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Contents

Articles

Paulina Bojanowska

YOUTH POLICY AS ECONOMIC INVESTMENT:
HUMAN CAPITAL, DIGITAL YOUTH WORK
AND LOCAL DEVELOPMENT IN THE EUROPEAN UNION 5

Paulina Kozieł, Michał Dąbrowski

HIGH-MIX LOW-VOLUME PRODUCTION SPECIFICITY –
A CASE STUDY OF FORMULA 1 POWER UNITS 23

Ireneusz Pszczółka

SELECTED ASPECTS OF OFFICIAL FOREIGN RESERVE
ASSETS MANAGEMENT IN THE EUROSISTEM 35

Jacek P. Rosa

"THE CURRENT MACROECONOMIC SITUATION
IN IRELAND" 47

Marzena Sobol

Monetary Policy in Response to Supply Shocks –
A Comparative Analysis of the Actions of the National Bank
of Poland and the European Central Bank during the 2022
Energy Crisis..... 69

ARTICLES

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Paulina Bojanowska¹

YOUTH POLICY AS ECONOMIC INVESTMENT: HUMAN CAPITAL, DIGITAL YOUTH WORK AND LOCAL DEVELOPMENT IN THE EUROPEAN UNION

Abstract

European youth policy is conventionally analysed through the lenses of participation, inclusion, citizenship, mobility and personal development. However, many of its instruments also generate effects that are economically significant, although they are not always captured by conventional measures of public expenditure efficiency. Investment in youth work, non-formal education, digital learning environments and the institutional capacity of youth organisations may contribute to human capital formation, employability, social capital, organisational productivity and local development. This article examines the economic dimension of European Union youth policy, with particular attention to the growing role of digital youth work and reusable educational resources.

The study is conceptual and analytical in character. It combines an analysis of the EU Youth Strategy 2019-2027, the European Youth Work Agenda and the European digital education framework with selected socioeconomic indicators and literature on human capital, non-formal learning, employability and social capital. Five principal mechanisms through which youth-policy interventions may generate economic value are identified: human-capital accumulation, enhancement of labour-market preparedness, formation of social capital, strengthening of organisational

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capacity and economies of scale associated with digital educational resources.

The analysis indicates that youth policy should not be interpreted exclusively as redistributive or social expenditure. Under appropriate institutional conditions, it can constitute a form of developmental public investment whose benefits accumulate at individual, organisational and territorial levels. Digitalisation further strengthens this investment dimension by enabling learning resources to be reused across institutions, locations and successive groups of beneficiaries. Nevertheless, the article argues against reducing the economic value of youth work to short-term employment effects or attempting to monetise complex social outcomes without sufficient causal evidence.

The paper proposes a multidimensional framework for assessing the economic effects of youth policy based on human capital, organisational productivity, resource utilisation, network effects and long-term socioeconomic outcomes.

Keywords: youth policy; human capital; digital youth work; employability; social capital; local development; European Union; non-formal education.

JEL classification: I25, J24, J18, H52, O33.

Paper type: conceptual article.

Introduction

The socioeconomic position of young people constitutes an increasingly important element of European economic policy. Transitions between education, employment and economic independence now take place under conditions shaped by rapid technological change, demographic ageing, changing occupational structures and growing demand for adaptable and transferable competences. Young people's capacity to participate effectively in economic life therefore depends not only on the completion of formal education, but also on their ability to acquire new skills, access information, develop professional and social networks, adapt to technological change and navigate increasingly complex institutional environments.

These challenges are reflected in contemporary European labour-market indicators. Despite considerable improvement over the previous decade, the share of young people aged 15-29 who are neither in employment nor in education and training remains

economically significant. In 2025, the NEET rate in the European Union amounted to 11.0%, exceeding the EU-level target of less than 9% by 2030. The issue is therefore not limited to unemployment itself. Extended periods of inactivity during the transition to adulthood can contribute to depreciation of skills, weaker attachment to the labour market, lower lifetime earnings and increased dependence on social transfers.

At the same time, technological transformation is changing both the skills demanded by employers and the institutional environment in which young people learn. Digital competence has become an increasingly important component of human capital. Yet the widespread perception of younger generations as inherently digitally competent conceals substantial inequalities between individuals and Member States. Access to digital technologies, the ability to use them productively and the capacity to evaluate digital information remain unevenly distributed.

Within this context, European youth policy occupies an interesting position between education policy, social policy, labour-market policy and local development policy. Traditionally, youth policy has been associated primarily with participation, citizenship, inclusion, mobility and personal development. These dimensions remain essential. However, such an interpretation may understate the economic relevance of interventions addressed to young people and the organisations supporting them.

Non-formal learning may generate transferable competences. Youth organisations may provide access to information and networks relevant to education and employment. Participation in community initiatives may strengthen social and psychological capital. Professionalisation of youth workers may increase the quality and productivity of organisations providing services to young people. Digital learning environments may expand access while creating possibilities for the repeated use of educational resources at comparatively low marginal cost.

Youth work can therefore be interpreted not only as a service consumed during the period in which it is delivered, but also as an investment producing capabilities that remain available after the initial expenditure has occurred.

This interpretation is consistent with the architecture of the EU Youth Strategy 2019-2027, organised around the interconnected

concepts of Engage, Connect and Empower. The Strategy explicitly recognises participation in democratic, social and economic life, mobility and exchange, as well as the development and recognition of youth work. The European Youth Work Agenda subsequently strengthened the emphasis placed on quality, innovation, recognition and the development of youth-work structures.

The economic dimension of these processes deserves greater attention. While substantial literature exists on the social and educational value of youth work, comparatively less consideration has been given to its role in the accumulation of human and organisational capital and to the economic characteristics of increasingly digital forms of non-formal education. The main purpose of this article is therefore to identify and systematise the mechanisms through which European youth policy may generate economic value.

1. Research questions

RQ1. Through which mechanisms can youth-policy interventions contribute to the formation and utilisation of human, social and organisational capital?

RQ2. How does digitalisation affect the accessibility, scalability and potential economic efficiency of youth-work interventions?

RQ3. Under what conditions can expenditure on youth work be interpreted as developmental public investment rather than exclusively as current social expenditure?

The article does not seek to demonstrate that participation in youth work directly causes employment growth or increases individual income. Such claims require longitudinal data and credible causal identification. Instead, the analysis focuses on economically relevant intermediate mechanisms that can reasonably be associated with youth-policy interventions.

This distinction is important because the economic contribution of youth policy is likely to emerge through cumulative and indirect effects rather than through a single observable outcome.

2. Youth policy within the socioeconomic policy framework of the European Union

2.1. From youth participation to socioeconomic participation

The EU Youth Strategy 2019-2027 provides the principal framework for cooperation in the youth field. Its three dimensions – Engage, Connect and Empower – reflect an understanding of youth policy extending considerably beyond leisure activities or political participation.

The first dimension, Engage, concerns meaningful participation by young people in civic, political, social and economic life. From an economic perspective, this is significant because participation depends partly on capabilities that are also relevant to labour-market and entrepreneurial activity: initiative, communication, decision-making and understanding of institutions.

The second dimension, Connect, refers to mobility, cooperation, exchange and solidarity. Its economic implications include the accumulation of intercultural competence, the enlargement of professional and social networks and improved access to information and opportunities extending beyond local labour markets.

The third dimension, Empower, places particular emphasis on youth work, youth organisations and the creation of conditions allowing young people to develop competences and exercise autonomy. It therefore provides the clearest link between youth policy and human-capital development.

The economic relevance of these dimensions does not imply that European youth policy should be subordinated to labour-market objectives. Youth work has intrinsic social, educational and democratic value. Nevertheless, the same processes through which young people increase autonomy and participation may also improve capabilities relevant to their economic trajectories.

A useful distinction can therefore be made between the primary objectives of youth policy and its secondary economic effects. The former may concern participation, inclusion or personal development, while the latter may include improved employability, stronger networks, better access to information and increased capacity to undertake productive activity.

3. Youth work as investment in human capital

Human-capital theory provides the most direct economic framework for analysing educational aspects of youth policy. Becker's classical approach conceptualises expenditure on education and training as investment because it increases individuals' productive capabilities and may generate returns over an extended period.

Formal education represents only one environment in which such capital is accumulated.

Non-formal education, volunteering, peer learning, international mobility and participation in youth organisations can generate competences that may subsequently be transferred to occupational or entrepreneurial settings. These include communication, teamwork, leadership, project management, creativity, problem solving, digital competence and the ability to organise one's own work.

Souto-Otero (2016) demonstrated that participation in non-formal education within youth organisations can be analysed through changes in human, social and psychological capital, including dimensions associated with employability. This framework is particularly useful because it avoids treating employability as equivalent to employment.

Employment is an outcome influenced by labour demand, macroeconomic conditions, regional inequalities, occupational structures and individual characteristics.

Employability refers instead to a set of resources enabling a person to identify, obtain and maintain employment or adapt to changes in the labour market.

Youth work can plausibly influence the latter even when it cannot determine the former.

This distinction has substantial implications for evaluation. A youth programme should not automatically be deemed ineffective because its participants do not immediately enter employment. Conversely, an employment outcome observed after participation cannot automatically be attributed to the programme.

A more appropriate analytical approach is to examine whether youth-policy interventions produce measurable changes in the competences and resources theoretically connected with subsequent socioeconomic outcomes.

4. Social capital and network effects

Human capital alone does not fully explain individuals' ability to access economic opportunities.

Information concerning employment, education, funding, entrepreneurship and mobility is frequently transmitted through social relationships. This gives social capital economic significance.

Coleman (1988) emphasised that social relations can constitute resources facilitating individual and collective action. In the youth-policy context, networks formed through organisations, volunteering, exchanges or community initiatives may expand young people's access to people and institutions outside their immediate environment.

This mechanism may be particularly important for young people with fewer opportunities.

Individuals from households characterised by weaker economic or educational resources may also have more limited access to networks capable of providing information about careers, mobility, education or entrepreneurship. Youth organisations can partly compensate for these differences by functioning as intermediary institutions.

The same logic operates at organisational level.

Cooperation between youth organisations, educational institutions, local authorities, libraries, enterprises, training organisations and employment services can facilitate knowledge exchange and reduce duplication of activities.

From an economic perspective, these relationships can reduce information and transaction costs.

An organisation that has access to tested methodologies, shared educational resources or established institutional partners does not need to develop every component of its activities independently.

Networks may consequently generate positive externalities extending beyond the individuals directly participating in a funded intervention.

5. Organisational capital and the professionalisation of youth work

One of the less frequently analysed economic dimensions of youth policy concerns the organisations responsible for delivering youth services.

Youth centres and non-governmental organisations require more than pedagogical competence. Their operation also depends on capabilities associated with strategic planning, budgeting, fundraising, project management, human-resource coordination, volunteer management, risk management, evaluation, communication, data protection and partnership development.

Deficits in these areas can affect organisational productivity even where organisations have strong substantive expertise in working with young people.

This creates an important distinction between investment directed at young beneficiaries and investment directed at institutional intermediaries.

Training one young person primarily creates individual human capital.

Training a youth worker, coordinator or manager may create both individual and organisational capital because the acquired competence can subsequently influence multiple activities and successive cohorts of beneficiaries.

The potential multiplier can be represented schematically as:

$$I \rightarrow Cw \rightarrow Qo \rightarrow Bn$$

where I denotes initial investment, Cw the competence of the youth worker, Qo the quality or capacity of the organisation, and Bn the outcomes experienced by multiple subsequent beneficiaries.

This mechanism makes capacity-building programmes economically interesting even where the initial number of direct participants is relatively small.

Their potential value depends not only on the number trained but also on the number of subsequent beneficiaries reached through the improved institutional capacity.

6. Digital youth work and the economics of scalability

Digitalisation adds another dimension to the economics of youth policy.

Traditional face-to-face education generally involves substantial variable costs. Expanding the number of participants often requires additional trainer hours, rooms, travel and organisational inputs.

Digital educational resources have a different cost structure.

The production of a high-quality online course, simulation or educational game may require considerable initial expenditure. However, once developed, the same resource can be made available to additional users without replicating the entire development cost.

A simplified average-cost function can be written as: $AC(N) = [F + M(N)] / N$, where F represents fixed development costs, $M(N)$ represents maintenance and variable delivery expenditure, and N represents cumulative users.

As N increases, the fixed development cost is distributed across a larger beneficiary population. This creates the possibility of economies of scale.

The mechanism should not be overstated. Digital education is not costless after development. Platforms require hosting, security, updating, moderation and sometimes direct pedagogical support. Content may become obsolete. Technological changes can require redesign.

Nevertheless, the economic structure of digital learning differs materially from a model in which each subsequent participant requires approximately the same quantity of physical resources.

Digitalisation may also reduce some barriers to access. Participants can potentially engage in learning regardless of geographical distance, at different times, without transport costs and without requiring local access to specialised trainers.

This can be particularly relevant in rural areas and smaller localities where specialised educational infrastructure is limited.

At the same time, digitalisation can reproduce inequalities. Access to hardware, connectivity and digital competence differs across population groups. Effective digital youth policy should therefore avoid treating the existence of an online resource as equivalent to actual accessibility.

7. From European policy objectives to institutional implementation

The transition from European strategic objectives to local practice requires institutions capable of operationalising broadly formulated concepts such as empowerment, participation or digital transformation.

One practical challenge is the heterogeneous professionalisation of youth work across Member States. The organisational forms

of youth centres differ substantially, as do the roles performed by coordinators, facilitators and youth workers.

This creates a potential implementation gap.

European policy increasingly recognises the value of youth work, while organisations operating locally may lack structured pathways for developing the managerial and pedagogical competences necessary to provide it sustainably.

A useful illustration is provided by the Erasmus+ cooperation partnership DIGI-YOUTH KIT (project no. KA220-YOU-BEBF9C1C), developed by 11 organisations from six European countries. Its relevance for the present analysis lies not in the project itself, but in the way a transnational initiative translated broad European priorities into concrete institutional-capacity instruments. The intervention included structured digital learning for people coordinating and animating youth centres, an educational simulation concerning youth-centre management and the development of cooperation between youth centres. According to the project documentation, the partnership intended to develop the knowledge of 300 youth workers and create an informal network of at least 20 youth centres or youth spaces.

The project's needs analysis had previously gathered 50 responses representing 40 organisations from 12 countries, and the consultation indicated substantial interest in structured training for youth-centre coordinators.

The significance of this example lies in the type of competence targeted.

The coordinator-oriented educational component included budgeting, sustainability, evaluation, planning, organising, coordination, and management of physical, mobile and virtual youth centres.

The component oriented towards direct work with young people included communication, design of non-formal educational activities, inclusion of young people with fewer opportunities, participant safety and risk management, youth information and digital tools.

This is an example of how European youth-policy concepts can be converted into forms of human and organisational capital.

The intervention does not prove that these competences increase employment or local GDP. Its analytical relevance is different: it demonstrates the institutional mechanism through which policy

aimed at improving the quality of youth work may potentially produce economically meaningful capacities.

8. Digital educational resources as intangible public assets

The economic interpretation of digital youth work becomes particularly useful when educational resources survive beyond the period during which they were financed.

A digital course can be viewed as a form of intangible educational asset.

Suppose that the initial development of a resource costs EUR 60,000.

If it is used by 300 individuals, fixed development expenditure per user equals EUR 200. At 1,000 cumulative users, the figure falls to EUR 60, and at 5,000 users to EUR 12.

These calculations do not constitute a complete cost-benefit analysis because they omit maintenance, updating and support costs.

They demonstrate a different point: utilisation over time fundamentally changes the economic evaluation of a digital educational resource.

A project evaluated exclusively according to the participants recorded during its formal funding period may therefore appear substantially less efficient than the same intervention assessed across the useful lifetime of its outputs.

This has implications for programme evaluation. For reusable resources, an economically meaningful indicator is not merely development expenditure divided by initial participants, but cumulative development and maintenance expenditure divided by cumulative meaningful users of the resource.

The term meaningful users is essential. A platform visit, registration or download does not necessarily indicate learning. Future evaluation should distinguish visitors, registrations, active users, course completions, competence gains and subsequent application of acquired knowledge. Only then can the scale of digital resources be meaningfully connected with their economic efficiency.

9. Youth work and local development

Youth policy also has a territorial dimension. Local development depends not only on physical infrastructure and investment capital

but also on the quality of local institutions and the capabilities of residents.

Youth centres, community organisations and local learning spaces can constitute elements of social infrastructure. Their role may include providing access to educational activities, career and education information, digital resources, opportunities for volunteering, mentoring, peer networks, civic participation, contact with local institutions and space for developing projects and initiatives. These functions may be particularly relevant in rural and peripheral areas where access to specialised services is limited.

A lack of opportunities for education, culture, participation and social activity is unlikely to be the sole determinant of youth migration. Nevertheless, it can contribute to young people's perception that opportunities for development are concentrated elsewhere. Local youth infrastructure can therefore be considered one element of territorial attractiveness and community resilience.

Its economic role is indirect. A youth centre does not create regional growth simply by existing. Its potential contribution depends on whether it increases capabilities, connects individuals with institutions, supports local initiatives and remains sustainably embedded in the local ecosystem.

For that reason, youth-policy evaluation should increasingly consider territorial outcomes such as durability of local organisations, partnerships created, access to learning opportunities, mobilisation of volunteers, involvement of local enterprises, and subsequent projects and investments.

10. Preventive economic value of youth policy

An additional dimension concerns prevention. Public policy evaluation often concentrates on the observable benefits generated by an intervention. However, some interventions create value partly by reducing the probability of adverse outcomes.

The economic costs associated with prolonged youth inactivity can include lost production, lower tax revenues, additional social transfers, deterioration of skills, poorer future employment prospects and increased demand for social services. Youth work cannot eliminate these risks, and it would be methodologically inappropriate to attribute the entire avoided cost of inactivity to a youth programme.

Nevertheless, interventions that strengthen attachment to education, social participation, self-efficacy and institutional networks may operate as protective factors. This suggests a preventive-investment interpretation. The economic rationale resembles other preventive policy domains. Expenditure may be justified not because every participant would otherwise experience an adverse outcome, but because the intervention changes the probability distribution of future outcomes. Empirical confirmation of this mechanism would require longitudinal research comparing participants with appropriately selected control groups. At present, it is better regarded as an economically plausible pathway than as a directly quantifiable return.

11. Measuring the economic effects of youth policy

A major limitation in the evaluation of youth policy is the dominance of implementation indicators. Typical project-monitoring systems record the number of participants, training sessions, publications, events and satisfaction levels. These indicators are useful for accountability but provide only limited information about economic value. A more appropriate framework should distinguish several levels.

Table 1. Multilevel framework for the economic evaluation of youth-policy interventions

Level	Dimension	Examples of indicators
I	Inputs	expenditure, staff time, infrastructure
II	Outputs	participants, courses, resources, hours of provision
III	Human-capital outcomes	competence gain, completion, certification
IV	Behavioural outcomes	use of acquired skills, participation in further education
V	Organisational outcomes	funding acquired, activities delivered, productivity
VI	Network outcomes	partnerships, referrals, joint initiatives
VII	Socioeconomic outcomes	education, employment, entrepreneurship, inactivity
VIII	Territorial outcomes	institutional sustainability, local learning capacity

Source: Own study

The framework also illustrates the problem of attribution. The causal distance from the original intervention increases with each level. A course can reasonably be expected to influence competence

directly. Its influence on employment twelve months later is more difficult to isolate. Its influence on regional economic development is even more indirect. Evaluation should therefore become more cautious rather than more assertive as the analytical distance from the intervention increases.

12. Discussion

The analysis indicates that the conventional distinction between social expenditure and economic investment is insufficient for understanding contemporary youth policy. A youth-work intervention may create several types of assets simultaneously. Training generates human capital. Organisational development creates managerial capacity. Networks create relational capital. Digital platforms create reusable intangible resources. These assets can remain productive beyond the accounting period in which the original expenditure occurs.

This does not imply that all youth-policy expenditure is efficient or that every funded project constitutes an investment in an economic sense. Three conditions are particularly important.

First, the intervention must generate durable capabilities, rather than only short-lived participation.

Second, these capabilities must subsequently be used.

Third, the resources created should be sufficiently transferable and accessible to reach beneficiaries beyond the original implementation environment.

Digitalisation strengthens the importance of these conditions. A high-quality digital resource may have considerable long-term value if repeatedly used by subsequent cohorts. Conversely, a technically sophisticated platform with minimal utilisation may represent poor public value despite successful completion of formal project indicators. This observation has consequences for European funding programmes.

Evaluation systems should devote greater attention to cumulative use after project completion, competence retention, reuse by external organisations, subsequent beneficiaries reached by trained professionals, organisational changes and network persistence. Such indicators would provide a stronger basis for assessing whether project financing creates temporary activity or durable capacity.

13. Policy implications

Several implications emerge from the analysis.

First, capacity building in youth organisations should be treated as an economically relevant policy objective.

The effectiveness of youth policy depends partly on the institutional quality of organisations implementing it. Professionalisation of management, evaluation and digital provision can therefore generate benefits extending beyond the immediate participants in training.

Second, the evaluation horizon should extend beyond the formal project period.

This is especially important for digital resources and organisational-development interventions.

Third, secondary beneficiary reach should be measured.

Where the direct beneficiary is a youth worker, the number and characteristics of young people subsequently reached may provide a more meaningful indication of the intervention's scale than the original training cohort alone.

Fourth, non-formal competence recognition should focus on demonstrated learning.

Certificates and digital badges can contribute to the visibility of acquired skills only when they correspond to transparent learning outcomes.

Fifth, digitalisation should be evaluated jointly with accessibility.

Increasing the number of online resources does not necessarily increase participation among groups with weaker digital capabilities.

Sixth, network sustainability should become an evaluation criterion.

The economic value of institutional networks depends not on formal membership alone but on actual information exchange, cooperation and joint activity.

Finally, the economic interpretation of youth policy should remain complementary to, rather than replace, its social and democratic rationale.

Reducing youth policy entirely to labour-market productivity would disregard many of its primary objectives.

The relevant insight is instead that social empowerment and economic capability are frequently mutually reinforcing rather than competing outcomes.

14. Conclusions

European youth policy operates at the intersection of education, social inclusion, civic participation, labour-market preparation and local development.

Its economic significance is therefore broader than is suggested by conventional classifications of public expenditure.

The analysis identified five principal mechanisms through which youth-policy interventions can generate economically meaningful outcomes: accumulation of human capital; strengthening of employability-related capabilities; creation of social and institutional capital; development of organisational capacity; and economies of scale associated with reusable digital resources.

These mechanisms justify interpreting selected forms of expenditure on youth work as developmental investment.

The strongest argument for such an interpretation is not that youth programmes directly generate measurable increases in GDP or employment. The available evidence generally does not permit such simple attribution.

Rather, youth policy can create capabilities and institutional assets that influence subsequent economic behaviour and the quality of local service provision.

Digital transformation strengthens this potential by increasing the transferability and scalability of educational resources.

However, it also makes utilisation and sustainability increasingly important. The creation of a digital resource is economically relevant only to the extent that it is subsequently used and contributes to actual learning or institutional change.

This leads to a broader conclusion for public-policy evaluation.

Youth interventions should not be assessed exclusively through participant numbers, events delivered or satisfaction ratings. Evaluation should increasingly focus on what remains after the intervention has formally ended: competences, institutional capacity, networks, reusable resources and their subsequent utilisation.

Such an approach provides a more appropriate basis for understanding the relationship between youth policy and economic development.

European youth policy should therefore neither be reduced to social consumption nor justified by exaggerated claims of immediate financial returns. Under appropriate institutional

conditions, it represents investment in the productive, adaptive and relational capacities of individuals and organisations.

In economies facing demographic change, technological transformation and increasing demand for continuous skills development, these capacities constitute an increasingly important component of long-term socioeconomic resilience.

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ARTICLES

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HIGH-MIX LOW-VOLUME PRODUCTION SPECIFICITY – A CASE STUDY OF FORMULA 1 POWER UNITS

Abstract

This article addresses the issue of High-Mix Low-Volume (HMLV) production, with particular emphasis on its application in the Formula 1 environment. The aim of the study is to present the specific characteristics of low-volume, high-mix production and identify the factors influencing its effectiveness, using the example of Formula 1 Power Unit production. The theoretical section characterizes the HMLV model, highlighting, among other things, the importance of process flexibility, technology, digitalization, and Industry 4.0 solutions. The practical section analyzes the specifics of Formula 1 Power Unit production, taking into account the production tools used, inventory and spare parts management, material and operational constraints, and the impact of technical and financial regulations on the organization of research and development processes. The study utilized desk research, a case study, and secondary data analysis. The analysis indicates that Formula 1 Power Unit production exhibits key characteristics of the HMLV environment: small production scale, high technological complexity, significant component diversity, the need for rapid response to change, and strong integration of design, production, and research and development processes. The results also indicate that regulatory and financial constraints can foster more efficient resource use, increased reliability, and the development of innovative solutions. Formula 1 can

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therefore provide a valuable source of best practices for other high-tech sectors utilizing high-mix, low-volume production.

Keywords: High-Mix Low-Volume, HMLV, Formula 1, powertrains, low-volume production, Industry 4.0.

JEL classification: L23, O31, O32.

Introduction

Modern manufacturing companies operate in an environment of increasing market volatility, shortening product lifecycles, and growing customer expectations for product customization. As a result, traditional mass production models are increasingly giving way to solutions that ensure high flexibility of manufacturing processes while maintaining high quality and cost-effectiveness. One model responding to these challenges is high-mix low-volume (HMLV) production, characterized by the production of small batches of products with a wide variety of designs and technologies. This type of production is primarily used in high-tech sectors such as the aerospace and motorsport industries, where precision, reliability, and the ability to quickly adapt the production process to changing requirements are crucial.

The development of Industry 4.0 concepts, additive technologies, digital twins, and advanced IT systems has created new opportunities for organizing HMLV production. These solutions enable increased process flexibility, shorter product design and implementation times, and more efficient management of resources, inventories, and research and development activities. A particularly interesting example of a production environment utilizing such solutions is Formula 1 (F1), where technologically advanced products are manufactured in small batches while operating under strict regulatory, financial, and time constraints.

The aim of this article is to present the specifics of high-mix, low-volume production and identify the factors determining its effectiveness, using the example of F1 Power Unit (PU) production. The theoretical section discusses the characteristic features of HMLV production, the importance of modern technologies, and the digitalization of production processes. Next, using a case study of (F1), the organization of PU production is analyzed, paying particular attention to the technologies used, inventory and spare parts management, the impact of technical and financial regulations, and the role of research and development. The article was created using desk research, case studies, and secondary data analysis, allowing for a comprehensive approach to the issue in both theoretical and practical contexts. The authors attempted to contact F1 PU manufacturers to obtain in-depth data on the topic, but due to intellectual property protection, they received a negative

response. The analysis conducted in this article allows us to demonstrate how the experience of one of the most technologically advanced production environments can provide a source of best practices for other companies operating in the high-mix, low-volume model.

1. High-Mix Low-Volume Production – characteristics and specifics

High-mix, low-volume production (HMLV) is one of the most demanding models for organizing manufacturing processes. Unlike mass production, which primarily aims to achieve the highest possible efficiency at the lowest unit cost, HMLV systems focus on flexibility, the ability to quickly change product ranges, and the production of short series of highly complex products. In such conditions, the ability to quickly adapt the production process to changing technical and design requirements is crucial (Schmitt, Zorn, & Gericke, 2021; Altıparmak & Xiao, 2021).

The specific nature of HMLV production is causing companies to shift away from highly specialized production lines in favor of universal CNC machining centers and additive manufacturing technologies. This type of production enables the rapid production of prototypes, tools, and final components with complex geometries without the need for expensive tooling. This is particularly important in the aerospace and motorsport sectors, where small batches of parts with high quality and material requirements are produced. The development of additive manufacturing technologies simultaneously shortens production lead times and reduces the number of assembly operations by integrating multiple elements into a single component (Blakey-Milner et al., 2021; Tan, Weng, Sui, Chew, & Bi, 2021).

In a low-volume production environment, maintaining high inventory levels is usually economically unjustified. Instead of a make-to-stock strategy, make-to-order and engineer-to-order models dominate, where components are manufactured according to current demand. However, this approach requires highly efficient production planning, high process reliability, and the ability to quickly replenish spare parts in the event of a failure. In industries using this type of production, the balance between inventory maintenance costs, operational safety, and component availability is particularly important, as even a single failure can disrupt the entire project (Altıparmak & Xiao, 2021; Blakey-Milner et al., 2021).

Companies operating in high-tech sectors achieve a competitive advantage primarily through intensive research and development. In conditions of limited production runs and high product complexity, computer simulations, digital design, and advanced process verification methods become particularly important before physical production begins. This allows for reducing the number of costly prototype improvements, shortening the implementation time of new designs, and increasing the reliability of final products. This phenomenon is particularly evident

in the aviation, space, and motorsport industries, whose experiences are increasingly being adopted in other industries utilizing HMLV production (Schmitt et al., 2021; Tan et al., 2021).

2. Digitalization and modern technologies in High-Mix Low-Volume production

Modern enterprises implementing high-mix, low-volume production increasingly utilize solutions characteristic of Industry 4.0. IT system integration, data flow automation, and the use of Internet of Things (IoT) technologies enable ongoing monitoring of production processes and faster response to schedule changes. In a HMLV environment, where each batch may differ from the previous one, digital management of technological information becomes particularly important, reducing errors resulting from frequent product configuration changes. Industry 4.0 solutions also support production planning, enabling decision-making based on real-time data, which translates into greater flexibility and efficient use of production resources. This becomes particularly important in high-tech industries, where order fulfillment times and the ability to quickly adapt the production process constitute a significant competitive advantage (Tahmina, Garcia, Geng, & Bidanda, 2022; Gan, Musa, & Yap, 2023).

One of the most important developments in modern manufacturing is the use of the digital twin concept. It involves creating a virtual equivalent of a product or production process, which is continuously updated with data from the actual object. This allows for simulations, predicting component behavior during operation, and assessing the effects of proposed design changes without the need for costly physical prototypes. In low-volume production, the use of digital twins reduces the number of design iterations, shortens the implementation time of new solutions, and improves the quality of the design process. These solutions are finding increasing application in industries where the cost of a single prototype is very high and the reliability of the finished product is crucial (Zhou, Zhang, & Gu, 2022; Onaji, Tiwari, Soulatiantork, Song, & Tiwari, 2022).

The aviation, space, and motorsport industries are among the industries dominated by short production runs, a high degree of product customization, and very stringent quality requirements. Produced components must simultaneously meet requirements for strength, reliability, low weight, and precision, which significantly differs from traditional automotive production. A characteristic feature of both sectors is the very close integration of research and development with the production process. Developed solutions are constantly tested, analyzed, and refined, and information acquired during operation forms the basis for subsequent design changes. For this reason, the motorsport sector is often cited as one of the most important sources of best practices for companies implementing

high-mix, low-volume production, and many of the production organization methods used there are also applicable to other technologically advanced industries. This justifies using F1 as an example illustrating the specificity of HMLV production (Tahmina et al., 2022; Gan et al., 2023).

3. F1 PU production as an example of a High-Mix Low-Volume production

3.1. F1 – specifics of production

Since its creation as World Championship series in 1950, F1 became one of the most recognizable motorsport series in the world. From its early days, technological innovations were inseparable part of competition, as teams were trying to find every possible advantage within the confines of the rules. Innovations like twin-chassis construction, six-wheeled cars, moving engine to the rear, active suspension, or more recent F-ducts, double or blown diffusers and even Dual-Axis Steering (DAS) are all examples of regulation loopholes found and exploited by competitors. While all those solutions were eventually banned and some of them made comeback, the reality is obvious – sooner or later F1 teams will find a loophole in the rules and then exploit it – if they deem possible gains worth the effort and resources. This reality governs production and development of every part of the car, including PUs. And while Fédération Internationale de l'Automobile (FIA), the body that makes and enforces the rules of F1 is doing whatever it can to close those loopholes, it would be unreasonable to expect them to find and seal all of them. Understanding the regulatory environment of F1 manufacturing and comparing it to current state of openly available academic and industrial knowledge, can provide valuable insight into manufacturing side of the competition.

F1 serves as an example of Low-Volume High-Mix manufacturing, both in the overall construction of racing cars and in the production of PUs. Each PU consists of six specified by the rules components, those being:

- Internal Combustion Engine (ICE) [4],
- Turbocharger (TC) [4],
- Motor-Generator Unit-Heat (MGU-H) [4],
- Motor-Generator Unit-Kinetic (MGU-K) [4],
- Energy Store (ES) [4],
- Control Electronics (CE) [2],
- Exhaust (EX) [8].

All those components together create a single PU, however it is valuable to note that they don't have to be used in predefined sets, meaning that they can be mixed and matched together. For example, TC can be replaced with all other components remaining as they are. Compatibility of specifications may need to be considered. Also, usage limits for the season are not the same

for all components, with 2025 values noted in square brackets in the list above (FIA, 2025b, Article 28). For the chosen period, there were four PU manufacturers³ supplying differing number of teams. While each of those was focused primarily on supplying their own racing operation (for example Mercedes-AMG High Performance Powertrain was focused on supplying mainly Mercedes-AMG Petronas Formula 1 Team) they had to supply other customer teams with equal PUs (FIA, 2025a, Appendix 4).

In summary, Formula One manufacturing in general is a kind of a hybrid between automotive and space industries. Manufactured cars are few, very advanced and could be described as made to carry out one specific task of racing within one set of regulations. Similarly to spacecraft, which are also (usually) few, very advanced and made to carry out a specific task or mission. Considering the above, it's clear that substantial part of knowledge relating to space industry can be applied to Formula One manufacturing.

3.2. Production tools and inventory management

Manufacturing a highly diverse range of parts requires different tools and machines than mass production of similar or identical components. Where mass production can utilize dedicated machines that are made to output a single part in massive quantities, Low-Volume High-Mix Manufacturing requires a different approach. Wherever possible, each machine should be able to produce every part with minimum time spent on retooling (Gödri, 2022). For this reason, CNC and various types of technologies commonly referred to as 3D Printing are the best choice (Gramegna et al., 2020).

Although the authors are unable to specify parts within PU that could be manufactured by hand, such approach may be utilized for some components, especially since manual labor is used in the automotive industry for parts made from carbon fiber (Uchida et al., 2015) and that group of materials is used, among others, for construction of structural reinforcements (FIA, 2025a, Article 15) or survival cell (FIA, 2025a, Article 12) of the Formula One car.

A natural consequence of Low-Volume Manufacturing are lower levels of inventory of finished products, as the preferred strategy is Make-to-Order not Make-to-Stock (Gan et al., 2023), as can be seen in mass production. Just like delivery deadline in commercial operation, factories supplying Formula One teams may face short-term necessity for replacement parts because of unplanned events, like collision or malfunction during track operations. It is reasonable to assume that such instances can and sooner

³ While three of those maintained largely the same ownership, there were changes with regards to operation run by Red Bull and Honda. While they bear no significance to the subject of article, authors chose to include this information to provide some clarity for readers who choose to delve deeper into the details.

or later will force the team to manufacture additional parts to maintain necessary supply of the items in question. In extreme cases, losses are unreplenishable in time to continue running the car in question, however this may not necessarily be caused by the lack of on-track supply, but rather inability to rebuild the car in time. This problem does have additional caveat, under the FIA Financial Regulations introduced in 2021, teams must account for costs associated with car components and their manufacture within the Financial Regulations framework (FIA, 2025c, Article 1). This means, that teams are more incentivized to repair damaged parts – to some extent – than to just throw them out and use new ones.

In case of collision damage to PUs and their components, there were extreme cases where damage was so severe, that a whole Unit was effectively irreparable and therefore lost, an example would be crash damage to Charles' Leclerc Ferrari (Larkham, 2021) and Sergio Perez's Red Bull (Rencken, 2021) during Hungarian Grand Prix in 2021. This obviously puts additional strain on the factory, which now not only has to deliver the PUs according to schedule, but also must manufacture one more to replace the race damage. While it is reasonable to expect that there is a supply of parts always maintained specifically to replace components destroyed in a crash, relative rarity of entire PU being scrapped may still put a strain on supply chain, as it is unexpected situation.⁴ However, sometimes team decides to use new PU from the available stock, despite the incurred costs and even sporting penalties (FIA, 2025b, Article 28) for exceeding the allocation, simply because of performance advantage that can be gained. An example of that would be Mercedes' Lewis Hamilton taking a new ICE for the Brazilian Grand Prix in 2021 and then winning a race despite being massively disadvantaged by penalties (F1, 2021).

3.3. Material and use regulations

There are also limitations on materials that can be used and already mentioned limits on components usage. Alloys cannot contain certain elements, while using others is limited to certain percentage depending on the part in question (FIA, 2025a, Article 5, Article 15). Those regulations exist for several reasons, but the one that interests us is cost limitation. In the past teams were experimenting with usage of exotic materials like beryllium (Collantine, 2007), or even running engine from brand-new condition down to scrap over a single qualifying sessions in a practice called "qualifying grenades" (Wright, 2026), which obviously resulted in huge runaway operating costs. Material regulations, combined with other changes,

⁴ While there were many cases of significant crash damage to the PU, the already mentioned 2021 Hungarian Grand Prix is the only time in the last 10 years when entire PU was destroyed beyond repair, that authors have found.

like introducing ICE usage limits in 2004 (FIA, 2003, Article 86) and aforementioned Financial Regulations in 2021 (FIA, 2021), slowly shifted the manufacturing of PUs from High to Low-Volume, forcing manufacturers to ensure reliability, as allowed engine allocation went down from 18 in 2004 (F1, n.d.-a)⁵, to 3 in 2018 (FIA, 2018, Article 23), before increasing again in 2023 (FIA, 2023, Article 28) which can be reasonably seen as tied to increased number of races (F1, 2023).

3.4. Research and development

Over the years, the R&D in F1 shifted, most notably in preparations for 2021 season and introduction of Financial Regulations. Before if there was a problem to solve, bigger, better financed teams could just outspend their competitors (Stuart, 2019). While it was possible for smaller team with less financial resources to spend smart and achieve good results, as proven by the results of Force India in 2016 (F1, n.d.-b) and 2017 (F1, n.d.-c), big teams like Mercedes, Ferrari or Red Bull (first two also manufacturing their PUs in-house⁶) could simply “throw the money” at the problems and obtain a solution.

Since 2021 approach has changed. Teams can no longer indefinitely rinse and repeat their tests and experiments. Instead, as authors have learned through LinkedIn communication with Mercedes, they want to get the result of the test right on the first try, as they cannot afford to repeat it multiple times. This enforces total and absolute control over testing environment to avoid accidentally introduced variables. While somewhat open to interpretation, it could be argued that the tighter financial constraints may have reduced the willingness of teams to pursue highly speculative development programs with uncertain returns.

Conclusion

The analysis confirms that high-mix, low-volume production is one of the most demanding models for organizing manufacturing processes, combining the need for high flexibility with rigorous requirements for quality, reliability, and timely completion. Operating companies in such an environment requires the use of universal production technologies, advanced digital tools, and efficiently organized planning, logistics, and knowledge management processes.

The example of F1 PU production demonstrates that the specific nature of the HMLV environment extends beyond the manufacturing process

⁵ Regulations for 2004 set limit of one engine per race weekend per driver. There were 18 races as shown in the calendar in citation, thus 18 engines per driver per season.

⁶ Red Bull Powertrains was created in 2021, and it was not until 2026 when Red Bull cars were powered by PUs made by their subsidiary.

and also encompasses research and development organization, spare parts management, component planning, and adapting the company's operations to changing technical and financial regulations. Solutions specific to Industry 4.0 play a particularly important role, including additive technologies, digital production management systems, and the digital twin concept, which enable cost reduction, shorter implementation times, and increased product reliability.

Based on the conducted analysis, several key conclusions can be drawn. First, effective implementation of high-mix, low-volume production requires a high level of integration between design, production, and research and development processes. Second, modern digital technologies are now not only a tool supporting production, but one of the fundamental factors determining the competitiveness of companies operating in this model. Third, the experience of F1 indicates that properly designed regulatory constraints can stimulate the development of innovative technical solutions and increase resource efficiency, rather than merely restricting manufacturers' freedom of action. Finally, the analysis confirms the validity of treating F1 as a valuable case study, allowing for the identification of good practices that can be adapted to other high-tech sectors, particularly the aerospace industry and companies engaged in low-volume production of highly diverse products.

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ARTICLES

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SELECTED ASPECTS OF OFFICIAL FOREIGN RESERVE ASSETS MANAGEMENT IN THE EUROSYSTEM

Abstract

The paper discusses the policy of managing foreign exchange reserves in the euro area. The aim is to assess changes in the size and structure of official reserve assets in the Eurosystem (European Central Bank and National Central Banks) from 2017 to 2025. Particular emphasis is placed on assessing the adequacy of official reserve assets using selected indicators. The paper is based on the international literature and statistical data. The main data sources are publications issued by the European Central Bank and Eurostat.

Keywords: foreign reserves, central bank, gold, Eurosystem.

JEL classification: E44, E58, F32.

Paper type: Theoretical research article.

1. Introduction

Central banks play a fundamental role in the functioning of modern economies. Traditionally, their core responsibilities have included issuing currency, conducting monetary policy and maintaining financial stability. Among their key functions is also the management of official reserve assets, which constitute an important component of a country's financial and monetary security (Zaleska, 2020, p. 268). A number of countries developed

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the practice of holding foreign currency reserves in the mid-nineteenth century to back their liabilities and domestic currency with a view to supplementing their gold and silver reserves. Since then, the reasons for holding foreign currency reserves have evolved over time and across countries (Chițu, Gomes, Pauli, 2019, p. 40). Foreign exchange reserves are primarily liquid, readily available foreign assets, including holdings of foreign securities and convertible foreign currencies. These assets must be actually held by the monetary authorities and cannot be merely pledged to them. They are one of the most important elements of a country's financial security, including its monetary security (Zaleska, 2020, p. 269).

Rybiński (2011, p.229) defines foreign exchange reserves as foreign assets held by central banks denominated in foreign currencies and special drawing rights (SDR), which, if necessary, enable currency interventions or the provision of foreign currencies to domestic banks in crisis situations. These assets, together with the reserve position in the International Monetary Fund (IMF) and gold, constitute the official reserve assets. The reserves are part of the national wealth and are most often located in the central bank. Foreign reserves, at an adequate level, are necessary for financial security, including the currency security of the state. The required level of reserves varies depending on the type of economy. Advanced economies, particularly issuers of major reserve currencies such as the euro area, generally have a less pressing need to hold large reserve assets (Chițu, Gomes, Pauli, 2019, p. 45). This means that central banks issuing an international currency operate differently from banks in countries with local currencies because its liabilities are widely accepted in global trade. This is also related to the function of a safe-haven currency, which to some extent the euro is (Pszczółka, 2021, p. 88).

The primary objective of foreign exchange reserve management by the European Central Bank (ECB) is to achieve a triple priority: liquidity, security, and return on investment.

Liquidity is the most important objective and provides the resources necessary to conduct potential foreign exchange interventions in the markets. Second in importance is security, which means protecting capital from excessive market and credit risk. The third objective is return on investment, i.e. generating income from assets held after meeting liquidity and security criteria (Sitek, 2021, p. 499-502).

This paper is a review and its aim is to assess changes in the size and adequacy of the European Central Bank and Eurosystem's official reserve assets from 2017 to 2025. The analysed period begins with the inclusion of the Chinese renminbi in the ECB's reserve portfolio following its incorporation into the SDR basket in 2016 and reflects the growing economic significance of China as one of the euro area's major trading partners. Due to the complexity of reserve adequacy assessment,

the analysis employs selected indicators commonly used in the literature to evaluate the sufficiency of reserve holdings. The study is based on a review of the relevant literature and an analysis of statistical data obtained primarily from publications issued by the European Central Bank and Eurostat.

2. The concept of foreign exchange reserves in the euro area

The international reserve assets of the euro area consist of the Eurosystem's reserve assets, i.e. the ECB's reserve assets and those held by the national central banks (NCBs) of the euro area Member States. The ECB's foreign reserves ensure that the ECB has sufficient liquidity to conduct foreign exchange operations if needed. Those foreign reserves were originally established by means of the transfer of foreign reserve assets from the NCBs of the euro area when Stage Three of Economic and Monetary Union began on 1 January 1999. Article 105 of The Treaty on European Union stipulates that one of the basic tasks to be carried out by the Eurosystem is to hold and manage the official foreign reserves of the Member States, without prejudice to the holding and management by the governments of these Member States of foreign exchange working balances. Consequently, there are no official foreign reserves in the euro area apart from those held by the Eurosystem. Eurozone central banks are required to transfer a portion of their foreign reserves to the ECB. The Governing Council of the ECB decides on the proportions and the amounts that will be required by specific deadlines. Pursuant to Article 30.1 of the Statute of the ESCB (European System of Central Banks), the initial amount of foreign reserves transferred to the ECB by central banks is up to 50 billion euro. Gold accounted for 15% of the transferred reserves, with the remaining 85% consisting of Japanese yen and US dollars. Because the obligation to make foreign reserve payments applies only to the Eurosystem member states (other EU member states are exempt from this obligation until they join the euro area), the total paid-up reserves at the time the ECB commenced operations amounted to the equivalent of 39.5 billion euro (Wierzba, 2003, p.67). The accession of each additional country to the EMU results in an increase in the ECB's equity capital and an increase in the common pool of reserves. The amount of foreign reserves to be transferred to the ECB is determined each time a country joins the euro area, based on its share in the ECB capital key and the current level of ECB reserve assets. The shares of individual national central banks in the capital subscription key are based on 50% of the country's share in the EU population and 50% of its share in the EU's gross domestic product.

The ECB holds and manages the foreign reserves that are transferred to it for the purposes set out in the Statute of the ESCB. The foreign reserves remaining with the NCBs are held and managed by the NCBs in accordance

with the provisions of Article 31 of the Statute of the ESCB. The external operations that may affect the ECB's and NCBs' holdings of reserves are set out in Article 23 of the Statute of the ESCB. First, the ECB and the NCBs may establish relations with central banks and financial institutions in other countries and, where appropriate, with international organisations. Second, they may acquire and sell spot and forward all types of foreign exchange assets and precious metals. Third, they may manage the foreign assets they hold. Finally, they may conduct all types of banking transactions in relations with third countries and international organisations, including borrowing and lending operations (ECB, 2000, p.52). The ECB's official reserve assets can be regarded as the Eurosystem's most liquid tranche that would be used as the first reserve pool to fund any foreign exchange interventions, the official reserves held by the NCBs can be seen as separate and autonomous investment tranches. Nevertheless, according to the Statute of the ESCB, a part of these reserves should be readily available for intervention purposes at short notice, if necessary (Chițu, Gomes, Pauli, 2019, p. 43-44). This also means that it must be possible to convert the portfolio into cash balances in a short time frame and at minimal cost (Chițu, Gomes, Pauli, 2019, p.53).

The currency composition of reserve assets is determined by the Governing Council. It takes into account expected intervention needs and is amended as necessary. The ECB does not actively manage the currency composition of reserve assets to avoid indirect interference with the common monetary policy. The ECB's decisions regarding the management of foreign reserves by national central banks are communicated in the form of investment benchmarks and limits to be observed. They publicly announce actions taken in response to central recommendations so that partners in international financial markets can recognize transactions conducted by national central banks on their own behalf and on behalf of the European Central Bank. The ECB has defined four key parameters for the investment of its foreign reserves:

- two-level investment benchmarks for each currency (strategic and tactical),
- permissible deviations from these benchmarks,
- a list of permissible instruments and operations,
- limits on credit risk exposure.

The details of these parameters are confidential to avoid undue impact on financial markets. Benchmarks apply to two levels of management: strategic and tactical. The strategic benchmark for each currency, determined by the Governing Council, reflects the ECB's long-term policy requirements and risk and return preferences. The tactical benchmark

is determined by the ECB's Executive Board. It must be maintained within pre-defined deviation ranges from the strategic benchmark. It reflects the ECB's short- and medium-term return and risk preferences, taking into account prevailing market conditions. In conducting daily foreign exchange reserve management operations, national central banks therefore have a certain degree of autonomy, allowing them to deviate from the established limits (Młodkowski, 2008, p.89-90).

3. Adequate level of foreign exchange reserves of Eurosystem

The appropriate amount of official reserves should depend on the characteristics of a given country, directly reducing the pressure against which reserves are held. This is more important in the case of developing economies than in developed economies such as the euro area (Pszczółka, 2024). Nugée (2011, p. 13) believes that while managing foreign exchange reserves, the most important thing is their safety, because they are part of the national wealth. This means that their profitability is less important, but it systematically increases, especially in the context of a visible raise in the value of reserve assets. The literature indicates several important indicators of the adequacy of foreign exchange reserves.

The main indicators assessing the adequacy of foreign exchange reserves are the ratio of foreign exchange reserves to the volume of imports and the ratio of foreign exchange reserves to the size of the broadest monetary aggregate (M3). The first one shows the number of months for which a country can maintain its level of imports if all other capital flows disappear; a rule assumes that the country should maintain foreign exchange reserves allowing it to maintain a constant level of imports for the next three or four months (Pineau, Dorroccini, 2006, p. 31). The other one shows the degree of coverage of domestic money with funds in foreign currencies, it is assumed that 30% coverage ensures the security of the domestic economy, and a drop below 10% causes an increase in the threat of devaluation of the national currency (Barwiński, et al., 2003, p. 8); The IMF considers 20% to be a typical, safe level in developing economies (IMF, 2016, p. 23) and for developed economies, a level above 10% is adequate.

Additionally, a few more indicators are often used. One of them is the ratio of foreign exchange reserves to short-term foreign debt. This indicator, also called the Greenspan-Guidotti rule, shows a country's ability to service short-term external debt in during a sudden deterioration in external financing conditions. Typically, a country is considered safe in this aspect if its foreign exchange reserves exceed the value of the mentioned debt (Pineau, Dorroccini, 2006, p. 30). The level of foreign exchange reserves is also considered adequate when reserves amount to between 30% and 50% of total external debt (Skopiec 2016, p. 226). A less frequently used

indicator, but also appearing in the literature is the ratio of foreign exchange reserves to GDP. It relates reserves to the overall level of economic development of a country and is useful for countries with stable finances and a healthy banking system (Barwiński, et al., 2003, p.8).

The literature also proposes several models for estimating the optimal level of foreign exchange reserves. (Gatnar, 2013, p. 23-32). One of them is Assessing Reserve Adequacy metric (ARA) proposed by the IMF (2016, p. 12-15). ARA metric measures a broad set of risks reflecting potential drains on the balance of payments and has four weighted components: short-term external debt, M2, export income and other liabilities (Arslan, Cantú, 2019, p. 2-10).

Although foreign exchange reserves are an important instrument for preventing currency crises, there is a limit to their amount, which is necessary to effectively prevent possible market turbulence. This is important because maintaining excessively high foreign exchange reserves generates additional costs for the central bank. The main cost is the need to sterilize the increase in the supply of liquid reserves in the banking system, which is the result of the increase in the value of foreign exchange reserves (Pszczółka, 2024). Redo (2013, pp. 197) points out that too high foreign exchange reserves may force the economy to maintain higher than possible interest rates, limit the effectiveness of the mechanism of transmitting monetary impulses to the real economy.

According to current data from Eurostat and the European Central Bank, at the end of 2025, imports amounted to EUR 221,3 billion², and the M3 aggregate amounted to EUR 17611 billion. Foreign exchange reserves at the end of this period amounted to EUR 1775 billion. Assuming the above values, the Eurosystem's foreign exchange reserve adequacy indicators are as follows:

- the import-to-foreign exchange reserves ratio is 0.125; this means that foreign exchange reserves are sufficient to cover over eight months of imports, a value typical of economies with the highest (A) investment-grade rating;
- the M3-to-foreign exchange reserves ratio is over 10%.

In the case of the analyzed indicators, their values indicate a high level of potential resilience of the euro area economy to sudden deteriorations in external financing conditions, and the level of foreign exchange reserves is adequate.

² ec.europa.eu/eurostat/web/products-euro-indicators/w/6-13022026-bp (30.08.2026).

4. Amount and currency structure of the European Central Bank and Eurosystem foreign exchange reserves

The ECB's foreign reserves portfolio consists of US dollars, Japanese yen, Chinese renminbi (CNY), gold and special drawing rights. Additionally, a reserve position in the IMF is included in the case of the reserves of the entire Eurosystem. The composition of the reserves changes over time, reflecting changes in the market values of invested assets, as well as the ECB's foreign exchange and gold operations. The currency composition of the ECB's official reserves reflects policy considerations, in other words, the ability to conduct and fund effective interventions in euro against other major currencies. From this point of view, the US dollar and the Japanese yen are the two most relevant intervention currencies (Pszczółka 2011). The Chinese renminbi was added in 2017 after its inclusion in the SDR basket in 2016 and given its increasing international role and the importance of China as one of the euro area's largest trading partners (Chițu, Gomes, Pauli, 2019, p. 48).

In the years 2017-2025, the amount of ECB and Eurozone reserve assets increased systematically. In the case of the ECB, its official reserve assets were equivalent to around 62 billion euros at the end of 2017. These reserves comprise around EUR 44 billion in foreign currencies (US dollar, Japanese yen and onshore Chinese renminbi) and around EUR 17,5 billion in gold, with the remaining assets held in SDRs (table 1). The ECB's foreign currency holdings are mainly invested in securities and money market deposits or are held in current accounts. Securities in this portfolio are valued at year-end market prices. At the end of 2017, the entire Eurosystem held EUR 669,7 billion in total official reserve assets (including the ECB's official reserve assets). The NCBs hold significant additional official reserves on top of those held by the ECB.

The ECB's official reserve assets increase in euro terms to EUR 68,6 billion in 2018. The foreign currency holdings increase to EUR 49 billion mainly owing to the depreciation of the US dollar and Japanese yen against the euro (ECB, 2019) and the entire Eurosystem held EUR 719 billion in total official reserve assets. In 2019, the euro equivalent value of the ECB and Eurosystem's official reserves increased across all major positions, while a decline of the ECB's official reserve assets was recorded in 2020 (tabela 1).

Table 1. Official reserve assets and other foreign currency assets of the ECB (approximate market value, EUR millions) in 2017-2025

Positions/Year	2017	2018	2019	2020	2021	2022	2023	2024	2025
Official reserve assets	62,037	68,642	73,225	71,042	77,909	84,151	86,661	99,334	114,699
Foreign currency reserves (convertible foreign currencies)									
	43,792	49,161	50,235	44,671	50,492	54,741	54,150	55,927	53,158
Securities	34,690	39,471	41,642	35,821	36,768	37,213	46,230	48,241	45,310
total currency and deposits	9,102	9,690	8,593	8,850	13,724	17,528	7,920	7,687	7,848
IMF reserve position	-	-	-	-	-	-	-	-	-
SDRs	671	693	712	683	1235	1,768	2,100	2,240	1,780
Gold (including gold deposits and gold swapped)									
	17,558	18,192	21,976	25,056	26,120	27,688	30,418	40,893	59,751
volume in millions of fine troy ounces	16,229	16,229	16,229	16,229	16,229	16,229	16,285	16,285	16,285
Other reserve assets (financial derivatives)									
	15	596	302	632	62	-46	-6	274	9

Source: Own compilation based on data from (ECB, 2022), (ECB, 2026)

From 2021 to 2024, all major official foreign exchange reserve items of the entire Eurosystem increased systematically (table 1, 2). In 2025 total official reserve assets of the ECB increased to EUR 114,7 billion and its foreign currency holdings of US dollars, Japanese yen and Chinese renminbi decreased to EUR 53,1 billion, mainly owing to the depreciation of the US dollar and Japanese yen against the euro. As part of this rebalancing, during the first quarter of 2025 the ECB sold a small portion of its US dollar holdings and fully reinvested the proceeds in Japanese yen. (ECB, 2026). The total euro equivalent value of the Eurosystem official reserve assets increased to EUR 1774,8 billion (table 2).

Table 2. Official reserve assets and other foreign currency assets of the Eurosystem (approximate market value, EUR millions) in 2017-2025

Positions/Year	2017	2018	2019	2020	2021	2022	2023	2024	2025
Official reserve assets	669,678	719,051	813,569	879,737	1,057,044	1,114,211	1,147,627	1,394,873	1,774,869
Foreign currency reserves (convertible foreign currencies)	224,220	253,157	264,671	258,841	280,675	294,816	271,952	289,417	283,268
Securities	187,011	202,737	223,396	219,220	227,979	234,940	236,476	252,481	255,737
total currency and deposits	37,210	50,420	41,275	39,621	52,695	59,876	35,476	36,936	27,531
IMF reserve position	17,298	22,146	24,353	31,058	33,343	36,895	34,548	32,277	32,119
SDRs	49,925	51,758	53,413	50,586	180,821	186,508	186,918	191,429	176,569
Gold (including gold deposits and gold swapped)	375,038	388,452	469,141	534,706	557,443	590,844	646,855	869,119	1,269,940
volume in millions of fine troy ounces	346,654	346,534	346,458	346,338	346,349	346,317	346,314	346,115	346,117
Other reserve assets (financial derivatives)	3,197	3,538	1,991	4,547	4,763	5,148	7,355	12,631	12,973

Source: Own compilation based on data from (ECB, 2022), (ECB, 2026)

The ECB's current gold holdings represent well over half of its total official reserves, compared with 15% in 1999. This increase is a result of the significant increase in the gold price over the past two decades, and especially between 2017 and 2025 (table 3). As a percentage of total reserves, the ECB's gold holding is broadly similar to that of many other central banks in advanced economies (World Gold Council, 2026). For the entire Eurosystem, the value of gold holdings accounts for over 70% of all official reserve assets.

The ECB was a party to the 1999 Central Bank Gold Agreement (CBGA), which was signed on 26 September 1999 by 15 central banks, including those belonging to the Eurosystem. Between 2005 and 2009 the ECB carried out sales of gold in full conformity with the Central Bank Gold Agreement. The ECB and 21 other central banks that were signatories of the Agreement, decided not to renew it upon its expiry in September 2019. Following the conclusion of the fourth agreement (CBGA4), central banks decided that they no longer saw a need for maintaining the formal agreement and would not extend the agreement due to the development and stabilization of the gold market. Their representatives also confirmed that gold remains an important element of global foreign exchange reserves and that none of them currently plans to sell significant amounts of gold. N. Dempster, Managing Director of the World Gold Council, stated that this is strong support for gold's role in global foreign exchange reserves and it provides significant support for the gold market worldwide (Pszczółka, 2019, p.58). Therefore, the number of ounces of gold in the Eurosystem did not change negatively in the period under analysis (table 1,2).

Table 3. Gold price in 2017-2025 (USD)

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025
Gold price	1082	1121	1354	1544	1609	1706	1868	2511	3669

Source: Own compilation based on data from (ECB, 2022), (ECB, 2026)

The US dollar is the main component of the ECB's foreign currency holdings. The second most important currency is the Japanese yen, and the structure is completed by the Chinese currency. In 2023 and 2024, compared to previous years, the share of the US dollar increased at the expense of the yen and it accounted for 83% of the total at the end of 2024. The US dollar continues to be the main component of the ECB's foreign currency holdings, accounting for 78% of the total at the end of 2025 (table 4).

Table 4. Currency structure of the ECB's foreign currency holdings in 2017-2025 (%)

Currency	2017	2018	2019	2020	2021	2022	2023	2024	2025
USD	77	76	77	76	77	78	81	83	78
JPY	22,5	23	22	23	22	21	18	16	20
RMB	0,5	1	1	1	1	1	1	1	2

Source: Own compilation based on data from (ECB, 2022), (ECB, 2026)

The purpose of the ECB's foreign currency holdings is to finance potential interventions in the foreign exchange market. For this reason, as noted above, the ECB's foreign currency holdings main objective is liquidity. Therefore, the greater part of this portfolio comprises securities with short maturities. In 2021, securities with a maturity less than one year comprised 64,8%, between one and five years 27,4%, between five and ten years 6,7%, and over ten years 1,2% (ECB, 2022). In 2022, securities with a maturity less than one year comprised 67,1%, between one and five years 23,6%, between five and ten years 8%, and over ten years 1,3% (ECB, 2023). In 2023, securities with a maturity less than one year comprised 69,8%, between one and five years 25,6%, between five and ten years 8,9%, and over ten years 1,2% (ECB, 2024). In 2024, securities with a maturity less than one year comprised 64,3%, between one and five years 21,5%, between five and ten years 7,2%, and over ten years 1,4% (ECB, 2025). In 2025, securities with a maturity less than one year comprised 48,5%, between one and five years 41,1%, between five and ten years 9,2%, and over ten years 1,2% (ECB, 2026). Although some reallocation towards longer maturities was observed in 2025, short- and medium-term securities continued to dominate the portfolio structure. This confirms that liquidity remains the primary objective of reserve management, followed by security and, only subsequently, return on investment.

Conclusions

The analysis confirms that official reserve assets remain an important component of the Eurosystem's financial architecture, despite the euro area's relatively limited need for foreign exchange reserves compared with economies issuing non-reserve currencies. The unique institutional structure of the Eurosystem, in which reserve assets are held both by the European Central Bank and by national central banks, combines centralized policy coordination with decentralized reserve management.

Between 2017 and 2025, the value of official reserve assets increased significantly both at the level of the ECB and across the Eurosystem as a whole. This growth was driven primarily by the appreciation of gold, which strengthened its position as the dominant component of reserve assets. Consequently, gold continued to play a strategic role in the composition of Eurosystem reserves, reflecting its function as a store of value and a safeguard against periods of heightened uncertainty in international financial markets.

The assessment of reserve adequacy indicates that the Eurosystem maintained a level of reserves sufficient to meet potential liquidity needs and withstand adverse external shocks. The currency structure of the ECB's foreign currency holdings remained relatively stable throughout the period under review. The US dollar retained its dominant position, while the Japanese yen continued to serve as the second most important reserve currency. Following the inclusion of the Chinese renminbi in 2017, its share in the reserve portfolio remained limited, although its presence reflects the growing importance of China in the global economy and international trade.

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ARTICLES

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Jacek P. Rosa

"THE CURRENT MACROECONOMIC SITUATION IN IRELAND"

Abstract

Ireland holds the Presidency of the Council of the European Union for the current six months. It is worth taking this opportunity to take a closer look at the state of its economy. The economic outlook for Ireland is optimistic. Assuming the end of the conflict in the Middle East, which is a bigger problem for the pro-export structure of Irish companies than the war in Ukraine, we can expect new FDI in sectors other than those exploited so far, e.g. AI computing centers, renewable energy (wind farms) or even the agri-food processing sector. Traditionally, Ireland will count on investors from the USA, as well as partial (e.g. in agriculture) financing from EU funds. The economic elites are counting on the success of Trump's policy of strengthening the role of the United States. The Irish government is aware of the importance of the presence of both American and other foreign companies for employment and budgetary policy, and will strive to promote Ireland as Europe's industrial hub in modern technologies of the 21st century. The rapid development of the US economy will generate demand for Irish products, especially in modern technologies (including space technologies – the development of the space conquest program by E. Musk in the next 20 years), and a possible drop in energy prices may reduce the operating costs of industry and transport in the near future. At that time, the political position of the Republic of Ireland in the perspective of 2030. will increase significantly, and the prospect of reunification with the poorer north of the island will be more realistic. After reunification, and assuming the current high immigration dynamics, with a demographic substitutability level of 1.15, there would be more than 8 million people living in a united Ireland – a return to the 1841 value of 8.2 million people. Before we get into the main content,

it is important to note a particularly positive feature of the political and economic system of Ireland, where there are no extreme political forces such as the extreme right or the extreme left. The Communist Party does not exist here, and the communist Sinn Fein is more of a nationalist party than a communist one, and being always in opposition to the 2 big centrist parties, Fianna Fail and Fine Gael, it does not pose a serious threat to economic development based on American capital and EU funds.

Keywords: Irish macroeconomics, Modified GNI (GNI*), Foreign Direct Investment (FDI), economic dualism, US multinational corporations, fiscal policy, corporate income tax (CIT), labor market, inflation, EU Council Presidency.

JEL classification: E01, E60, F21, F23, H25, J21.

Content

Most of macroeconomic indicators for Ireland are very good at the moment. Compared to other eurozone countries, Ireland is a model example of rapid and qualitative economic development. It consistently bases its development on prioritizing two elements: job creation in future-oriented, technologically promising and science-intensive sectors, and budget balance. Foreign Direct Investment (FDI) mostly comes from the USA. It is worth tracing the basic macroeconomic indicators for Ireland recently and with a perspective for the future, as well as against the background of other countries of the Eurozone, the EU and the world.

Gross Domestic Product

Values:

Ireland is one of the few countries in the world where foreign investment can distort the statistical reading of GDP, GNP and other measures of prosperity. It's like measuring sea level in northern France or in Dublin Bay, where the difference between high and low tide is significant. This difference is not visible, for example, in Florida or Hawaii. Therefore, a new GNI meter* has been introduced. It is Modified Gross National Income (GNI* or Modified GNI).

It is the official indicator used by the Central Office for Statistics (CSO) of Ireland to measure the size of the Irish national economy. It excludes global distortions caused by multinational corporations – such as the transfer of profits, the depreciation of intellectual property, and the leasing of foreign aircraft – to provide a more accurate picture of national wealth. And it is this value that is worth taking into account when analyzing macroeconomic processes in Ireland. GNI* may be almost half of GDP in some years.

Another measure often used to measure economic dynamics more accurately is Modified Domestic Demand (MDD), which better reflects the real state of the domestic economy.

Ireland's GDP at current prices in 2025 was €603 billion and its GNI* was €334 billion., i.e. 55.4% of GDP. In current prices, Ireland's GDP (for 2024) is €562.8 billion and the GNI* is €321.2 billion.

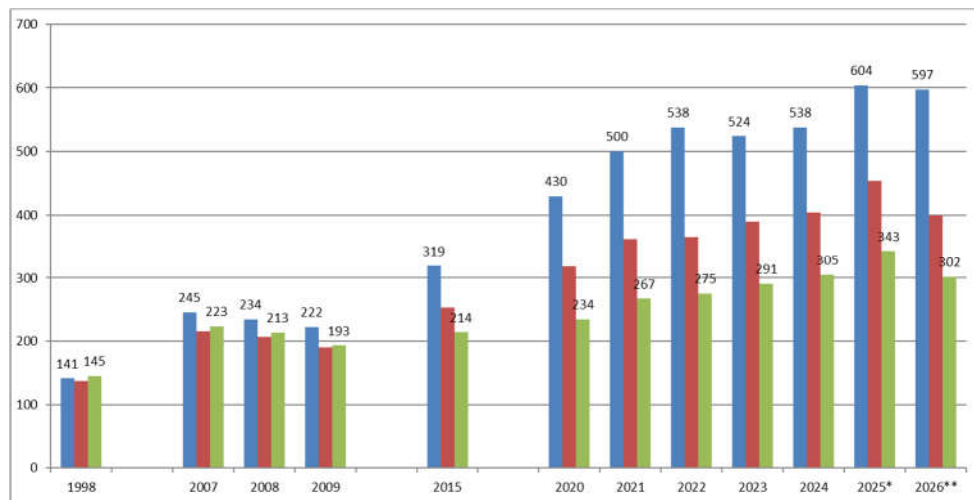


Chart 1. Values of GDP, GNI and GNI* at constant prices – billion euros, in selected years (1998-2026). Data for 2025 based on CSO – GDP growth rate in 2025 was 12.3%, data for 2026 – EC forecast (expected GDP decline of 1.2%). In blue – GDP, in red Gross National Income, in green GNI*

Source: CSO <https://www.cso.ie/en/interactivezone/statisticsexplained/nationalaccountsexplained/grossdomesticproductgdp/>

Ireland is a small economy. With a population of 5.4 million, it accounts for around 4% of the euro area's GDP and 3% of the EU-27's GDP. Since joining the EU, it has practically not changed its share of the EU's population (around 1.2%) compared to the EU-27 and has tripled its share of EU-27 GDP (see Figure 2).

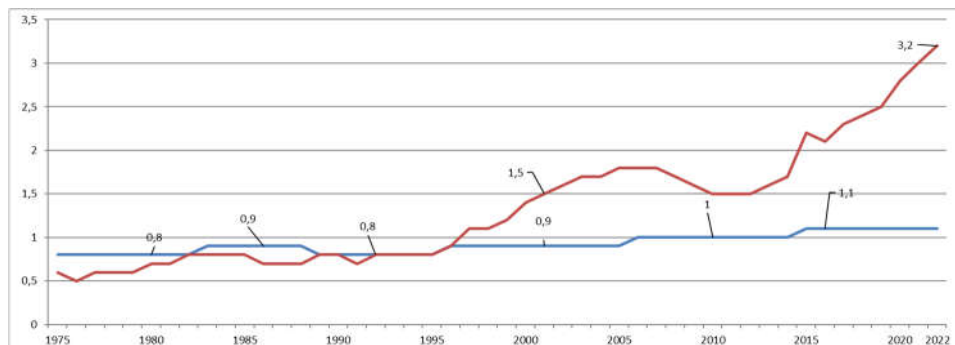


Chart 2. Comparison of population and GDP % compared to the EU-27 for Ireland since its accession to the EEC in 1975.

Red line – GDP, blue line – population

Source: CSO <https://www.cso.ie/en/interactivezone/statisticsexplained/nationalaccountsexplained/grossdomesticproductgdp/>

GDP per capita

Nominal GDP per capita (IMF projection for 2026 - approx. USD 140 thousand) places Ireland at the very top of the world, but it is the most "inflated" of the discussed indicators – for the reasons described in the GNI*. A more authoritative GNI* per capita is about half of this amount (about USD 70,000), and the Actual Individual Consumption Index (AIC), which Eurostat uses to measure material living standards, places Ireland only around the EU average.

This statistical discrepancy in per capita income has practical implications, from the amount of contributions to the EU budget to international wealth rankings, which sometimes misrepresent Ireland as a wealthier country than household incomes would indicate.

GDP/GNI* growth

Ireland is the leader in terms of economic growth rate (see Table 1). The trend of GDP development in the last several quarters indicates high volatility and dependence on external factors. Stable GDP growth was observed until the fourth quarter of 2022 inclusive. From 2023 onwards, large fluctuations have been observed. A technical recession occurred in Q4. 2023. The economy entered the growth path in the second half of 2024, but from the second quarter of 2024. Last year, there was a slowdown in economic dynamics. Experts point to the new customs and trade policy in the US as the reasons for the slowdown.

Table 1. Ireland's GDP growth rate (quarterly, year-on-year) – %

Quarter	Value
Q1 2022	7,4
Q2 2022	7,6
Q3 2022	7,3
Q4 2022	7,8
Q1 2023	2,4
Q2 2023	-0,8
Q3 2023	-4,7
Q4 2023	-6,6
Q1 2024	-2,7
Q2 2024	-2,3
Q3 2024	4,0
Q4 2024	11,6
Q1 2025	20,1
Q2 2025	17,2
Q3 2025	11,2
Q4 2025	2,2
Q1 2026	-6,0

Source: CSO <https://www.cso.ie/en/releasesandpublications/fg/fp-pgdp/preliminarygdpestimatequarter12026/>

For several decades, the main driver of dynamics has been FDI-based exports from the USA. As a result of the above-average share of foreign capital in GDP creation, there are large differences between GDP and Gross National Income and Modified National Income. Over the past 30 years, Ireland's GDP has grown steadily and only in 2008, 2009 and 2023 was economic growth negative (in 2008 and 2009 as a result of the global financial crisis, and in 2023 as a delayed consequence of the pandemic). The CSO's preliminary estimate of 29 April 2026 indicated a decline in Ireland's GDP of **-2.0%** q/q in the first quarter of 2026. The data from June 4 revised this to **-12.1%** (MDD +0.6%). The final data, published at the turn of June and July 2026, revised the GDP result again – to **-7.0%** (MDD +0.3%) – which shows the scale of uncertainty around Irish GDP data in the short term.

In the years 2022 – 2026, GDP growth in the following years was: +9.2%, **-3.2%**, +2.6%, +12.3%, and **the European Commission's forecast for 2026 speaks of a decline in Ireland's GDP in 2026 by -1.2%**. Meanwhile, in the same period, the MDD recorded positive values all the time: 2022 +9.5%, 2023 +0.5%, 2024 +1.8%, 2025 +4.9% and forecast for 2026 +2.6%. Also, the data for GNI* was "flattened", but did not fall below 0 in any of the years. Which may mean **that the economy "cleaned" of FDI-related flows is doing very well.** The values for GNI* for 2022 were: +6.7%, 2023 +5%, 2024 and 2025 +4.8% each.

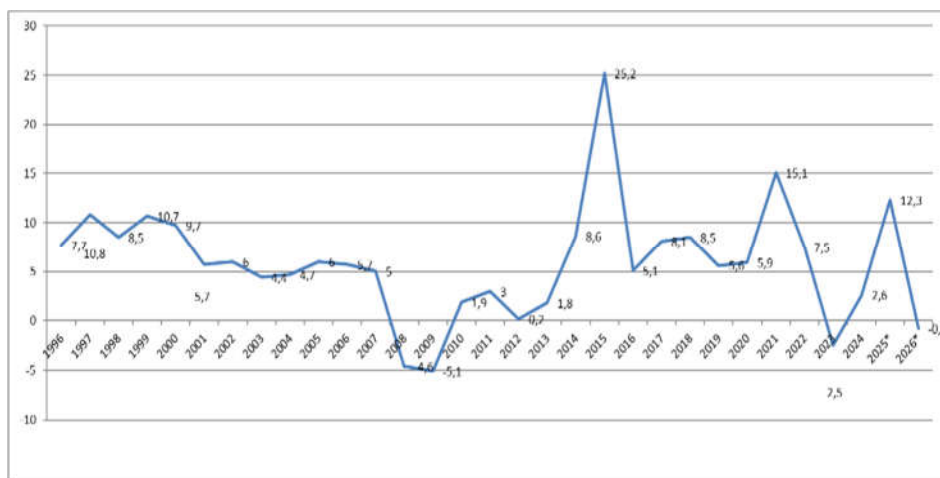


Chart 3. Ireland's GDP growth rate 1996-2024, forecast (IMF) for 2025 and 2026)

Source: World Bank and IMF

At the turn of June and July 2026, the CSO also published the annual national accounts (ANA 2025). After the revisions, GDP growth for the whole of 2025 was reduced from 12.3% to around 8%. The scale of difficulties in forecasting Irish GDP is well reflected in the range of forecasts for 2026: from -4.5% (ESRI) and -2.7% (CBI, June Bulletin), through -1.2% (EC), to +3.1% (Ministry of Finance). Interestingly, in its June newsletter, the CBI also raised its MDD forecast – to 3.3% in 2026 and an average of about 3.1% per year in 2026–2028 – thanks to the corporation's exceptionally strong investments in AI and data centers.

Table 2. Ireland's position against the euro area in 2025. Ranked according to economic dynamics.

Country	GDP growth rate in %	GDP per capita USD (a)	Unemployment rate in % of labor force	Accumulated debt as % of GDP	Current balance of the budget balance as % of GDP b)
1. Ireland	12,3	140 100	4,7	32,9	+4,0
Ireland	4,8*	70 286 *		61,5*	+7,0
2. Malta	4,0	44 600	3,2	46,4	-2,5
3. Cyprus	3,8	37 900	4,2	55,0	+2,5
4. Croatia	3,4	25 100	4,6	56,3	+0,9
5. Bulgaria	3,1	23 848	3,5	29,9	-3,5
6. Lithuania	2,9	31 700	6,7	39,5	+1,2
7. Spain	2,8	35 400	10,0	100,7	-3,3
8. Greece	2,1	24 400	7,9	146,1	+0,3
Latvia	2,1	25 500	6,9	46,9	-3,1
10. Portugal	1,9	30 100	5,6	89,7	+0,7
11. Netherlands	1,8	66 100	4,0	44,4	+0,4
12. Belgium	1,0	56 600	6,5	107,9	-5,2
13. France	0,8	47 600	7,8	115,6	-5,3
Slovakia	0,8	26 400	5,6	61,4	-5,0
15. Austria	0,6	60 200	5,8	81,5	-2,8
Luxembourg	0,6	158 700	6,8	26,5	+1,5
Estonia	0,6	31 900	6,5	24,1	-3,4
18. Italy	0,5	40 300	5,5	137,1	-4,0
19. Finland	0,2	53 100	10,2	88,5	-4,3
Germany	0,2	56 100	4,0	63,5	=-1.8
Eurozone	1,4	54 180	6,3	87,8	-2,8

<https://ec.europa.eu/eurostat/databrowser/view/tec00115/default/table?lang=en>

(for GDP growth rate)

<https://ec.europa.eu/eurostat/web/products-euro-indicators/w/3-02122025-bp>

(for the unemployment rate)

<https://ec.europa.eu/eurostat/web/products-euro-indicators/w/2-21072025-ap>

(for cumulative debt) - data for 2026 according to Eurostat (report from April 2026)

*/ GNI * – data for Ireland according to modified GNI

a) IMF projection for 2026, GNI* for Ireland for 2025

b) data for Ireland for 2024

The decline in GDP observed in Q1 this year is clearly related to the fuel crisis caused by the Gulf War. Ireland's growth outlook for 2026-2028 points to a possible slowdown in development. MDD will grow steadily, but at a slower pace than in 2025. According to the Central Bank of Ireland (CBI), the average growth of MDD in 2026-2028 will be around 2.8%. In its baseline forecast from the beginning of 2026, the Central Bank of Ireland assumed for 2026. decrease **-2.7%** YoY (downward revision), Modified Domestic Demand: approx. +3.3% YoY, i.e. growth in the real domestic economy.

On a quarter-on-quarter basis, the results are as follows: Q1. 2026: MDD +0.6%, GNP +1.5%. According to analysts, the most likely scenario for 2026 is a deep minus in the first quarter of 2026 - already recorded, there will be a strong statistical rebound in the second quarter, and the whole year will be slightly negative in terms of GDP (technical correction), but there will be an increase in the domestic economy in terms of MDD and GNI*. It is worth pointing out that the MDD is more important than GDP for ECOFIN/Eurogroup analyses, as the European Commission and the Irish Ministry of Finance also treat classic GDP as unrepresentative.

The range of forecasts for 2026 – from -4.5% (ESRI) to +3.1% (Ministry of Finance), with the EC (-1.2%) and the CBI (-2.7%) in the middle – in itself shows how uninformative the GDP index can be in the case of Ireland. For 2027, the CBI expects GDP to rebound to +6.5% and the EC to +3.4%. As a conclusion, it can be proposed that in the case of Polish, GNI* should also be counted and not GDP, because due to the increasing FDI investments in Poland, GDP will be increasingly polluted by transfer flows between the parent corporation and the place of investment, blurring the picture of the size of prosperity in Poland.



Figure 4. Comparison of the share of individual sectors of the economy in the creation of GNI*. Industry 37%, Agriculture 3%, Services 60%
Source: CSO 2025

An interesting complement to the picture of Ireland is demography. According to the CSO, the country's population in April 2025 was 5.4586 million people, after an increase of 78.3 thousand people over the course of 2024. Immigration amounted to 125.3 thousand people and it was the fourth consecutive 12-month period in which the influx of people exceeded 100 thousand people. This increases the labour stock and domestic demand potential, but at the same time increases the pressure on housing, transport, schools and public services. Ireland has a favourable population potential compared to most EU countries. The country's population is growing mainly due to a positive migration balance. This is a factor that strengthens the labour market and domestic demand. At the same time, rapid population growth is exacerbating pressures on housing, transport, schools and healthcare. Demography is therefore an asset for Ireland, but it is also becoming one of the main infrastructural constraints. The structure of population growth is twofold: in addition to record immigration, Ireland maintains a positive birth rate, although the fertility rate (about 1.5 according to the CSO) is already clearly below the simple replacement of generations. The CBI forecasts an increase in the labour pool to about 3.0 million people in 2026. **According to the Irish government's intentions, the preferred direction of employment will be the IT and AI industry, data centers – service, renewable energy, pharmacy and medical device industry, and IT services. From the point of view of social cohesion, the state will be involved in housing construction.**

Labor market

The situation on the labor market has traditionally been the focus of attention of all Irish governments since the 1990s. In the 1980s, the unemployment rate in the Republic oscillated above 15%, and the emigration of workers was a common phenomenon. It was only from the 1990s, after the implementation of liberal reforms, that unemployment fell to about 5% and remains around this value to this day. The year 2025 closed with a rate of 4.4%, and the data for Q1. indicate a slight increase in the number of unemployed by about 18 thousand people to the level of 142 thousand (of which 50 thousand are immigrants). FDI, mainly from the USA, plays a key role in job creation. The government's investment support agency IDA Ireland reports that the total number of employees in companies supported by the agency (the majority of which are US entities) is 312,400 people.

American corporations directly employ about 11% of the entire workforce in Ireland. Despite its sceptical approach to the populist policies of the new administration, the government is trying hard to establish a privileged relationship with President Trump, fearing for the future of the labor market.

The statements of the Prime Minister and other members of the Irish government about American capital are centered around a full commitment to protecting this relationship, defending against global tariff risks, and stressing that investment is a "two-way street". The upcoming Presidency of the European Union will be an opportunity to promote the great importance of transatlantic relations for the economies of the European Union countries. The ministers' statements clearly indicate that the American Big Tech and BioPharma sector do not choose Ireland solely for tax reasons (especially after the OECD raised the CIT rate to the required level of 15% in 2024, with exceptions for 12.5%). Government statements repeat the argument that the US sees Ireland as a "trusted partner in Europe", with a highly skilled, English-speaking workforce and barrier-free access to the EU market of 450 million consumers.

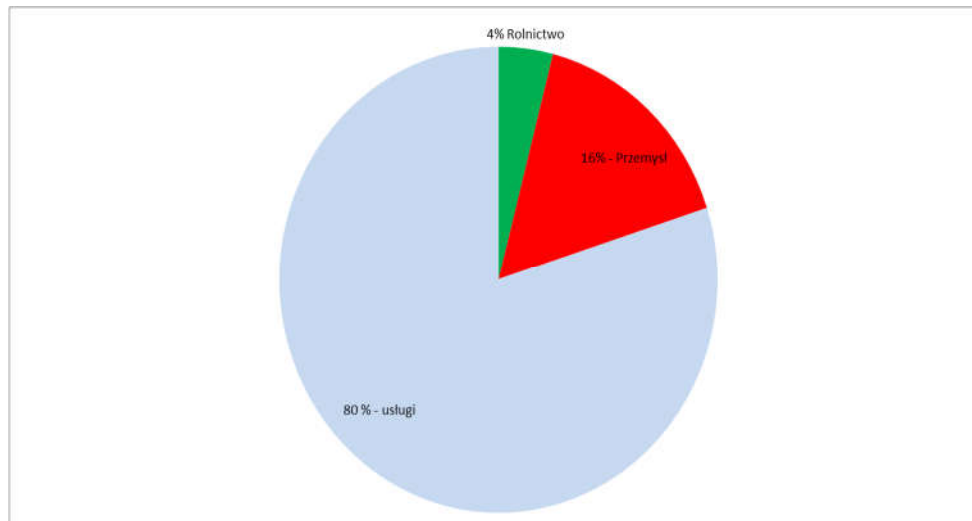


Figure 5. Comparison of the share of employees in Ireland in 2025 in terms of industry

Source: CSO 2025

The latest CSO data do not change the positive assessment of the labor market, but they show a slight cooling. The number of people in the workforce increased by 18 thousand, or 0.6% year-on-year, which was the lowest annual growth rate in five years. The labor market remains the strength of the Irish economy. Employment remains at a high level, but the data for Q1. 2026 indicate a slight cooling. The employment rate of people aged 15-64 fell to 73.3%, compared to 74.7% a year earlier. The largest annual declines in employment were recorded in the administrative sectors (-10.7%)

Unemployment in Ireland remains historically low. In Q1. 2026, the unemployment rate was 4.9%, compared to 4.3% a year earlier. The increase in unemployment is moderate, but confirms a slight weakening of the labor market. For the government, this will be one of the key political indicators, especially in the event of a downturn in the economic situation and FDI declines. The monthly reading for June 2026 (published on July 6, 2026) is already 5.0% and 145.1 thousand unemployed – the highest since March and the fourth month this year with a reading of at least 5%. The CBI forecasts an average annual forecast of 5.1% in 2026 and 5.2% in 2027-2028, while the EC forecasts 4.8% and 4.9%, respectively, still clearly below the euro area average (around 6.3%).

The situation of young workers requires separate observation. In Q1. 2026, although the youth employment rate fell to 42.9%, compared to 45.3% a year earlier, it is among the best in the euro area. The situation of young workers in Ireland is in many respects better than the euro area average, but it also poses significant challenges. The most important differences are:

- Higher salaries – young workers in Ireland tend to earn more than their peers in most eurozone countries.
- Low unemployment – the youth unemployment rate is usually lower than the euro area average, making it easier to find a job.
- A large number of job offers – especially in the technology, finance, pharma and service sectors.
- High cost of living – especially in Dublin. Rents and prices of apartments are among the highest in Europe, which limits the real purchasing power of young people.
- Problems with the availability of housing – the shortage of apartments causes many young people to rent premises for a long time or live with their family or roommates.
- Strong presence of TNC. The presence of many global companies gives you greater opportunities to develop your career and gain experience.

Ireland offers young workers better job prospects and higher earnings than the euro area average, but the high cost of living, especially housing, reduces the advantage of higher wages. As a result, the standard of living depends largely on where you live, in your industry and in your career.

Increase in real wages:

Nominal wages in Ireland are rising, but their real growth is limited by inflation and very high housing costs. In practice, this means that the good macroeconomic situation is not always fully felt by households. The costs

of rents, mortgages, energy and services are particularly important. They are the ones that determine the social assessment of salary increases.

Work efficiency

Labor productivity in Ireland is very high, but it is heavily distorted by the presence of multinational corporations. The foreign sector achieves many times higher productivity than the domestic sector. This means that high productivity rates of the entire economy do not always reflect the situation of small businesses, local services or construction. This is another example of the dualism of the Irish economy. According to the annual national accounts, the foreign sector produced about 47% of the total value added of the economy, directly employing a much smaller part of the workers.

Capital Efficiency

Capital efficiency in Ireland is difficult to interpret. A large part of the capital included in the statistics is related to intellectual property, intangible assets, aircraft leasing and the activities of global corporations. Therefore, the data on capital and investments alone do not always show a real increase in the potential of the national economy. What is more important is whether FDI investments translate into local employment, infrastructure, taxes and sustainable economic activity. A new phenomenon is the investment boom related to artificial intelligence: imports of machinery and equipment increased in Q1. 2026 by 45% y/y, including data processing equipment by as much as 126%, and data center equipment is already responsible for more than half of investments in machines and equipment. This is a real deepening of capital in the country, but its productivity will depend on the ability of the power grid to serve new facilities.

Inflation

Ireland is one of the 11 founding countries of the monetary union in the EU. The ECB's monetary policy protects Ireland from deep inflationary shocks and cements its position as a global export hub. However, this is at the expense of a more expensive domestic loan than if it were outside the ECB, which directly exacerbates the problem with the availability of housing for the island's residents. **The current inflation rate in Ireland is low at 3.7% on an annual basis (CSO data for April 2026)**, which is the highest reading since the beginning of 2024. The HICP (Harmonised Index of Consumer Prices) stood at 3.6%. The main driver of the current price increases is the sharp jump in the cost of energy and liquid fuels (up 15.5% year-on-year), caused by the escalation of the conflict in the Middle East. Inflation forecasts for the coming years point to a peak in the second half of 2026, followed by a gradual fading of price pressures.

May and June data for 2026 show a slight slowdown in inflation. The CPI in May 2026 was 3.6% year-on-year, compared to 3.7% in April. Core inflation excluding energy and unprocessed food was 2.9%. The preliminary estimate of the HICP for June 2026 showed a price increase of 3.3% year-on-year. Ireland has therefore not returned to the scale of the 2022-2023 inflation shock, but the cost of living – especially energy, housing and services – remains sensitive.

A significant change took place in monetary policy: on 11 June 2026, the ECB raised rates by 25 bps (deposit rate of 2.25%) – this is the first increase since September 2023, justified by the energy shock following the outbreak of the war in the Middle East; Markets are pricing in another one in September. The Eurosystem projections foresee HICP inflation in the euro area at 3.0% in 2026 and 2.3% in 2027. For Ireland, the CBI forecasts 3.5% and 2.9%, respectively, with energy alone currently contributing more than 1 percentage point to inflation. The government's protective measures (m.in. a reduction in fuel excise duty and a postponement of the increase in the carbon fee, at a cost of approx. EUR 755 million) expire at the end of July, which may boost the readings in the second half of the year.

Public finances

The situation of public finances is very good. In relation to GDP, Ireland has one of the lowest accumulated public sector debts (32.9% of GDP) in the EU. Also in relation to GNI*, which more realistically reflects the macroeconomic situation, the accumulated debt of the state budget oscillates within 60% of GNI*. This still means a good fiscal situation, but less spectacular than using GDP alone. Every year, surpluses are generated in the budget – in 2025 1.8%. This is the result of revenues from personal income tax (CIT), paid mainly by transnational corporations.

Approx. 31% of the total annual revenues to the budget are CIT funds. More than 287,000 registered companies pay this tax, but the Irish system is characterized by extreme concentration, unheard of in other countries. The three American corporations Apple, Microsoft and Eli Lilly are responsible for 46% of all CIT revenues (which amounts to approx. €13 billion per year). 10 global corporations are responsible for 56% of all state CIT revenues. In 2025, this translated into about 18.5 billion euros. Ew. if these 10 companies leave Ireland, it would become a country with a current budget debt of **-1.1%** of GDP and **-1.6%** of GNI*. Suffice it to point out that the sum generated from CIT by foreign corporations is almost equal to the annual total budget expenditure on education (EUR 18.1 billion). According to experts and managers employed in the FDI sector in Ireland, capital flight should not be expected in the coming years. Better operating conditions

and tax conditions in the US introduced by Trump will not have much significance for the already existing plants in Ireland, but there is a noticeable tendency in the administration and government agencies to want to compete downwards with the tax and create even more favorable conditions for FDI in the Republic. The upcoming IE Presidency of the RUE will be a good opportunity to promote Ireland as a unique place in the EU to invest in the sectors of the technological future. Data for 2025 show a further strengthening of the role of pharmaceuticals in Irish exports. According to the CSO, exports of medical and pharmaceutical products increased by 39.0% to €138.6 billion, and accounted for 53.2% of Ireland's total goods exports. This strengthens the trade balance, but at the same time increases the country's dependence on a few large companies and on demand and regulation in the US market. The effect of earlier shipments of inventories to the US was already visible at the beginning of 2026. In January 2026, exports of medical and pharmaceutical products fell by 61.0% year-on-year, to 5.9 billion euros. This does not automatically mean a collapse of the sector, but rather a correction after a very good 2025.

Public finances remain very good. In 2025, the *general government sector* recorded a surplus of €11.2 billion, or 1.8% of GDP. The concentration of CIT revenues in a small group of international corporations remains a permanent risk.

Tax system in Ireland

Ireland (like most European countries) taxes labour to a large extent. **PIT** (Personal Income Tax) in Ireland is progressive: most employees pay 20% in the first bracket of income (standard rate) and 40% on income above a certain threshold, and there are additionally social contributions (PRSI) and the social security levy of the USC, so that the total burden depends on income and family situation.

A more liberal approach is in the case of **CIT**. CIT (corporate tax) in Ireland is 12.5% for trading income, which is one of the lowest levels among developed economies and one of the main factors attracting foreign investment (especially technology and pharmaceutical companies).

Compared to Western economies, Ireland stands out with a very low CIT, but its taxes on labour and consumption are closer to the European average; The state finances extensive public services, m.in, from high revenues from international corporations. Compared to countries such as Germany, France or the United Kingdom, Ireland has a more pro-investment tax system for companies, while high-income earners can effectively pay more than 40% after taking into account all burdens.

VAT in Ireland has a basic rate of 23%, which is similar to many Western European countries (e.g. Poland 23%, France 20%, Germany 19%), with reduced rates for selected goods and services.

Despite global changes in tax policy and pressure from the Donald Trump administration to move production and investment to the United States, Ireland remains one of the most attractive destinations for American investors. Today, the country's competitive advantage is determined not only by favorable tax solutions, but above all by a mature business ecosystem, access to highly qualified employees and the effect of concentration of international companies¹.

Over the past four decades, Ireland has built a strong cluster of technology, pharmaceutical and medical companies. The presence of 16 of the world's 20 largest technology companies m.in Apple, Microsoft and Alphabet and most global pharmaceutical and medtech companies m.in AbbVie, Gilead, Merck, GE Healthcare and Stryker creates economies of scale that attract more investors. What is particularly telling, the small town of Carrigtwohill in County Cork is the headquarters of as many as five of the mentioned pharmaceutical companies. Companies are more likely to locate their operations where their business partners, suppliers and developed industry infrastructure already operate. As highlighted in the government's report on the Irish semiconductor industry, "Intel's presence has helped attract a cluster of suppliers, service providers, and related industries, contributing to regional economic development and sectoral resilience."² Success breeds success.

The IDA (Industrial Development Agency) – the government agency responsible for attracting foreign direct investment (FDI) to Ireland – confirms the country's continued high attractiveness. Between 2023 and 2025, the agency recorded the best three-year foreign investment inflow cycle in its history. In 2023, IDA acquired 248 investments (an increase of 2.5% compared to the previous year), which translated into the creation of 19,000 jobs. In 2024, 234 projects were implemented, which supported the creation of 13,500 jobs. The year 2025 brought record results – 323 foreign investments with the potential to create 15,300 new jobs, which means an increase of 38% compared to the previous year. Among them, there were 78 investments from companies entering the Irish market for the

¹ Based on <https://www.irishtimes.com/business/economy/2026/07/10/why-us-multinationals-keep-choosing-ireland/>.

² <https://www.irishtimes.com/business/economy/2026/07/10/why-us-multinationals-keep-choosing-ireland/>.

first time, which, as IDA stressed, demonstrates "Ireland's continued attractiveness for start-up investors". Importantly, about 65% of new projects came from the United States, and the momentum continued in the first half of 2026 – IDA recorded 190 investments, 6% more than in the same period of the previous year. The increase in the number of investments came despite the announcement of an increase in the tax attractiveness of the US, the introduction of 15% tariffs on most imports from the EU and an international reform of corporate taxation³.

Experts point out that although competitive tax policy has laid the foundation for Ireland's success, its advantage is now based primarily on the quality of the business environment and the accumulated human capital. This means that the reduction in the tax advantage has not yet translated into an outflow of investors. As Peter Vale of Grant Thornton put it, "Ireland is so much more than taxes." Although multinational corporations are making declarations about moving production to the US, as analysts note, these announcements are not being implemented. Internal factors such as the housing crisis, high energy prices (a problem repeatedly raised by Intel) and infrastructure constraints, including grid overload, remain the biggest challenges for further investment inflows⁴.

Budget

The 2026 budget – under the slogan "Strengthening our Foundations for the Future" envisages a deficit of €8.5 billion (1.5% of GDP according to the EC's forecast for 2026). It is a balanced budget, which is rare compared to the eurozone.

³ Based on <https://www.irishtimes.com/business/economy/2026/07/10/why-us-multinationals-keep-choosing-ireland/>.

⁴ Based on <https://www.irishtimes.com/business/economy/2026/07/10/why-us-multinationals-keep-choosing-ireland/>.

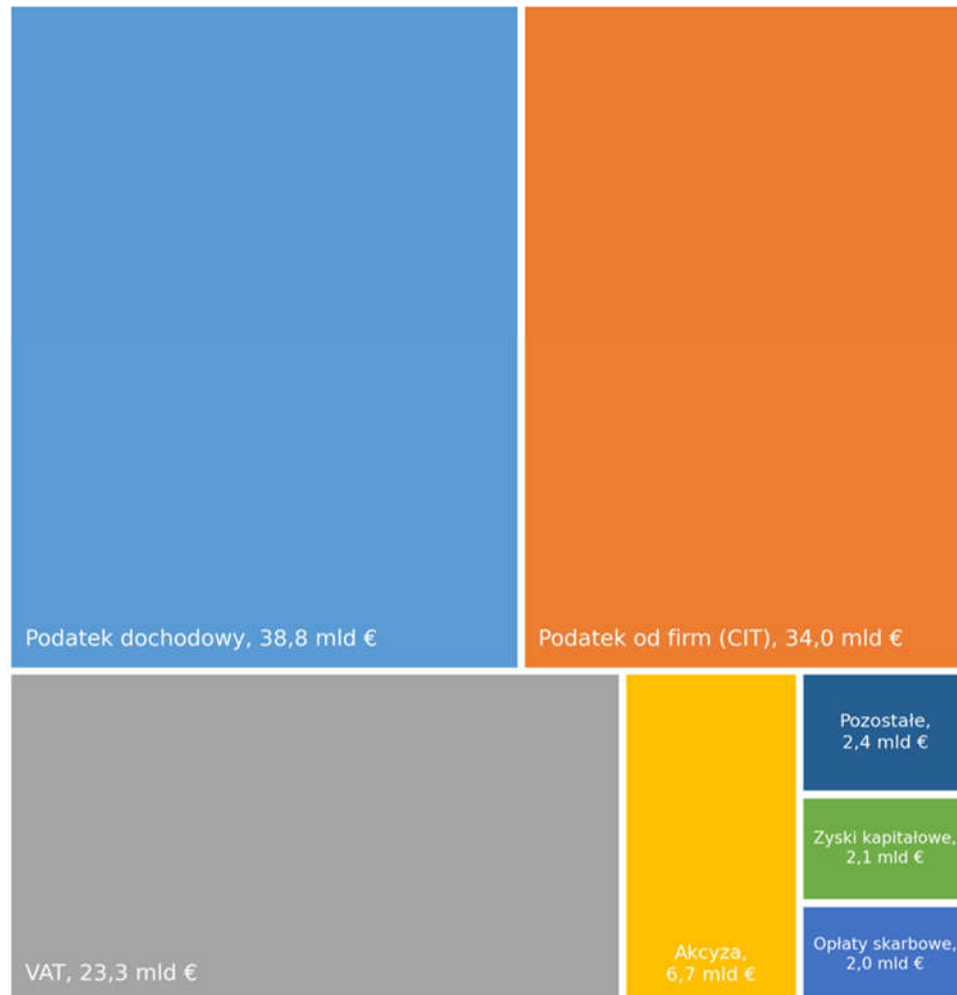


Figure 6. Structure of revenues to the Irish budget in 2026

Revenue: in 2026, the government plans to raise €109.3 billion in taxes; the three largest sources are income tax (€38.8 billion), CIT (€34.0 billion), and VAT (€23.3 billion) — the full structure in the chart below.

Expenditure: €117.8 billion of expenditure approved by the parliament (including €19.1 billion of capital expenditure) and €15.9 billion outside this pool (m.in debt service, contribution to the EU). The most will be given to social protection (€28.9 billion), health (€27.4 billion), education (€13.1 billion) and housing (€11.3 billion).

The key tax changes in 2026 are: 9% VAT on gas and electricity until the end of 2030 and on gastronomy and hairdressing from 1 July 2026; R+D relief increased to 35%; the USC threshold up by EUR 1,318; relief for tenants extended until the end of 2028; Excise duty on cigarettes +0.50 euros.

Trade and payment balance

Thanks to the model of an open export-oriented economy adopted in the 1990s, Ireland has been a large exporter of industrial products to the EU and US markets for several decades. The surplus in the goods balance is 16% of GDP. The largest trading partner is the European Union, and broken down by national countries, the first partner in terms of the value of trade in goods is the USA, the second is the United Kingdom. The commodity structure of exports is dominated by the pharmaceutical, IT, machinery and equipment sectors. The trade surplus (excluding services) in 2024 amounted to €89 billion. The high dynamics is noteworthy, as in 2023 the surplus amounted to less than EUR 56 billion. Foreign trade trends are clearly negative, as geopolitical instability in the Persian Gulf and political instability in the US may have a negative impact on further export expansion.

Irish export sentiment for 2026 is cautious and marked by strong uncertainty, in stark contrast to the record-breaking and extremely dynamic year of 2025. While demand for key goods from Ireland remains stable, managers and exporters' organisations are facing technological and geopolitical cooling of markets. Expectations for 2026 can be described as a "controlled landing". Business is aware that a repeat of the double-digit dynamics of previous years is impossible due to the global economic slowdown. However, stable demand for Irish IT services and medicines protects the country from a deeper crisis. On the positive side, there is the initiative of pharmaceutical giant Pfizer, which negotiated terms with the White House that allowed the vast majority of Irish drug exports to the US to avoid tariffs, and the new rates would affect only 2-3% of the volume – provided, of course, that Trump does not intervene politically in response to the Irish government's harsh criticism of Israel's policy towards Palestine.

In addition, in 2026, the statistical effect of foreign trade movements in 2025, related to the concerns of corporations about the consequences of increased tariffs, should be taken into account. At the end of last year, pharmaceutical companies made mass deliveries and sent stocks abroad "in stock". They did so for fear of the introduction of new American tariffs. The correction took place in March 2026, and the concerns partially materialized in the statistics. CSO's trade data for March 2026 showed a sharp nominal decline in the value of exports of chemicals and

pharmaceuticals by more than 70% year-on-year, reflecting the market fade of last year's artificial boom.

Table 5: Ireland's turnover of goods with major global partners, 2023 and 2024, in million euros

Direction	Export value 2023	Export value 2024	Import value 2023	Import value 2024	Value of trade turnover 2023	Value of trade turnover 2024	Surplus /deficit 2023	Surplus /deficit 2024
USA	54034	72628	22949	22840	76983	95468	31085	49788
EU	81180	88586	48467	48848	129647	137434	32713	39738
Including selected countries:								
-Germany	20436	20131	8906	12179	29342	32310	11530	7952
-Belgium	18388	17031	2722	2802	21110	19833	15666	14229
- France	6770	6445	17647	13533	24417	19978	-10877	-7088
- Netherlands	16719	22993	5839	6732	22558	29725	10880	16261
- Italy	6165	7072	2674	3134	8839	10206	3491	3938
-Poland	1715	1741	1260	1421	2975	3162	455	320
Zj. Kingdom (UK)	22406	20867	26330	22049	48736	42916	-3924	-1182
including Irl. Mon.	4961	5159	5241	5400	10202	10559	-280	-241
China	9541	10068	10846	11843	20387	21911	-1305	-1775
Japan	3818	3347	2546	2231	6364	5578	1272	1116
Switzerland	4077	3656	8149	2761	12226	6417	-4072	895
Together, all countries	196030	223786	140294	133562	336324	357348	55736	90224

Source: <https://www.cso.ie/en/releasesandpublications/ep/p-gei/goodsexportsandimportsdecember2024/> CSO statistical publication, 2024

The trade balance remains one of Ireland's strengths. However, exports are increasingly concentrated in terms of sectors. In 2025, medical and pharmaceutical products accounted for more than half of all commodity exports. This is beneficial for the trade surplus, but increases Ireland's dependence on several large corporations and on the US market. The correction of pharmaceutical exports at the beginning of 2026 showed that part of the record results of 2025 were the result of earlier shipment of inventories.

Scale of concentration: In 2025, 42.9% of goods exports went to the US, and the broad category of chemicals and related products accounted for 68% of all exports. The latest CSO data shows that Ireland's current account recorded a surplus of €17.9 billion in the first quarter of 2026, and €48.3 billion for the whole of 2025. At the same time, exports of goods in the first quarter of 2026 were €25.2 billion lower than a year earlier,

and imports were €6.2 billion higher. This means that Ireland's balance of payments is shaped not only by trade in goods, but also by services, income flows and operations of multinational corporations.

Ireland's balance of payments is also not sustainable and has been structurally surplus in its current account for years. According to the latest CSO report published in March 2026, this surplus amounted to as much as €12.8 billion in the fourth quarter of 2025 alone. On a full-year basis, the current account surplus oscillated around 8.4% of nominal GDP.

Investments in high-tech sectors

The development of AI and data centers is an investment opportunity for Ireland, but it is also starting to be an energy constraint. According to the CSO, data centers consumed 22% of metered electricity in Ireland in 2024, compared to 5% in 2015. Their consumption increased by 10% in 2024 to 6,969 GWh. This means that the next wave of FDI will be increasingly dependent not only on taxes and access to the EU market, but also on the state's ability to provide energy, transmission networks and social acceptance of infrastructure.

Infrastructure

The updated National Development Plan provides for spending €275.4 billion from the state budget over 10 years (€102.4 billion for the first 5 years). It is the largest investment program in the country's history, with priority for water, energy and transport.

Environmental protection, renewable energy

The carbon tax (ETS 1 equivalent) will increase by €7.50 in 2026 to €71/t CO₂ (target €100/t in 2030); €1,114 million in revenues will go to, m.in energy, buildings and social protection.

The Irish welfare state and growing immigration

Ireland provides extensive social protection, but it is not considered a welfare state to the same extent as Denmark, Sweden or Finland. Its model combines relatively attractive benefits with an emphasis on employment and individual responsibility. Thanks to a strong economy, the state can finance a wide range of aid, but the high cost of living remains one of the biggest challenges for residents.

Ireland is a welfare state, but its model is different from the Nordic countries. Social expenditure is significant, but many benefits are dependent on income (the so-called means-tested), and the system puts more emphasis on professional activation rather than universal benefits. Social spending

in Ireland is only about 15% of GDP (public social spending), which places Ireland among the OECD countries with the lowest share of social spending in relation to GDP. However, compared to GNI*, it is already about 30%. Compared to many European countries, cash benefits in Ireland are relatively high, in particular: unemployment benefits, family benefits, support for people with low incomes.

At the same time, the high cost of living, especially housing and rent, makes the real value of these services lower than it might seem. The most important social benefits include:

- Child Benefit – is available for every child, regardless of the family's income.
- Jobseeker's Benefit and Jobseeker's Allowance – support for unemployed people; Some of the benefits depend on previous contributions, and some on the financial situation.
- Family benefits – allowances for low-income families and support for single parents.
- Housing benefits – help in paying rent for people who meet income criteria, although the availability of housing remains a big problem.
- State pensions – financed from the social security system and taxes.
- Sickness and maternity benefits – include, m.in sickness, maternity, paternity and parental benefits.
- Support for people with disabilities – benefits and professional activation programs.
- Medical Card – people with low incomes can benefit from free or partially funded healthcare.

Social support has increased since 2026, as the budget provides funds for: +10 euros per week in social benefits, 2.9 billion euros for social housing, a permanent reduction in the student fee by 500 euros and at least 220 additional hospital beds.

Conclusion

Ireland is one of the fastest growing economies in Europe and has maintained a high rate of economic growth for many years. The country is characterized by low unemployment, which indicates almost full employment, and a stable public finance situation. Ireland's economy is very open and strongly geared towards exports of goods and services, especially in the technology, pharmaceuticals and finance sectors. An important success factor was the attraction of numerous foreign investments thanks to low taxes and favorable conditions for doing business. Many global corporations, mainly from the United States, have their European headquarters in Ireland. The presence of these companies has contributed

to the growth of employment, income and the development of modern technologies. At the same time, the Irish economic model is heavily dependent on foreign capital, especially American capital. This poses a significant risk in the face of changes in US economic policy and global tax reforms. An additional challenge is the high cost of living and problems with the availability of housing. Despite these risks, Ireland remains one of the most competitive and dynamic economies in the European Union.

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Marzena Sobol¹

MONETARY POLICY IN RESPONSE TO SUPPLY SHOCKS – A COMPARATIVE ANALYSIS OF THE ACTIONS OF THE NATIONAL BANK OF POLAND AND THE EUROPEAN CENTRAL BANK DURING THE 2022 ENERGY CRISIS

Abstract

The aim of the article is to provide a comparative analysis of the actions of the National Bank of Poland and the European Central Bank during the 2022 energy crisis, with particular emphasis on the NBP's monetary policy and its effects in terms of containing inflationary pressures. The actions of the ECB provide a benchmark for assessing the timing and scale of the NBP's response. The analysis covers the years 2019–2025, with particular emphasis on the period 2021–2023. It is demonstrated that despite the earlier commencement of monetary policy tightening by the NBP, inflation in Poland reached a higher level and remained elevated for longer than in the euro area. This indicates that assessing the effectiveness of monetary policy in containing inflationary pressures requires consideration not only of the scale and pace of the central bank's response, but also of economic conditions, including the nature and strength of supply shocks and the specific characteristics of the domestic monetary policy transmission mechanism.

Keywords: energy crisis, inflation, core inflation, monetary policy, National Bank of Poland, European Central Bank, supply shock.

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JEL Codes: E31, E52, E58, Q43.

Introduction

The 2022 energy crisis constituted one of the most severe supply shocks with which the European economy had been confronted in recent years. A sharp increase in energy commodity prices, restrictions on the supply of gas and other energy carriers, and disruptions in commodity markets translated into higher production costs and prices of goods and services. The effects of the crisis were particularly visible in inflationary processes, although their scale and persistence differed across individual European economies. Poland was among the countries in which price increases reached a particularly high level and persisted for a relatively long period.

High inflation constituted a significant challenge for monetary policy. On the one hand, central banks had to limit the risk of high inflation becoming entrenched and inflation expectations increasing; on the other hand, they had to take into account the negative impact of high energy prices on economic activity. This problem was particularly important due to the supply-side nature of the initial shock, the sources of which remained largely beyond the direct influence of monetary policy. At the same time, increases in energy prices gradually passed through to the prices of other goods and services, increasing the risk of inflationary processes becoming entrenched.

The aim of the article is to conduct a comparative analysis of the actions of the National Bank of Poland and the European Central Bank during the 2022 energy crisis, with particular emphasis on the monetary policy pursued by the NBP and its effects in terms of containing inflationary pressures. The actions of the European Central Bank primarily provide a benchmark for assessing the NBP's policy, allowing for a comparison of the timing of the commencement of monetary policy tightening, the scale of interest rate increases, and the course of inflationary processes in Poland and the euro area.

The analysis covers the years 2019–2025, which makes it possible to capture the determinants of monetary policy at the outbreak of the energy crisis, including the economic and inflationary situation preceding its occurrence and the measures undertaken by the NBP during the COVID-19 pandemic. Particular attention is devoted to the years 2021–2023, encompassing the build-up of inflationary pressures, the outbreak and peak intensity of the energy crisis, and the NBP's response to its effects. The years 2024–2025 constitute a supplement to the analysis, making it possible to assess the subsequent effects of the monetary policy pursued and the course of the disinflation process.

1. Origins and Macroeconomic Effects of the Energy Crisis in Poland and the Euro Area

The 2022 energy crisis resulted from the accumulation of several factors. One of the most important was the outbreak of the war in Ukraine and, consequently, the blocking of important channels for the supply of energy commodities, i.e. natural gas, hard coal and crude oil, which constituted basic raw materials for industry. Their limited supply and high prices were further exacerbated by the pricing and supply policy pursued at that time by the OPEC+ countries.² This situation ultimately led to a specific supply shock and, subsequently, a sharp increase in prices and production costs in many global economies.³

The crisis had a particularly strong impact on the European economy, which found itself at a critical point in terms of energy security. To a large extent, this resulted from many years of structural neglect, including, in particular, limited investment in energy infrastructure, errors in planning the energy transition, as well as an insufficient diversification of energy supply sources. Within the framework of the European Union's climate and energy policy, the "European Green Deal", natural gas was recognised as a less carbon-intensive fuel than coal and was therefore expected to play the role of a "bridge" in the energy transition (European Commission, 2019). As a result, many EU countries began closing coal-fired power plants, gradually switching to gas-fired installations. This process was supported through EU subsidies. The model implemented in the EU assumed stable and inexpensive gas supplies, mainly from Russia, which proved to be erroneous from a geopolitical perspective. Before Russia's invasion of Ukraine, Russia supplied approximately 45% of total natural gas imports to the EU. After the outbreak of the war, Russia's share in EU gas imports fell drastically and by the end of 2024 amounted to approximately 19% in total. (European Commission, 2025) As a result, there was a record increase in energy prices, disruptions in industry, followed by a rapid increase in inflation and a deterioration of the social and economic situation throughout the Union. The effects of the crisis were particularly strongly felt in euro area countries where dependence on Russian gas was greatest

² OPEC+ was established in 2016 as an informal, expanded format of the OPEC organisation. In addition to countries that are formal members of OPEC, it also includes, among others, Russia, Kazakhstan and Mexico. These countries participate in joint production decisions.

³ The pricing and supply policy for crude oil pursued by OPEC+ countries at the beginning of 2022 was dictated by concerns about lower demand for this commodity in connection with the increasing risk of a global economic slowdown. An additional political aspect of this policy was the reluctance to yield to pressure from the USA and the desire to maintain unity with Russia.

(e.g. Germany, Austria, Slovakia), while the infrastructure of these countries prevented a rapid switch to other sources of supply.

The energy crisis also affected the Polish economy, and its impact on inflationary processes was significantly stronger than the average in the European Union and the euro area. This resulted from the simultaneous impact of demand-side and supply-side factors. On the one hand, a strong rebound in domestic demand following the COVID-19 pandemic played an important role, supported by expansionary fiscal policy (including anti-crisis shields) and the very accommodative monetary policy of the NBP. On the other hand, the economy was affected by supply constraints associated with disruptions to global supply chains and a sharp increase in energy commodity prices. An additional factor increasing the scale of the supply shock in Poland was the high share of coal in the domestic energy mix and substantial dependence on imports of this commodity from Russia. The introduction of an embargo on Russian coal forced its replacement with imports from alternative sources, which consequently further increased energy costs and intensified inflationary pressures.

Figure 1 presents changes in HICP inflation in Poland, the euro area and the EU in 2021–2022.

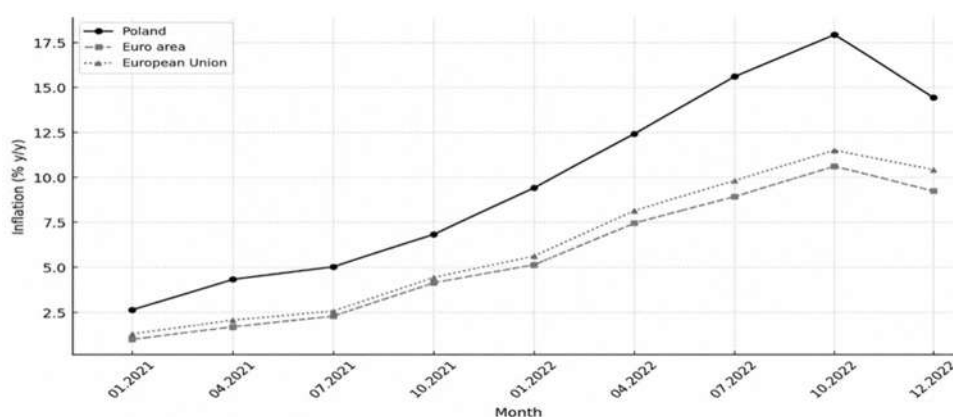


Figure 1. HICP inflation in Poland, the euro area and the EU (2021–2022)

Source: Author's own elaboration based on Eurostat data

As follows from the data presented in Figure 1, HICP inflation accelerated significantly throughout the European Union in 2021–2022, although its dynamics varied across individual countries. Poland was among the countries with the highest inflation. Already at the end of 2021, the HICP in Poland exceeded 6%, while the average for the euro area and the European Union as a whole stood at approximately 5%. In 2022, these

differences widened further. At its peak (autumn 2022), HICP inflation in Poland exceeded 17%, while in the euro area it reached approximately 10.6%, and in the European Union as a whole slightly more than 11%. The persistently higher level of inflation in Poland suggests that, in addition to external shocks common to Europe as a whole, domestic factors also played an important role, particularly stronger demand-side pressures and greater vulnerability of the economy to increases in energy prices.

Poland faced not only the highest inflation in the region, but also its more severe impact on real incomes, particularly those of households. The increasing share of expenditure on energy, higher than in wealthier EU countries, additionally intensified the lack of systemic protection mechanisms during the first phase of the crisis.

Figures 2a and 2b present data on changes in electricity prices for households in Poland, the euro area and the EU in 2021–2022. Figure 2a presents nominal prices (EUR/100 kWh), while Figure 2b presents the same prices adjusted for purchasing power parity (PPS), enabling a comparison of the actual burden of energy costs on households.

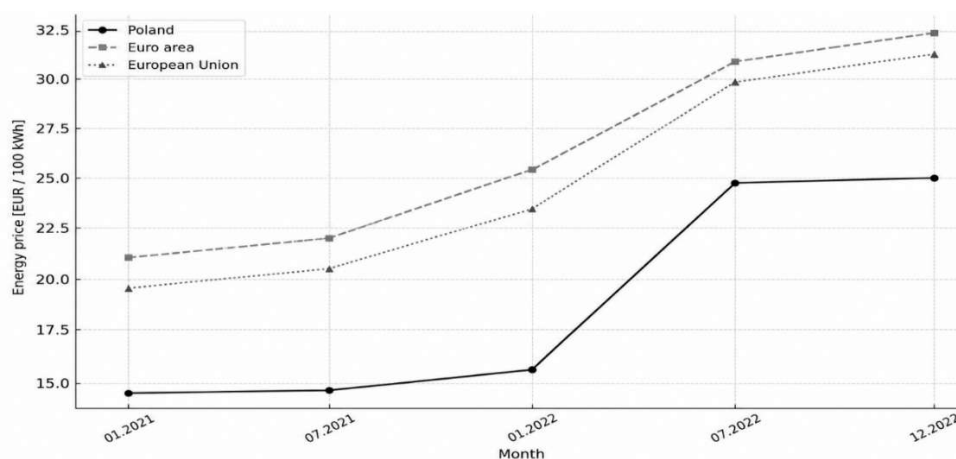


Figure 2a. Electricity prices in Poland, the euro area and the EU (2021–2022)

Source: Author's own elaboration based on Eurostat data

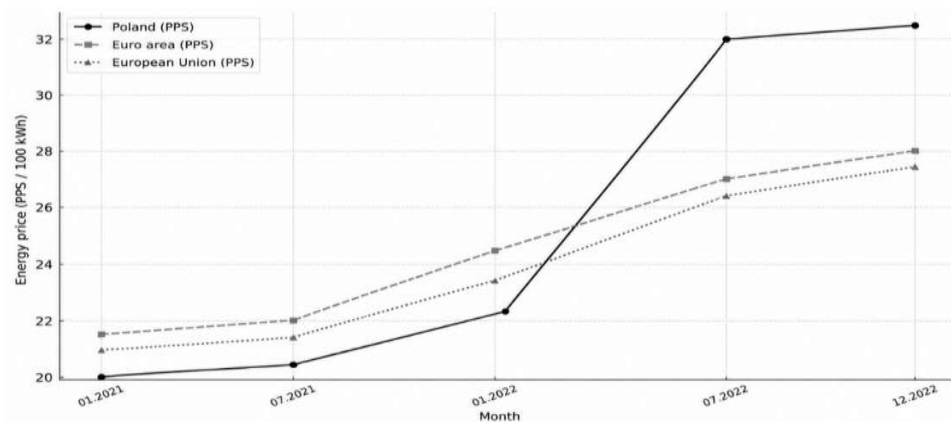


Figure 2b. Electricity prices (PPS) in Poland, the euro area and the EU (2021–2022)

Source: Author's own elaboration based on Eurostat data

The data presented in Figures 2a and 2b indicate that although nominal electricity prices in Poland in 2021–2022 were lower than the average in the euro area and the EU, after taking purchasing power parity (PPS) into account, from 2022 they exceeded the average values for both areas. The largest differences occurred in the second half of 2022, when electricity price in Poland reached approximately 32 PPS/100 kWh, compared with 27 PPS/100 kWh in the euro area and 26.5 PPS/100 kWh in the EU. This means that electricity constituted a relatively greater burden on the budgets of Polish households than on average in the euro area and the European Union as a whole.

The deepening imbalance, as well as the general increase in the operating costs of both enterprises and households, contributed to a weakening of global demand and constituted one of the factors limiting the pace of economic growth both in Poland and throughout the EU.

Figure 3 presents the rate of real GDP growth in Poland, the euro area and the EU in 2021–2022.

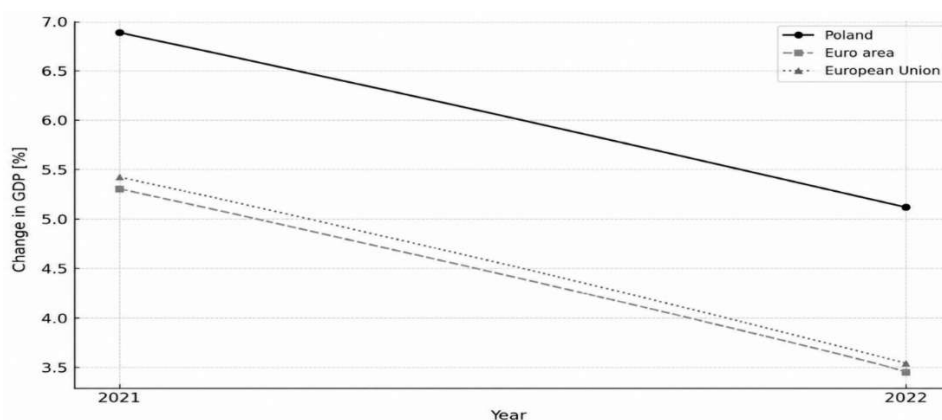


Figure 3. GDP growth (at constant prices) in Poland, the euro area and the EU (2021–2022)

Source: Author's own elaboration based on Eurostat data

As follows from the data in Figure 3, in 2021–2022 Poland recorded a higher rate of real GDP growth than the average in the European Union and the euro area. In 2021, following the slowdown caused by the COVID-19 pandemic, Poland's real GDP increased by 6.9%, while in the euro area and the EU it increased by 5.3% and 5.4%, respectively. In 2022, the rate of economic growth in Poland declined to 5.3%, but it still exceeded the average for the euro area and the EU as a whole, where it amounted to 3.5%. This means that the Polish economy maintained a relatively high growth rate despite deteriorating macroeconomic conditions. At the same time, as indicated above, economic growth was accompanied by exceptionally high inflation and a rapid increase in energy and living costs, which limited the real benefits resulting from the high rate of GDP growth.

In response to the increasing risk of recession, EU Member States, including Poland, implemented measures aimed at limiting the effects of the economic slowdown. One of the key elements of these measures was the REPowerEU plan presented by the European Commission in May 2022 (European Commission, 2022). Its objective was to rapidly reduce dependence on Russian fossil fuels by accelerating the energy transition and increasing the security and resilience of the European Union's energy system.

The REPowerEU plan focused primarily on supply-side and restructuring instruments supporting the development of renewable energy sources and investment in the clean energy sector. These were complemented by diversification of the sources of supply of traditional energy carriers, primarily natural gas, treated as a transitional fuel in the energy transition process. The plan also included pro-demand measures using fiscal

and income policy instruments. An important element also consisted of protective measures directed at the most vulnerable recipients, i.e. households and enterprises. Their objective was to maintain the purchasing power of households and reduce the risk of declines in production and employment in enterprises. As a result, the state assumed responsibility for partially shaping prices in markets (particularly energy and food markets), thereby influencing the prevailing conditions of demand and supply. Under normal circumstances, the volume of demand and supply is determined by the price mechanism. In the case of the energy crisis, this mechanism was adjusted through regulation of VAT and excise duty rates. By reducing or completely foregoing revenues from the aforementioned taxes, individual EU countries could act to mitigate inflationary pressures. Other measures included temporary price freezes, particularly for gas and district heating. Intervention in the price mechanism aimed at preventing increases in the prices of so-called strategic goods and services was an important factor in stabilising aggregate demand. In order to strengthen this effect, EU countries also introduced so-called protective allowances (e.g. the household protective allowance, the coal allowance).

According to estimates, EU countries spent a total of approximately EUR 681 billion on aid packages for households and industry between September 2021 and the end of January 2023, corresponding to approximately 4.6% of the Union's total GDP. Germany incurred the largest expenditure, allocating approximately EUR 268 billion for this purpose, which represented as much as 7.5% of German GDP. High expenditures were also recorded in Italy (EUR 59.2 billion, 2.8% of GDP), France (EUR 53.6 billion, 1.8% of GDP) and Spain (EUR 35.5 billion, 2.3% of GDP). Poland allocated approximately EUR 12.4 billion to support, representing 2% of its GDP. Although this amount was relatively lower in nominal terms, in relation to GDP it constituted a significant burden on the state budget (Sgaravatti et al., 2023).

The strong fiscal stimulus, supported by income policy instruments, limited the scale of the economic slowdown in Europe, while at the same time contributing to a deterioration in the fiscal balance in most EU countries.

Figure 4 presents the budget deficit as a percentage of GDP in Poland, the euro area and the EU in 2019–2023.

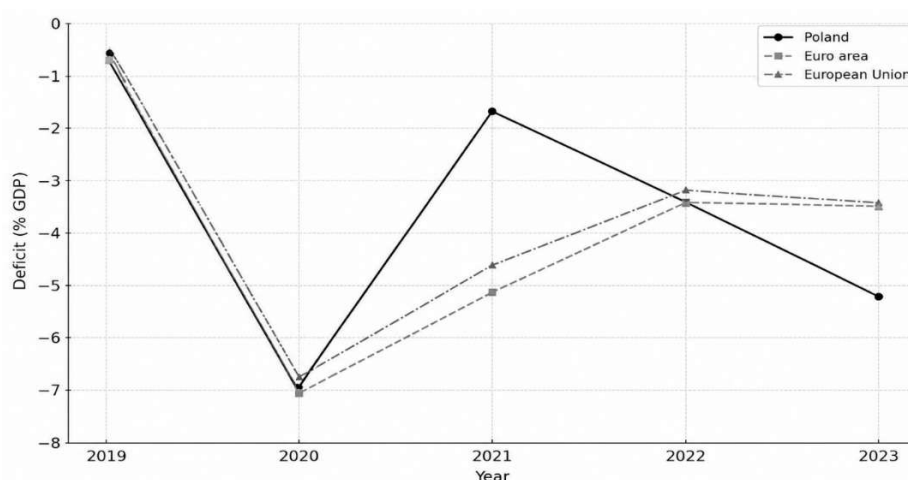


Figure 4. Budget deficit as a percentage of GDP in Poland, the euro area and the EU (2019–2023)

Source: Author's own elaboration based on Eurostat data

As follows from the data presented in Figure 4, in 2020 all analysed economies recorded a significant increase in the budget deficit, mainly as a consequence of expansionary fiscal policy aimed at limiting the effects of the COVID-19 pandemic. In 2021, with the improvement in economic conditions and the gradual phasing out of some anti-crisis instruments, the deficit-to-GDP ratio improved, reaching 1.7% in Poland, compared with 5.1% in the euro area and 4.6% in the EU.

In 2022, the deficit-to-GDP ratio in Poland increased to 3.4%, while in the euro area and the EU it amounted to 3.5% and 3.2%, respectively. The deterioration of the fiscal situation in Poland occurred amid a strong increase in energy and other goods prices, which increased pressure on public expenditure associated with mitigating the effects of the energy crisis and protecting household incomes. At the same time, high inflation contributed to rapid growth in nominal GDP, which partially limited the scale of changes in the deficit-to-GDP ratio. In 2023, as price dynamics slowed and public expenditure continued to increase, including expenditure related to protective measures, the deficit in Poland rose to 5.2% of GDP, exceeding the levels recorded in the euro area (3.5%) and the EU (3.4%).

The deepening budget deficits required financing through public debt, which contributed to an increase in the debt-to-GDP ratio. Consequently, many EU countries, including euro area countries, exceeded the reference values of 3% of GDP for the deficit and 60% of GDP for public debt, as specified in the Stability and Growth Pact.

Figure 5 presents public debt as a percentage of GDP in Poland, the euro area and the EU in 2019–2023.

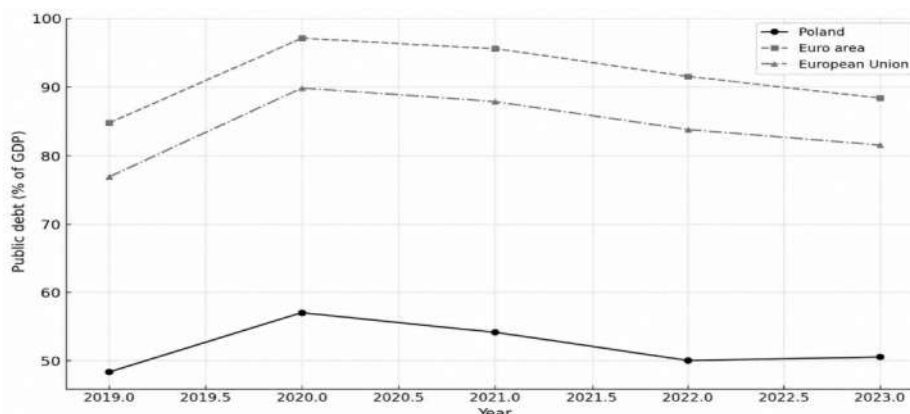


Figure 5. Public debt as a percentage of GDP in Poland, the euro area and the EU (2019–2023)

Source: Author's own elaboration based on Eurostat data

As follows from the data in Figure 5, the public debt-to-GDP ratio reached its highest level in 2020, amounting to - 56.6% in Poland, - 97.2% in the euro area, and - 90.7% in the EU as a whole. In subsequent years, a gradual reduction in indebtedness was observed, although it remained at a high level. As in the case of the budget deficit, the improvement in public debt-to-GDP indicators in Poland, particularly in 2021–2022, was partly a result of relatively higher inflation.⁴

In response to the unprecedented fiscal consequences of first the COVID-19 pandemic and subsequently the energy crisis, the European Union activated the so-called general escape clause under the Stability and Growth Pact, which temporarily suspended fiscal discipline requirements. The clause was activated for the first time in March 2020 pursuant to the European Commission Communication (COM/2020/123 final), enabling Member States to pursue expansionary fiscal policies in order to mitigate the effects of crises. According to the Commission's decision, it ceased to apply from 1 January 2024. The decision to deactivate the clause was taken

⁴ During the crisis caused by the COVID-19 pandemic and the 2022 energy crisis, some expenditure in Poland (e.g. on anti-crisis shields) was implemented through extra-budgetary entities, such as Bank Gospodarstwa Krajowego and the Polish Development Fund, which formally did not increase public sector debt according to the national methodology. This was one of the most frequently criticised phenomena in fiscal policy during this period. Eurostat and the European Commission include this debt in the debt of the general government sector under ESA 2010, which is why the actual level of Poland's public debt according to EU data was higher than that presented according to the national methodology.

in connection with the improvement in the economic situation in the European Union and the need to ensure the long-term sustainability of public finances. The Commission also announced the continuation of work on reforming the EU fiscal framework, aimed at simplifying it and increasing its effectiveness.

2. Monetary Policy Response to the Energy Crisis.

An analysis of the monetary policy pursued by the National Bank of Poland and the European Central Bank during the 2022 energy crisis requires consideration of measures undertaken already before its outbreak. The energy crisis occurred under conditions in which the economies of Poland and the euro area were still experiencing the effects of the COVID-19 pandemic, while central banks were pursuing exceptionally expansionary monetary policies aimed at limiting the effects of the recession and supporting the fiscal measures of governments. This means that the response of the NBP and the ECB to the 2022 supply shock was to a significant extent determined by earlier decisions concerning interest rate levels, the scale of liquidity provision, and the use of non-standard monetary policy instruments. For this reason, the analysis covers the years 2019–2025. The year 2019 provides a benchmark illustrating pre-pandemic macroeconomic conditions, while the subsequent years make it possible to trace the evolution of monetary policy, from a phase of strong monetary expansion, through the response to the energy crisis and the sharp increase in inflation, to the gradual normalisation of monetary conditions.

2.1. NBP Measures

As in the case of the crisis caused by the COVID-19 pandemic, the main burden of overcoming the effects of the 2022 energy crisis rested on the widely used instruments of fiscal and income policy. The effectiveness of these measures, however, depended to a significant extent on the monetary policy pursued in parallel, which ensured an appropriate level of liquidity in the financial sector and stable financing conditions for the economy. For this purpose, in addition to the traditional instrument in the form of interest rates, the NBP also used non-standard monetary policy instruments.

Figure 6 presents the path of changes in the NBP reference rate and CPI inflation and core inflation (excluding food and energy prices) in Poland in 2019–2025.

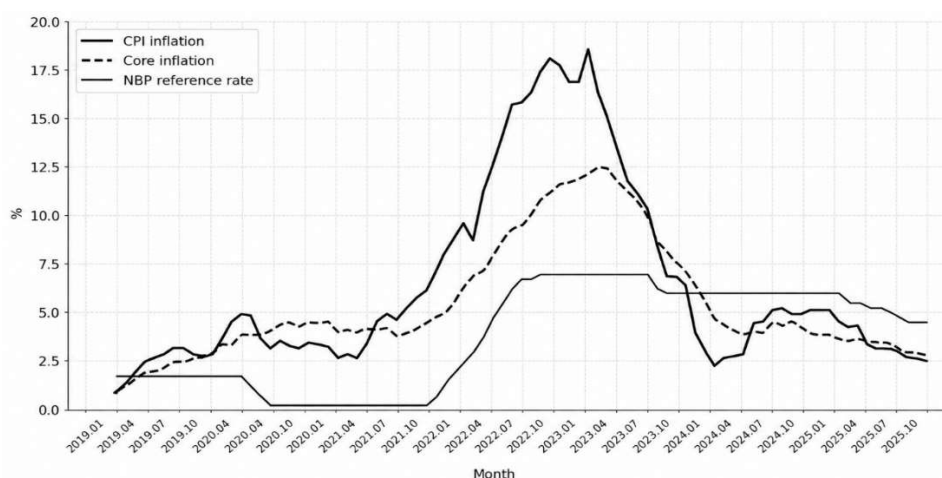


Figure 6. NBP reference rate and inflation (y/y) in Poland (2019–2025)

Source: Author's own elaboration based on NBP and Statistics Poland data

In response to the pandemic and the economic slowdown it caused (2020–2021), the NBP pursued a strongly expansionary monetary policy, reducing key interest rates to record-low levels. In May 2020, the reference rate was lowered to 0.1%, while the deposit rate reached 0.00% for the first time in history. At the same time, within the framework of structural open market operations, the NBP conducted purchases of Treasury bonds and bonds guaranteed by the State Treasury⁵, thereby seeking to increase liquidity in the banking sector and sustain bank lending.⁶ Core inflation, although slightly elevated, remained relatively stable during this period, confirming the rationale for the policy pursued.

The central bank's measures strongly supported the government's anti-crisis policy pursued at that time, enabling, on the one hand, fiscal expansion (in the form of anti-crisis shields and social allowances), and on the other hand reducing the cost of servicing the growing public debt. Although the NBP has no possibility of directly financing government expenditure (the prohibition of monetary financing of the deficit – Article 220 of the Constitution of the Republic of Poland), its actions enabled banks to more easily purchase bonds issued and/or guaranteed by the state

⁵ This refers to bonds issued by Bank Gospodarstwa Krajowego and the Polish Development Fund.

⁶ Low interest rates and NBP measures aimed at increasing liquidity in the banking sector led to a credit boom in 2021. In December 2021 alone, enterprises signed loan agreements with banks for a total amount of PLN 17.5 billion, representing an increase of almost 51 percent compared with December 2020. In the case of households, the increase amounted to almost 21 percent. For more on this subject, see Bednarczyk (2023, pp. 93–94).

and subsequently resell them as part of structural operations. It can therefore be stated that although, formally, the central bank's actions were consistent with the prohibition of direct deficit financing, they de facto served to support government policy, enabling the financing of anti-crisis measures indirectly. At the end of 2021, the value of public debt held by banks amounted to PLN 448.5 billion, representing an increase of more than PLN 125 billion compared with 2019. Although the largest increase occurred in 2020, in 2021 banks remained the state's largest creditor, holding 54.7 percent of the total amount of Treasury securities issued on the domestic market (Ministry of Finance, 2022).

Such monetary-fiscal coordination, particularly with regard to the timing of the operations conducted, gave rise to a debate among politicians and economists concerning the limits of central bank independence and the sustainability of such a form of support. It was pointed out that although such a policy may be effective in the short term, it may generate long-term risks associated with inflationary pressures and political incentives to use the central bank as an institution supporting fiscal policy (Michalski, 2022; Siemionczyk, 2024; Gąsiorowski, n.d.; Towarzystwo Ekonomistów Polskich, 2023).

In the second half of 2021, CPI inflation in Poland accelerated significantly, reaching 8.6 percent y/y in December 2021. The main causes were persistent disruptions to global supply chains associated with the pandemic, increasing energy prices related to the first signs of the energy crisis, as well as the expansionary fiscal policy pursued by the government, aimed at stimulating domestic demand. The rate of growth of core inflation also accelerated significantly. Ultimately, its level at the end of December 2021 amounted to 5.3 percent y/y, which was a clear signal indicating the persistence of the inflation shock. In response to these developments, the NBP began a cycle of monetary policy tightening. The first increase in the reference rate, however, took place only in October 2021, despite the fact that both CPI inflation and core inflation had already exceeded the inflation target in the middle of the year. The response therefore appears to have been significantly delayed. According to the logic of inflation-targeting policy, which the NBP officially follows in its actions, the central bank's response should be rapid and forward-looking, particularly in a situation of rising core inflation, which is a particularly important indicator because it reflects domestic price-setting processes, which are more strongly influenced by monetary policy than external supply shocks (NBP, 2023). In subsequent months, the reference rate was raised several more times (11 times in total), reaching 6.75 percent in September 2022, and thus increasing by a total of 6.65 p.p. Despite these increases, inflation continued to accelerate (CPI inflation increased by more than 10 p.p. during this period), which meant that the real interest rate remained negative for many months. As a result, it can be said that the NBP maintained an

accommodative monetary policy stance. This confirms the thesis that during this period the central bank sought to support (and in particular not to impede) the government's policy aimed at sustaining economic activity, even at the cost of temporarily elevated inflation.

In 2023, inflation began to decline gradually, which made it possible to begin a cycle of monetary policy easing. The first interest rate cut took place in September 2023. At that time, the reference rate was reduced by 75 basis points, i.e. from 6.75 percent to 6.00 percent. A further reduction took place in October of the same year, when the Monetary Policy Council decided to reduce the reference rate by 25 basis points, i.e. to 5.75 percent.

Ultimately, in the first quarter of 2024, CPI inflation moved close to the NBP's inflation target (in January 2024, CPI inflation amounted to 3.7 percent y/y). A slightly slower pace of decline was recorded in the case of core inflation, which remained above the target set for the CPI indicator until the end of 2024 (in December 2024, core inflation amounted to 4%), and reached its vicinity only in the first quarter of 2025 (3.6% in March 2025). As a result, following the first round of monetary policy easing, the NBP maintained interest rates unchanged in subsequent months, until May 2025, when the Monetary Policy Council (MPC) decided to reduce the reference rate by another 50 basis points, i.e. to 5.25 percent. In subsequent months of 2025, the Monetary Policy Council continued the gradual easing of monetary policy. By the end of the year, the NBP reference rate had been reduced to 4.25%, reflecting the consolidation of the disinflation process and the gradual reduction of price pressures in the economy. At the same time, both CPI inflation and core inflation continued their downward trend. In December 2025, CPI inflation amounted to 2.4% y/y, while core inflation amounted to 2.7% y/y, which meant that both indicators returned to levels close to the NBP's inflation target. This indicates the gradual fading of inflationary processes and the transition of monetary policy from a phase of strong tightening to a more neutral stance.

2.2. ECB Measures

The European Central Bank also responded to the increase in inflation in the Euro Area with a delay. The first increase in official interest rates took place only in July 2022, when the HICP inflation indicator, as well as the core inflation indicator (HICP – Overall Index Excluding Energy and Unprocessed Food), were significantly above the ECB's inflation target of 2 percent. Nevertheless, in the following months it was already fairly consistent in its actions aimed at calming inflation expectations and counteracting further price increases.

Figure 7 presents the path of changes in the Main Refinancing Operation – MRO rate of the European Central Bank and HICP inflation and core HICPX inflation (excluding food and energy prices) in the euro area in 2019–2025.

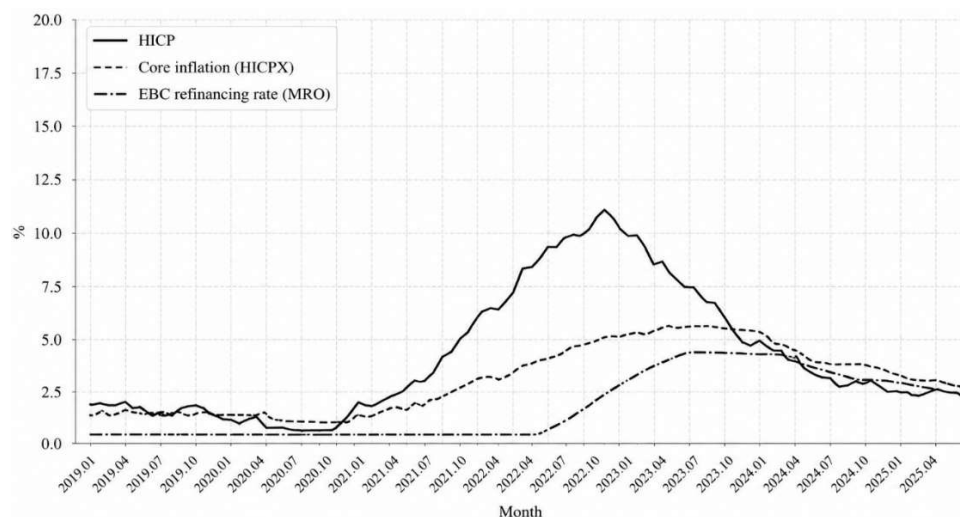


Figure 7. ECB Main Refinancing Operation (MRO) rate and inflation (y/y) in the euro area (2019–2025)

Source: Author's own elaboration based on ECB and Eurostat data

An analysis of the data presented in Figure 7 shows that the monetary policy of the European Central Bank was essentially convergent with that of the National Bank of Poland. Even before the outbreak of the COVID-19 pandemic, HICP inflation in the euro area fluctuated below the inflation target, which consequently allowed the ECB to focus mainly on supporting economic activity and was consistent with the measures undertaken by the governments of euro area Member States. The ECB maintained interest rates at extremely low levels, i.e. 0.00 percent for the main refinancing rate, 0.25 percent for the marginal lending facility rate, and (-0.5 percent) for the deposit facility rate. The achievement by key interest rates of the zero lower bound (Zero Lower Bound, ZLB) prevented the ECB from using interest rate cuts as a tool for responding to the crisis caused by the pandemic (Q1 2020 – Q4 2021). However, in an attempt to counteract the deepening of the crisis, the ECB significantly increased the scale of asset purchases (EUR 750 billion) under the PEPP programme (Pandemic Emergency Purchase Programme)⁷, and also provided commercial banks with liquidity

⁷ PEPP (Pandemic Emergency Purchase Programme) was launched in March 2020 as a response to the COVID-19 pandemic. Under the programme, the ECB purchased assets, mainly on the secondary market, from financial institutions holding “Counterparty” status, i.e. counterparties to ECB open market operations, in accordance with Eurosystem rules. These operations also involved purchases of government bonds on the secondary market. In addition to increasing market liquidity and providing financial support for

through inexpensive loans under the TLTRO III programme (Targeted Longer-Term Refinancing Operations III)⁸, which was intended to sustain lending and maintain favourable financing conditions for enterprises and households in the euro area (ECB, 2019; BBC, 2020).

The first symptoms of the energy crisis in the euro area appeared as early as the second half of 2021 and intensified clearly at the beginning of 2022 following the outbreak of the war in Ukraine. At the same time, HICP inflation increased rapidly, having shown a steady upward trend since March 2021 and reaching 8.9 percent y/y in July 2022, which was more than four times the level of the ECB's official inflation target. Moreover, since mid-2021, core inflation had also shown a steady upward trend, reaching 4 percent in July 2022. Despite this, the ECB did not tighten its monetary policy and continued to maintain official interest rates at extremely low (negative) levels. The absence of a traditional forward-looking response to the intensification of inflationary processes in the case of the ECB, which until then had been oriented towards the strict pursuit of an "ambitious" inflation target, could have been a signal that the priority objective was the desire to protect the uncertain economic recovery that was developing in euro area countries after overcoming the initial effects of the pandemic.

In subsequent months (from July 2022 to September 2023), the ECB increased the reference rate by a total of 4.50 p.p., i.e. to 4.5 percent. This was one of the highest levels in the entire history of ECB interest rate.⁹ The effect of these measures was a relatively rapid slowdown in the growth of inflation in the euro area. Although HICP inflation continued to rise in subsequent months, after reaching a peak of 10.6 percent in October 2022, it began to decline systematically. The ECB kept interest rates unchanged until June 2024, when a reduction of 25 basis points was decided. Ultimately, in the first quarter of 2025, HICP inflation returned to the inflation target. As regards core inflation, it reached its peak only in March 2023 (5.7%), after which it began to decline gradually, reaching a value close to the ECB's target in mid-2025.

anti-crisis measures within the euro area, their main objective was also to lower market interest rates and reduce financing costs for governments and firms (ECB, 2020).

⁸ TLTRO III is a targeted longer-term refinancing programme launched by the ECB in September 2019 as the third iteration of the earlier TLTRO programmes. The first TLTRO I programme was launched in September (Round I) and December (Round II) 2014 in order to counteract low inflation and economic stagnation following the 2007+ financial crisis and the euro area debt crisis (2010–2012). TLTRO II was launched in June 2016 as the first of four quarterly rounds. This time, the objective was to strengthen the transmission of monetary policy under conditions of negative interest rates (ECB, 2019).

⁹ Only four times, namely, three times in the period from 1 September 2000 to 31 August 2001 and once in the period from 21 June to 2 August 2023, did the ECB's official interest rate reach or exceed 4.50 percent (ranging from 4.50 to 4.75 percent).

3. Assessment of the Effectiveness of the Monetary Policies of the NBP and the ECB

When comparing the effects of the anti-inflationary measures taken by the NBP and the ECB, it can be observed that the NBP responded by raising official interest rate somewhat earlier than the ECB, i.e. at a lower level of inflation. The first increase in the NBP interest rate took place in October 2021, when CPI inflation amounted to 5.9–6.8 percent, while core inflation was 3.9–4.5 percent. The ECB began raising rates in July 2022, when HICP inflation amounted to 8.6–8.9 percent, while HICPX core inflation was 3.7–4.0 percent. This relatively rapid response by the NBP can be explained by several factors. First, Poland is characterised by higher natural variability of inflation and a greater influence of administered prices and food prices on its level than the euro area¹⁰. Second, inflation in Poland had already remained at a relatively high level before the energy crisis, resulting from a strong rebound in consumption following the COVID-19 pandemic and rapid wage growth. As a result, after its outbreak, inflation expectations quickly became de-anchored, forcing the NBP to take rapid action in order to prevent high inflation from becoming entrenched. The ECB could maintain interest rates at low levels for longer due to the long history of (very) low inflation and, consequently, strongly anchored inflation expectations. Third, in fulfilling its mandate, including its additional element of supporting the general policies of the EU and financial stability, the ECB must take into account the situation of many countries. In this case, an excessively rapid response by the ECB could have increased the risk of destabilising highly indebted European countries (e.g. Italy).

In the same year (2021), the NBP raised the interest rate twice, by a total of 165 basis points. In the following year (2022), it raised the rate 8 times, by a total of 500 basis points. Despite these increases, CPI inflation continued to rise systematically, reaching a peak in October 2022 (17.9 percent). As regards core inflation, it reached its peak in April 2023 (12.2 percent). Following the last increase (8 September 2022), the NBP maintained rates unchanged until September 2023, when, in response to a clear decline in inflationary pressures, it gradually began to ease its policy.

As regards the ECB, from the beginning of the monetary policy tightening cycle until the end of 2022, it raised the rate 4 times, by a total of 250 basis points, while in the following year (2023) it raised it 6 times, by a total

¹⁰ In Poland, electricity, gas, district heating and some municipal services are regulated by the state (UOKiK, URE). In euro area countries, these prices are more extensively market-based. In addition, the CPI basket is characterised by a higher share of “unstable” energy and food prices than the HICP basket, while having a smaller share of “stable” service prices.

of 200 basis points. During this period, HICP inflation, after reaching a peak in October 2022 (10.6 percent), began to decline systematically. Core inflation also began to decline gradually after reaching its peak in March 2023 (5.7 percent). As a result, starting in June 2024, the ECB began to gradually ease monetary policy.

Comparing the paths by which inflation approached the levels specified within the adopted inflation targets in Poland and the Euro Area, a considerable difference can be observed. Although these paths had a similar shape, in the case of Poland the path extended over a considerable longer period than in the Euro Area, ran significantly “higher” and was much more elevated in relation to the time axis (see Figure 8).

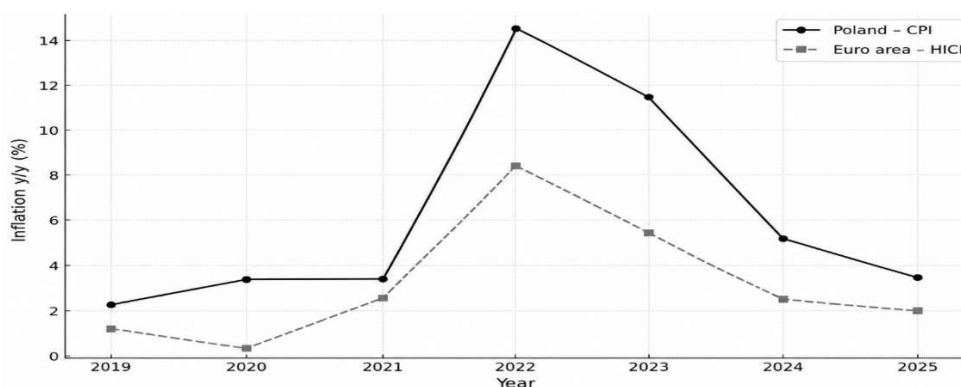


Figure 8. Path of CPI inflation in Poland and HICP inflation in the euro area (2019–2025)

Source: Author's own elaboration based on Statistics Poland and Eurostat data

These differences resulted, among other things, from the fact that, unlike in Poland, inflation in the euro area was driven mainly by external factors, i.e. energy, fuel and food prices, and to a lesser extent by internal demand-side pressures – the core inflation indicator in the euro area remained at a relatively lower level. As a result, after energy prices stabilised in 2023, inflation in the euro area began to decline more rapidly than in Poland. Moreover, the core inflation indicator in Poland remained elevated for significantly longer than in the euro area, resulting, among other things, from rapid wage growth, rising inflation expectations, and the pass-through of costs to consumers (the price–wage spiral mechanism). As a result, despite the fact that the NBP began raising interest rates earlier than the ECB, the real interest rate remained negative for a long time, which limited the restrictiveness of monetary policy. Finally, various forms of anti-inflation shields were introduced in Poland (e.g. zero VAT on food, energy price freezes), which temporarily limited inflation but, following their withdrawal,

generated secondary inflationary effects. Regulations in the euro area were less extensive, which contributed to a faster unwinding of the structural inflationary effects.

Opinions regarding the assessment of the monetary policy pursued by the NBP (particularly in 2022) are divided. Its rationale was upheld and widely explained by the MPC in regularly published reports and studies, as well as during public appearances (NBP, 2022). Positive opinions were also expressed, *inter alia*, within the Bank for International Settlements (BIS, 2023), the International Monetary Fund (IMF, 2024), as well as in reports published in 2022–2023 by rating agencies (e.g. Fitch, Moody's, S&P). They indicated that the NBP's actions were consistent with the objectives of monetary policy, and that its response was faster compared with central banks in the region. However, some economists argue that these measures in response to rising inflation should have been more decisive, and that the path towards the inflation target should have been shorter (Wójcik, 2022; Gospodarczyk, 2023; Kozłowski, 2021).

On the other hand, if the NBP had raised the reference rate more strongly in order, for example, to “keep pace” with inflation – which would apparently have meant raising this rate to levels in the range of 9–11 percent – this would have resulted in a stronger increase in lending rates for enterprises and households and a substantially greater decline in demand for such loans. This would also have led to an increase in the yields on Treasury securities and, consequently, an increase in the cost of servicing public debt. At the same time, foreign investors' interest in Polish debt would have increased, which could have led to an appreciation of the zloty exchange rate. An appreciation of the zloty exchange rate could, on the one hand, have led to a reduction in the cost of importing energy commodities, but on the other hand, it could have worsened the conditions for Polish exports and consequently limited their competitiveness. A more aggressive policy of raising the reference rate could therefore have resulted in a slowdown in the growth of domestic demand (especially from the private sector), an increase in the cost of servicing public debt, and a slowdown in export growth. The combined effect of all these factors would have resulted in a reduction in the rate of GDP growth and thus neutralised the efforts of the government and the central bank in supporting the government in pursuing the priority objective of sustaining economic activity. The risk of being unable to achieve this objective was even greater because subsequent stages of the energy crisis and the war in Ukraine created new circumstances that could affect both the prices and availability of energy commodities, which could further deepen the scale of the supply shock affecting the economy (Bednarczyk, 2023, pp. 97–99).

Despite the generally positive opinions, there is no doubt that the delay in the NBP's actions may have contributed to the entrenchment of inflation

expectations and inflation itself in the economy at a higher level, making the subsequent fight against inflation more difficult and more prolonged. Moreover, during the period of rising inflation, the President of the NBP and members of the MPC repeatedly expressed publicly the conviction that the increase in prices was temporary and that its main causes were supply-side factors independent of domestic monetary policy. Such a narrative may have been perceived as a signal of a lack of intention to tighten monetary policy rapidly and decisively, since it was assumed that inflation would decline on its own after external shocks subsided. As a result, this may have weakened the effectiveness of the inflation expectations channel and thereby limited the central bank's ability to effectively counteract price increases by shaping market participants' expectations.

Conclusion

The 2022 energy crisis led to a strong increase in inflation both in Poland and in the euro area, but its effects were clearly stronger and more persistent in Poland. Increases in energy, fuel and food prices constituted the primary factor intensifying inflationary processes; however, over time, domestic factors also became increasingly important. In Poland, this resulted in persistently high core inflation and a longer process of returning inflation to a level consistent with the central bank's target.

A comparison of the actions of the NBP and the ECB shows that the NBP began its cycle of interest rate increases earlier than the ECB, responding as early as October 2021 to mounting inflationary pressures. In 2022, the scale of monetary policy tightening was substantial; however, despite the measures undertaken, inflation in Poland continued to rise, reaching a peak in October 2022. Core inflation also remained elevated in 2023. This indicates that the earlier commencement of monetary policy tightening did not translate into a rapid reduction in inflationary pressures, and that the process of reducing inflation in Poland was spread over time.

Against this background, the actions of the ECB provide an important benchmark for assessing the NBP's policy. The ECB began raising interest rates later than the NBP, in July 2022, and subsequently increased them significantly over a relatively short period. In the euro area, inflation reached its peak in October 2022, while core inflation peaked in March 2023, after which both indicators began to decline gradually. A comparison of the course of inflation and the responses of the two central banks indicates that an earlier response to rising inflation alone does not determine the pace of its subsequent reduction. The scale and pace of monetary policy tightening were also important, as were the economic conditions under which it was conducted.

At the same time, the experience of the energy crisis indicates the limitations of monetary policy in responding to supply shocks whose sources

remain largely beyond the direct influence of the central bank. Increases in energy prices and their transmission to other groups of goods and services meant that monetary policy tightening alone was insufficient to rapidly contain inflationary processes. Fiscal measures undertaken to mitigate the effects of the energy crisis were also important, as, on the one hand, they alleviated its consequences for households and enterprises, while on the other hand they could affect the scale and persistence of inflationary pressures. This indicates the importance of appropriate coordination of monetary and fiscal measures under conditions of a strong supply shock.

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