., 2025).

However, it should be noted that the solution adopted in the Polish tax system, which consists in separate regulation of the issues of tax base estimation and the transfer prices, is not the only one possible. The German tax system served as a reference point for the creation of the Polish tax system as part of the transition from a socialist economy to a market economy. Due to the common features of both tax systems, it is worth comparing them. In the German tax system, as in the Polish one, the basic tax law is the Tax Ordinance. It also sets out rules for tax base estimation. These include the conditions and principles for tax base estimation. At the same time, these regulations also form the basis for estimation in cases of transfer pricing used to reduce tax libilities. Thus, the German solutions are broader in nature – they cover not only estimation in the absence of

the necessary data for assessing the tax liability, but also other cases of determining the tax base by estimation, including transfer pricing. The German Tax Ordinance specifies the reasons for the tax base estimation. German regulations require the tax base to be estimated if it is impossible to calculate (determine) the tax base (Act of October 1, 2002 Abgabenordnung art. 162).

It is particularly worth noting the possibility of estimation in the lack of cooperation between the taxpayer and the tax authorities. The obligation to cooperate is included in the German Tax Ordinance. According to the regulations, if the facts are to be established and assessed on the basis of tax law that applies to transactions outside the scope of the Tax Ordinance, the parties involved must clarify these facts and obtain the necessary evidence. In doing so, they must exhaust all legal and factual possibilities available to them. A party may not invoke the inability to clarify the facts or obtain evidence if it could have obtained them or had the opportunity to do so, taking into account the circumstances of the case (Act of October 1, 2002 Abgabenordnung art 90).

German regulations do not explicitly specify the methods that tax authorities may use. However, German literature indicates the possibility of using the following methods to estimate the tax base (Kuehn & Wedelsaedt, 2018):

- the internal comparative method;
- the external comparative method;
- the cash flow method;
- the assets method.

The internal comparative method and the external comparative method are understood in the same way as in Poland. With the cash flow method, current expenditure and investment value are checked. It is verified whether all of the taxpayer's income is sufficient to finance their standard of living (www.boden).

The asset method is based on the assumption that no one can spend more money than has at their disposal from their taxable and other sources. If, based on this assumption, an undeclared increase in assets is found, it can be assumed that the taxpayer has earned more income than hthey have declared (Judgment of

March 15, 2007). The asset method differs from the cash flow method only in that it puts emphasis on the meaning of the assets (Judgment of October 8, 1989). The cash flow and asset methods are similar to the estimation a taxpayer's incomes based on its expenses method.

The research conducted so far (Witczak, 2014b; 2015a; 2016b; 2016c; 2017b; 2018b) indicates that in none of the cases analysed in Poland did the tax authorities use the method of determining income on the basis of taxpayer's incomes based on its expenses method. In this regard, legislative changes should be proposed, as discussed in more detail in the section on changes in income estimation regulations.

## 3. Proposed changes to regulations on income estimation

This section of the article presents proposals for changes in income estimation regulations. These proposals are also the result of earlier researches and publications (Witczak, 2013; 2016a; 2016b; 2017a; 2017b; 2018a; 2018b).

Proposed amendments to the regulations on the use of income estimation methods were discussed as follows:

- specifying estimation methods in the regulation;
- applying the production method;
- changes in regulations concerning refraining the estimation of the tax base;
- using the method of determining income based on expenses;
- procedural changes;
- legislative forms of changes.

### *3.1. Specifying estimation methods in the regulation*

One of the proposed changes is to describe in detail the individual methods of tax base estimation in the form of a regulation of the Minister of Finance. This solution is used in transfer pricing regulations. Following the example of this regulation, each method should be described with an indication of the situa-

tions in which it can be applied. The descriptions provided in previous versions of the regulations can be used. In addition to the methods already mentioned in the regulations, it would also be necessary to list the methods indicated in the literature– in this respect, the descriptions presented in this literature could be used. Particular attention should be paid to the methods of determining income on the basis of information materials and determining income on the basis of determining income based on expenses, as specified in the following sections of this study.

### *3.2. Applying the production method*

According to the author, among the recommended changes, the use of the production method as the maximum scope for calculating estimated income, particularly the value of revenues, should be indicated. In estimation of revenues, the maximum revenue-generating potential of a given economic entity should be taken into account. The use of the production method is not intended to be definitive, but rather auxiliary. Therefore, determining revenues using this method is not definitive, but is intended to indicate their maximum range, which should not be exceeded when using another method of income estimation. Such a proposal does not mean that this method must be used in every situation, but only when the taxpayer questions the calculations made by the tax authority. Some administrative court rulings also suggest this solution. One of the cases analysed concerned a dentist whose income was estimated using information about payments made to her bank account. The panel of judges pointed to doubts regarding the amount of revenue determined by the tax authorities. In the court's opinion, there are reasonable doubts, primarily regarding the amount of revenue determined and accepted by the tax authorities, without reference to the reality of the applicant's business and the possible level of annual revenue (Judgment of March 2, 2007). What the panel of judges proposes in this particular case is precisely to use the production capacity method. A comparison of whether the amount of revenue (income) determined using another method would exceed the amount of revenue calculated using the production method.

### *3.3. Changes in regulations concerning refraining the estimation of the tax base*

The regulations provide for the possibility of refraining the assessment of the tax base. The regulations require tax authorities to refrain from determining the tax base by way of estimation if the data from the tax books, supplemented by evidence obtained in the course of the proceedings, allow the tax base to be determined (Dzwonkowski et al. 2003).

As indicated in the rullings, this provision "prohibits overly hasty estimation of the tax base without determining whether it can be determined on the basis of reliable evidence and data from that part of the tax records whose reliability has not been questioned by the tax authority. Estimation should only be used when there is no source data available to determine the actual tax base. The tax basis cannot be estimated if the data from the books, supplemented with data obtained during the proceedings, allows for the proper determination of that basis. Estimation should be treated as a 'necessary evil' and used in situations where the tax authority has no other means of determining the tax base. Estimation only allows for an approximate, rather than actual, determination of the tax base" (Judgment of March 20, 2013). It is recognised that this is an exceptional situation "because the tax base determined in this manner is not identical to the actual tax base, but should only approximate it as closely as possible. The legislator has provided for the possibility of refraining from applying this method if the evidence obtained in the course of the proceedings allows the tax base to be determined. This evidence may be of any kind. The existence of the possibility of determining the actual tax base imposes an obligation on the tax authority to make use of this possibility, i.e., to refrain from determining the tax base by way of estimation" (Judgment of April 18, 2013). Therefore, evidence gathered during tax proceedings is important for the application of the institution of refraining of tax base estimation.

A similar opinion was expressed by another panel of judges: "In the rullings of administrative courts, emphasis is placed on the exceptional nature

of determining the tax base by the estimation […]. It is emphasised that the task of the tax authorities is to determine the data necessary from the point of view of tax law in values as close as possible to the real ones. To this end, tax authorities should use all available data and, if they have access to such data, they should refrain from estimatinon of the tax base in order to determine the tax base that is closest to the real base. The basis for such a procedure is the provision of Article 23 § 2 of the Tax Ordinance […]. In other words, Article 23 § 2 of the Tax Ordinance excludes the application of the institution of the tax base estimation when it can be determined on the basis of reliable evidence. It should also be emphasised that the absence of tax records, while other data allowing the tax base to be determined exists, cannot be assumed to exclude the possibility of applying Article 23 § 2 of the Tax Ordinance […]. As emphasised in rullings, the ratio legis of Article 23 § 2 of the Tax Ordinance is that, as a rule, this solution is more advantageous for the taxpayer, as it allows them to determine the actual tax base rather than an approximate one determined by estimation" (Judgment of September 1, 2020).

When assessing taxes, tax authorities conduct tax proceedings. The purpose of tax proceedings is to issue a correct substantive decision in an individual case. A decision is possible if the principle of objective truth is applied. According to this principle, tax authorities take all necessary measures to clarify the facts of the case. Establishing the facts of the case requires gathering information about the facts. Such information is verified, among other things, by examining evidence (Babiarz et al., 2011). In tax proceedings, the basic principle applies that anything that may contribute to clarifying the case and is not contrary to the law should be admitted as evidence (Act of August 2, 1997 Tax Ordinance, Article 180). The regulations indicate that evidence in tax proceedings may include, in particular, tax books, tax returns submitted by a party, witness statements, expert opinions, materials and information collected as a result of inspections, tax information, and other documents collected in the course of analytical activity of the National Tax Administration, inspection activities, a tax inspection or

a customs and tax inspection, as well as materials collected in the course of criminal proceedings or proceedings in cases concerning fiscal delinquencies or fiscal offences (Act of August 29, 1997 Tax Ordinance art. 181). This means that tax proceedings are based on an open system of evidence. Evidence that is not listed or named in the regulations is also admissible. The admissibility of evidence is limited by its compliance with the regulations. Furthermore, the regulations adopt the principle of equal weight of evidence (Adamiak et al., 2011). The definition of evidence is not unambiguous. For the purposes of tax law, evidence should be understood as a means of proof which, in certain situations, may also be a source of evidence, e.g., a document or material evidence (Babiarz et al., 2011). Such evidence may therefore be used to determine the amount of income when refraining from the tax base estimation.

The research conducted so far indicates that in some cases of determining the tax base as part of a refraining from the tax base estimation, taking into account the evidence gathered in the course of tax proceedings, the tax base is in fact estimated. The tax authority does not know the actual income and determines it on the basis of available evidence (e.g., bank account inflows). In such situations, the tax base calculated by the tax authorities does not accurately reflect the amount of income earned by the taxpayer. This income is in fact unknown, but is determined on the basis of other evidence. Administrative courts assessing tax authorities accept such practices done by tax authorities. Therefore, in the author's opinion, this results in an erroneous narrowing of the interpretation of the scope of estimation. In fact, we are dealing with the tax base estimation, although Article 23 item 2 of the Tax Ordinance, i.e., the refraining of the estimation of the tax base, is indicated as the legal basis (Witczak, 2014a; 2014d).

Consideration should be given to introducing changes to the regulations. Among the methods of the tax base estimation, it is worth distinguishing the method based on information materials. Precise grounds for its application ought to be indicated. It should allow for the use of various types of evidence. As a result, the considered changes in the tax ordinance would allow the determina-

tion of the tax base using other evidences to be recognised as one of the estimation methods. In that case, the provision on refraining from the tax base estimation should be removed. This would not preclude the possibility of determining the tax base using evidence collected in the course of tax proceedings in the event of unreliable tax records.

### *3.4. Using the method of determining income based on expenses*

The research conducted so far indicates that in none of the cases analysed in Poland did the tax authorities use the method of determining income on the based on expenses (Witczak, 2014b; 2015a; 2016b; 2016c; 2017b; 2018b).

Legislative changes should be proposed in this regard. The failure to apply the method of determining income based on expenses may be due to the existence of separate provisions concerning revenues not based on the disclosed sources or coming from non-disclosed sources. The Personal Income Tax Act contains a separate chapter on the taxation of revenues not based on the disclosed sources or coming from non-disclosed sources (Act of July 26, 1991 on Personal Income Tax, Art 25b).

Revenues not based on the disclosed sources or coming from non-disclosed sources are considered to be: revenues not covered by disclosed sources, i.e., including revenues from sources indicated by the taxpayer, disclosed in an incorrect amount, and from undisclosed sources, i.e., including income from sources not indicated by the taxpayer and not determined by the tax authority. For both types of revenues, their amount is equal to the amount corresponding to the surplus of expenditure over taxable revenues (income) or non-taxable revenues (income) obtained before incurring that expenditure. Therefore, the tax base is determined as the difference between expenses and revenues (Babiarz Ed, 2016). The legislator has defined the definition of expenditure for the purposes of determining tax from undisclosed sources of revenues. An expense within the meaning of the regulations is the value of the property gathered in the fiscal year or the amount of funds expended in the fiscal year, in the case where it is impossible to identify the fiscal year in which the funds were gathered (Strzelec, 2015).

Non-disclosed sources of income are recognised as a result of taxation of non-disclosed sources not determining a tax base that approximates the actual state. The legislator has adopted the presumption that income and expenditure originate from non-disclosed income. However, this is considered to be a legal fiction. Taxation is carried out on the basis of randomly disclosed expenses and assets. The element of randomness is indicated by the fact that no comprehensive examination of the taxpayer's financial situation is carried out. It is argued that undeclared sources are subject to taxation on income in the form of assets and expenses that the taxpayer has failed to conceal, rather than on all or approximate income from undeclared sources (Dzwonkowski, 2009).

Regulations concerning non-disclosed sources of income actually allow for the use of the determining income on the basis of determining income based on expenses method. This appears to have significant implications for the practical application of income estimation regulations. Tax authorities do not use the method of determining income based on expenses, equating it with the possibility of its application only in the case of non-disclosed sources of income. In my opinion, the existence of separate regulations related to non-disclosed sources of income does not prevent the application of the method of determining income on the basis of expenses incurred under the regulations specified in Article 23 of the Tax Ordinance. In order to avoid any doubts as to interpretation, it would be advisable to include in the tax ordinance (or regulation) the method of determining income on the basis of expenses incurred as one of the possible methods of estimating the tax base. This method can be described as a last resort when there is no other data available to apply estimation methods.

The method can be characterised using the following formula (Huchel, 1994):

> net assets at the end of the period – net assets at the beginning of the period + expenditure – tax-free income – non-recognisable changes in assets = taxable income.

The regulation may specify the rules for determining the individual components of the formula.

### *3.5. Procedural changes*

In the author's opinion, the use of income estimation methods to determine a tax base that is as close as possible to the actual amount also requires procedural changes. These include:

- duty to cooperate;
- responsibility for giving false testimony;
- appointment of the Council for Proper Tax Base Estimation.

The author recommends introducing an obligation for taxpayers to cooperate in the Tax Ordinance. This would be particularly important when applying the method of determining income on the basis of information materials. Taxpayers would be required to provide information and explanations in connection with the estimation. The regulations contained in the German tax ordinance could serve as a model for legal solutions.

An important procedural element that would be helpful in applying estimation methods aimed at determining the correct amount of tax could be the introduction of criminal responsibility for making false statements by a party. Under the current legal framework, a party may only be questioned with their consent. The introduction of an obligation to cooperate could also include the possibility of questioning a party without their consent.

Another element of the proposed changes is the establishment of Council for Proper Tax Base Estimation. One of the significant problems in calculating income using the methods specified in the regulations, and in particular the external comparative method, is obtaining relevant data from comparable entities. Tax authorities have the technical capability to use data submitted by taxpayers regarding their income and expenses. However, this raises the issue of tax secrecy. Taxpayers whose income is estimated have no way of determining whether appropriate (comparable) entities have been selected. Tax authorities cannot disclose the details of the entities from which the data was obtained. This raises the issue of

objective verification of the accuracy of the income estimation. In such a situation, it would be advisable to consider obtaining an opinion from an independent body. Such a body could be the Council for Proper Tax Base Estimation.

Its members could be appointed from tax advisors, administrative court judges, academics, but also employees of tax administration bodies. The Council would issue opinions on the correctness of the use of comparative data covered by tax secrecy. The Council for Counteracting Tax Avoidance could serve as a model for the appointment and functioning of the Council. Further research should consider whether opinions would be issued only for cases of greater value or for all cases, regardless of the estimated income.

### *3.6. Legislative forms of changes*

The proposed changes may take various legislative forms. They may be amendments to the Tax Ordinance Act, or they may take the form of a regulation or guidelines issued in the form of a general interpretation by the Minister of Finance. It seems that the most appropriate solution would be amendments to the Tax Ordinance Act with the possibility of the Ministry of Finance issuing a regulation specifying the rules for estimation in detail. General interpretations or tax explanations prepared by the Minister of Finance may be issued as a supporting measure. The preparation of specific provisions is primarily the task of the legislative services of the Ministry of Finance and the legislator.

## 4. Conclusions

The tax base estimation is one of the instruments used to assess tax. The regulations provide for the possibility of using methods to estimate the tax base. In order to protect the interests of the State Treasury, the following changes have been proposed: specifying estimation methods in the regulation, applying the production method, changes in regulations concerning refraining the estimation of the tax base, using the method of determining income based on expenses, procedural changes. Legislative forms of changes were discussed as well. Some of the proposals presented may be further detailed in the course of the research.

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