FINANCIAL MARKETS AND FLOWS IN AN ERA OF MONETARY, FISCAL AND SOCIETAL CHALLENGES

edited by
Jan Mertl & Naděžda Petrů

University of Finance and Administration, Praha, 2025

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Preferred form of citation from this book is the chapter of a particular author, e.g.
ČERNÍK, O. (2025). Co-opetition in financial markets. In Mertl, J., Petrů, N. (Eds.). *Financial markets and flows in an era of monetary, fiscal, and societal challenges* (pp. 43–52). Prague: VŠFS. ISBN 978-80-7408-289-4.

Financial markets and flows in an era of monetary, fiscal, and societal challenges

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Publisher
University of Finance and Administration
Estonská 500, 101 00 Praha 10
Tel.: +420 210 088 733
www.vsfs.cz
First edition, Prague, 2025

This publication was not proofread, the authors are responsible for the content and linguistic aspects of their text.

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ISBN 978-80-7408-289-4

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Introduction

This scientific monograph is the outcome of the international conference Financial Markets and Flows 2025 (May 27–28, Prague, University of Finance and Administration), bringing together scholars, policymakers, and practitioners to deliberate on pressing issues that define the current economic, fiscal, and financial landscape. Unlike conventional conference proceedings, the present volume transcends the mere documentation of debates: it is conceived as a research-oriented publication in which discussion syntheses and scientific chapters interact to form an integrated body of knowledge. Its ambition is to critically assess current developments, to present empirically substantiated findings, and to provide conceptual frameworks that may serve both further research and informed policymaking.

The book's research character is manifested in several ways. First, it systematically links theoretical considerations with empirical evidence, drawing on case studies, econometric analyses, comparative research, and simulation models. Second, it addresses a wide spectrum of issues related to finance — from monetary policy and fiscal sustainability, through banking regulation and healthcare financing, to ESG (environmental, social and governance) standards and the economics of digitalization — while maintaining coherence through the unifying theme of financial markets and flows. Third, the volume explicitly formulates open questions, hypotheses, and methodological approaches, thereby offering fertile ground for continued scholarly inquiry.

From the outset, the volume situates itself within long-standing theoretical traditions of economics and finance. The chapters collectively engage with central questions posed by Keynesian macroeconomics, monetarist doctrines, the new institutional economics, and game-theoretic approaches to strategic behaviour. They also reflect the evolution of applied policy research in the domains of fiscal federalism, prudential regulation, and health economics. The guiding perspective is neither purely normative nor purely descriptive; rather, the contributions are analytical, comparative, and empirically substantiated, with a strong emphasis on the interplay between theory and practice.

The methodological approach of the book reflects the complexity of the subject matter. Quantitative approaches such as econometrics, correlation analysis, and agent-based modelling are complemented by qualitative syntheses, comparative institutional analyses, and game-theoretical reasoning. This plurality is intentional: financial markets and public budgets, especially under conditions of crisis and transition, cannot be fully captured by a single theoretical lens. Instead, the volume advocates a multi-perspectival approach, consistent with the tradition of political economy.

The first part of the book collects four chapters written by the leaders of expert panels. Each of these chapters synthesizes the deliberations that took place during the conference while embedding them into broader scholarly debates.

Topic of the first panel: stabilization of monetary policy – inflation and interest rates

This chapter revisits one of the central debates of macroeconomics: the trade-off between inflation stabilization and output growth. It focused on the interaction between domestic monetary conditions and global economic developments. It analysed the persistence of

inflationary pressures in the service sector, the structural duality of the Czech economy, and the influence of wage dynamics and labour market rigidity on price stability. Attention was given to the balance between economic flows and stocks, reflecting the need for macroprudential vigilance in an environment of financial volatility. On the international level, the content addressed how reindustrialization, protectionist trade policies, and the accumulation of public debt in major economies shape global interest rate trends and fiscal sustainability. In the Czech context, the material emphasized the appropriateness of a moderately restrictive monetary stance aimed at containing inflation, safeguarding financial stability, and ensuring flexibility in response to external economic shocks and long-term structural challenges. Special attention is paid to the experience of small open economies such as Czechia, where its monetary sovereignty interacts with European Central Bank policies, global capital flows, and inflationary shocks triggered by geopolitical tensions.

Topic of the second panel: impacts of extraordinary events on public budgets

Public finance theory has long distinguished between cyclical and structural deficits, and between temporary fiscal interventions and long-term sustainability. This chapter applies these conceptual distinctions to the Czech and European experience of the last decade, focusing on the COVID-19 pandemic and the energy crisis as fiscal stress tests. Drawing upon the traditions of fiscal federalism (Oates, Musgrave), theories of intergenerational equity, and institutionalist perspectives on debt sustainability, the chapter identifies both the resilience and the vulnerabilities of current fiscal frameworks. It also highlights the political economy asymmetry between the relative ease of fiscal expansion and the difficulty of consolidation.

Topic of the third panel: effects of energy sector changes on entrepreneurs

Energy economics provides a fertile ground for analysing the interdependence of technological change, regulation, and financial investment. This chapter employs the conceptual model of the “energy trilemma” — balancing security, affordability, and sustainability — to explore how entrepreneurs adapt to volatile energy prices, shifting regulatory regimes, and the geopolitical imperative of reducing dependence on external suppliers. It discusses nuclear energy, renewables, and natural gas not merely as technical options but as objects of contested policy design, reflecting the institutional failures and sequencing dilemmas known from the literature on transition economies.

Topic of the fourth panel: sustainability of financial flows in the EU and the Czech Republic in the context of ESG

This chapter situates the rise of ESG reporting within the tradition of regulatory harmonization in the European Union, tracing parallels with the earlier development of financial reporting standards. From the perspective of institutional economics and stakeholder theory, it analyses ESG as both a governance innovation and a source of compliance costs. It raises methodological questions about dual materiality, comparability of indicators, and the political economy of regulation, while also highlighting ESG as an opportunity for corporate strategy, reputational capital, and long-term investment flows.

The second part of the monograph assembles research chapters that extend beyond the panel discussions. These contributions are methodologically diverse yet united by their orientation toward empirical validation and theoretical advancement.

Co-opetition in Financial Markets

Drawing upon the foundational work of Nalebuff and Brandenburger, this chapter applies game theory to the financial sector, introducing models of cooperative competition. Using Edgeworth box diagrams and Nash bargaining theory, it demonstrates how co-opetition can generate Pareto-efficient outcomes under certain conditions. The analysis connects with the tradition of cooperative versus non-cooperative games (von Neumann, Morgenstern, Nash), while offering practical recommendations for financial market actors seeking to balance competition with mutual benefit.

Velocity of Money in the Digital Economy: An Agent-Based Model Calibrated with Czech Data (2000–2025)

This chapter employs agent-based modelling, a methodology rooted in complexity economics, to study the circulation of money under conditions of digitalization. Calibrated with Czech data over a 25-year horizon, the model defines heterogeneous agents, behavioural rules, and feedback mechanisms, thus allowing simulation of monetary velocity under alternative scenarios. The research builds upon classical monetary theory (Fisher's equation of exchange), while extending it to reflect digital payment systems, electronic money, and fintech innovations.

Economics of Productive Consumption and Positional Investing

Building on critiques of neoclassical consumption theory, this contribution develops the concept of productive consumption as a complement to positional (status-driven) consumption and investing. Employing a two-component model of financial markets and elements of game theory, it analyses how social comparison and cooperative strategies affect investment outcomes. The chapter thus engages with Veblenian economics, behavioural finance, and new institutional perspectives on consumption and inequality.

Current Trends in Prudential Banking Regulation

This chapter traces the historical evolution of prudential regulation, situating Basel I, II, and III within the broader literature on financial stability and regulatory arbitrage. It highlights the movement from standardized to internal risk-based approaches and discusses current challenges such as integrating climate risk and digital assets into prudential frameworks. The analysis engages with theories of regulatory capture, the "too big to fail" problem, and the future of supranational regulation in a fragmented global financial system.

EU General Sales Taxation and US Tariff Plan

Situated at the intersection of public finance and international trade theory, this chapter critically examines the role of value-added tax in international competitiveness. It considers whether VAT acts as a disguised trade barrier, drawing on WTO debates, and contrasts it with the tariff-based protectionism of the United States. The analysis situates VAT/GST within the Musgravian functions of taxation and explores reform options in light of global trade tensions.

Fiscal Space for Czech Healthcare and its Sustainability

This study applies the concept of fiscal space, as developed in health economics and international public finance, to the Czech healthcare system. It investigates state

contributions, insurance revenues, and expenditure trends, while situating Czechia within comparative international benchmarks. The chapter emphasizes the tension between universalism and sustainability, drawing on theoretical debates in health economics about efficiency, equity, and intergenerational fairness.

The Impact of Public Healthcare Expenditure on People's Health Status – A Comparison of Germany, Austria, and Czechia (2013–2021)

This empirical chapter explores the health production function, analysing how variations in public healthcare expenditure correlate with health outcomes across three Central European countries. Using correlation analysis and descriptive statistics, it examines not only health expenditure but also healthcare quality, staffing, and lifestyle factors. The findings are situated within the empirical literature on determinants of health (Grossman, Cutler), highlighting both limitations and policy implications.

The Influence of Bitcoin on the Volatility and Performance of an Investment Portfolio

Here, modern portfolio theory (Markowitz, Sharpe) is extended to incorporate Bitcoin as an asset class. The chapter analyses its correlation structure with traditional assets, its risk-return trade-offs in normal, high-interest, and crisis periods, and its role as a diversification instrument. The findings contribute to ongoing debates on the legitimacy of crypto assets in institutional portfolios.

Relationships Between Macroeconomic Variables and Stock Prices from the Perspective of Fundamental Analysis

Engaging with the literature on macro-finance linkages, this chapter examines how inflation, interest rates, and GDP growth affect stock valuations. Employing econometric models and grounding the analysis in fundamental analysis theory, it seeks to bridge the gap between macroeconomic conditions and micro-level stock performance, thereby contributing to investment decision-making frameworks.

Benchmarking ESG Reporting of Energy Companies in the European Union

This chapter offers a comparative benchmarking of ESG reporting across EU energy companies, structured along the three ESG dimensions and aligned with EU taxonomy. Drawing on theories of corporate governance, institutional isomorphism, and stakeholder accountability, it assesses the comparability, reliability, and strategic implications of ESG disclosure. The analysis demonstrates how ESG has become not only a compliance exercise but also a key determinant of investor trust and long-term corporate legitimacy.

Setting the national scene – Czechia and Slovakia: Together except of Banking Union

The final chapter compares the development of the Czech and Slovak banking sectors after the dissolution of Czechoslovakia, focusing on their differing approaches to the European Banking Union. While Slovakia joined the euro area in 2009 and became fully integrated into the Banking Union with ECB supervision and shared resolution mechanisms, the Czech Republic has retained its national currency and full supervisory control through the Czech National Bank. The analysis highlights the economic, legal, and political trade-offs of potential Czech participation in the Banking Union: enhanced stability and credibility versus the costs

of financial contributions and loss of sovereignty. Ultimately, the chapter frames the decision as a strategic choice between deeper European integration and preserving national control.

Scientific Contribution and Outlook

Taken together, the chapters of this monograph contribute to ongoing debates in economics, finance, and policy design by integrating theoretical reflection, methodological innovation, and empirical evidence. They engage with established traditions — from Keynesianism to monetarism, from Veblen to Grossman, from Basel to ESG — while also identifying new research frontiers shaped by digitalization, demographic change, and sustainability imperatives.

By combining synthetic overviews of expert debates with rigorously developed scientific studies, the book contributes to the cumulative advancement of knowledge. It demonstrates that financial markets and public finances cannot be understood in isolation: they are embedded in institutional structures, social relations, and technological contexts that constantly evolve. The central message of the volume is therefore one of interconnectedness: the stabilization of monetary policy, the resilience of public budgets, the dynamics of healthcare financing, the regulation of banking, and the sustainability of financial flows are all facets of a broader systemic transformation.

The scientific contribution of this monograph lies in its ability to combine conceptual depth, methodological innovation, and empirical application in a way that enriches the literature on financial markets, fiscal policy, and sustainability. Rather than approaching these topics as separate domains, the volume demonstrates their interconnectedness and interdependence, thereby responding to the growing need for systemic, thorough and connected analysis in economics and finance.

First, the monograph advances the theoretical understanding of how financial markets interact with broader economic and societal processes. The chapters on monetary policy, public budgets, and prudential regulation revisit long-standing debates in macroeconomic theory and financial economics while extending them into new domains such as digital currencies, co-opetition strategies, and ESG-driven investment. Theoretical frameworks are not treated as static but are tested, adapted, and in some cases reformulated to capture the complexity of present-day phenomena.

Second, the volume demonstrates a strong commitment to methodological plurality. It incorporates game-theoretic models, agent-based simulations, econometric analyses, comparative institutional studies, and benchmarking exercises. This diversity of methods underscores the argument that no single analytical tool suffices for capturing the dynamics of contemporary financial systems. Instead, it is precisely the interplay of different approaches — quantitative and qualitative, formal and empirical — that produces robust insights. The inclusion of simulation models and comparative analyses signals an openness to methods traditionally considered peripheral in mainstream economics but increasingly recognized as indispensable for dealing with non-linear, uncertain, and complex realities.

Third, the book makes a significant empirical contribution by calibrating models with real-world data, analysing the Czech and Central European context, and situating findings within broader European and global trends. Whether in the form of a calibrated agent-based model

of money velocity, cross-country comparisons of healthcare expenditure, or benchmarking ESG performance across EU energy companies, these empirical analyses provide evidence-based insights that are directly relevant to both academic inquiry and policy design. Importantly, they address the particularities of small and medium-sized economies within the European Union, which often serve as laboratories for larger systemic transformations.

Fourth, the monograph contributes to policy relevance and societal debate. It does so by highlighting trade-offs, constraints, and long-term structural pressures. For instance, the chapters on fiscal space and healthcare financing underscore the difficulty of reconciling universal coverage with demographic ageing, while the analyses of ESG regulation highlight both opportunities and bureaucratic risks. The discussion of energy transition illustrates the tension between sustainability and competitiveness, while the exploration of Bitcoin as a portfolio component reflects the challenges of integrating innovation into stable financial architectures. Collectively, these contributions provide a research-based foundation for policymakers facing the dual imperatives of short-term crisis management and long-term strategic planning.

Finally, the outlook of the monograph is oriented toward future research agendas. Several open questions emerge from the chapters:

- How can monetary policy frameworks adapt to digitalization, changing money velocity, and prolonged low-interest-rate environments?
- In what ways can fiscal institutions be redesigned to balance flexibility in extraordinary events with credibility and long-term sustainability?
- What models of co-opetition or collaborative competition are feasible in financial markets without undermining stability?
- How will prudential regulation evolve to incorporate risks linked to climate change, digital assets, and systemic interdependencies?
- Can healthcare financing models sustain universalism in ageing societies, and what role will fiscal space and preventive strategies play?
- To what extent will ESG standards transform corporate governance and investment practices, and how can measurement and comparability challenges be overcome?
- What is the long-term place of crypto assets in institutional portfolios, and how do they reshape the risk-return frontier of global finance?

By articulating these questions, the monograph both consolidates existing knowledge and outlines a research agenda for the coming decade. Its integrative approach demonstrates that the study of financial markets and flows cannot remain confined to siloed disciplines. Instead, it requires ongoing dialogue between macroeconomics, finance, institutional theory, public policy, and sustainability studies.

The overarching outlook is therefore twofold. At the academic level, the book reinforces the case for interdisciplinary, multi-method research capable of addressing systemic complexity, while maintaining the adherence to rigorous and appropriate research approach in included fields, like macroeconomics, finance, taxation and health policy. At the practical level, it underscores that sound policies must be informed by evidence, sensitive to long-term trade-offs, and adaptable to unexpected shocks. The monograph thus stands as both a contribution

to scholarly discourse and a reference point for policymakers, regulators, and practitioners navigating the current era of extraordinary challenges and profound transformation.

This introduction thus invites the reader to engage with the following chapters not merely as standalone contributions but as interconnected explorations of how financial markets and flows shape, and are shaped by, the profound challenges of our time. Presented monograph calls upon the reader to move beyond the surface of economic and financial debates and to enter a deeper contemplation of the forces that shape our societies and financial institutions. It has been crafted to convey knowledge, but also to evoke inquiry, to challenge assumptions, and to explore new research horizons. The reader is thus asked to approach the following pages with both rigor and imagination, allowing the work to serve as a companion in the search for understanding, as well as a stimulus for future thought and scholarly endeavour.

Prague, October 2025

doc. Ing. Jan Mertl, Ph.D.
editor

Part One

Topics of discussion panels as seen by their leaders

In this part, the four panels that took place during the first day of the conference are depicted and their topics are presented, summarized and extended by the leaders/moderators of those panels. In this sense, they used the emerged opportunity to create synthetic knowledge out of exploration and elaboration of the topics. As the panels´ themes were carefully chosen to comply with the main research focus of the conference, it makes an appropriate assessment of the content and thematic targeting of the whole event, as well as solid background and foundation for scientific exploration of those topics.

1. Panel 1: Stabilization of monetary policy – inflation and interest rates

Petr Budinský

Keynote Speaker:

- Jan Frait, Deputy Governor, Czech National Bank

Panellists:

- Miroslav Singer, Chief Economist, Generali CEE Holdings
- Jan Bureš, Chief Economist, ČSOB
- Vojtěch Šmajer, Analyst, OVB Allfinanz

Panel discussion was opened and moderated by Petr Budinský, Vice-Rector and Member of the Board of the University of Finance and Administration.

Keynote speaker prof. Jan Frait emphasized the importance of monetary policy and its tight link to the financial markets.

Introduction

The conference title contains the word “flows.” This title points to the dilemma that economists constantly face – whether to focus more on stocks or on flows. In macroeconomics, we have experienced quite significant shifts in this century. Since the 1990s, thinking was dominated by the idea that flows should be the primary focus, under the assumption that rational actors, supported by informed policymakers, would prevent stock imbalances from going too far (Frait, 2025). This assumption failed, leading to the global financial crisis and later the euro area debt crisis. As a result, we began to focus more on stocks – which, after all, is the role of macroprudential policy.

Covid-19 redirected our attention back to flows, and the new U.S. administration shifted the debate again toward international trade flows. At the same time, we are well aware of the risks associated with public debt levels, as well as the significant growth of assets held by non-bank financial institutions – particularly those that accept, transform, and distribute credit and liquidity risks. While this affects the domestic financial sector only to a limited extent, it still represents a significant indirect risk for our economy.

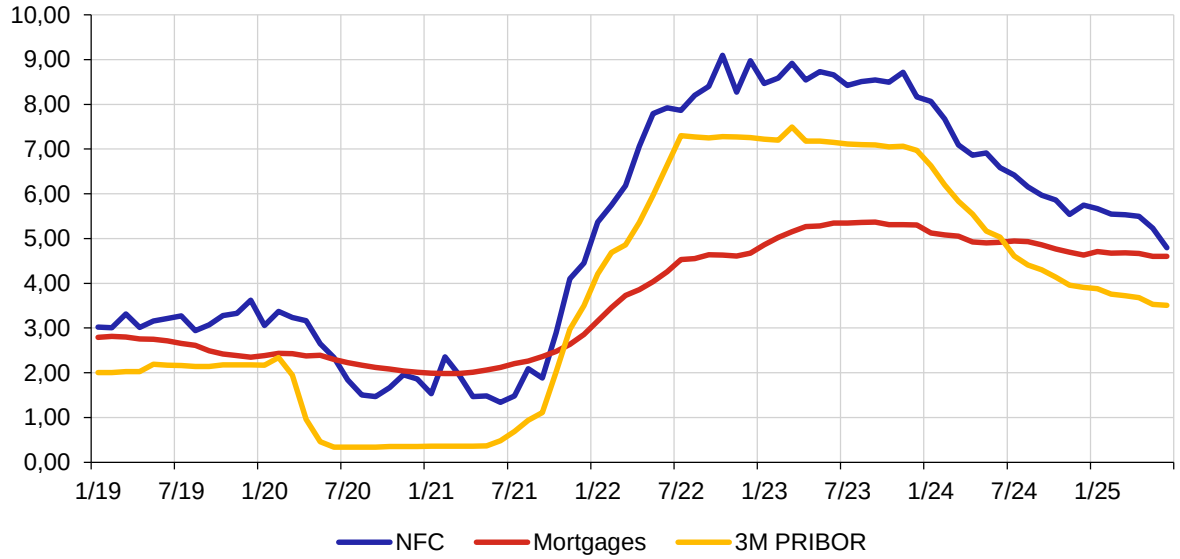
Current challenges

Since January 2025, many of us have been asking whether we are at the beginning of a historic event that may change the world. In my lifetime, the most significant such event, in terms of monetary and financial developments, was probably the collapse of the Bretton Woods monetary system. Market behaviour adjusted relatively quickly, but regulators and central banks were slower to adapt, as shifts of such nature are inherently difficult to grasp and require a change of mindset. Whether the current U.S. administration will reshape the world on a similar scale, I would not dare to predict.

The potential loss of the perceived value of the privilege of issuing a global reserve currency could undoubtedly have a historic impact. This privilege is potentially very powerful, but it requires a certain degree of responsibility – which comes at a cost (Gourinchas and Rey, 2022). For decades, the United States has benefited from this position, even though the current administration seems to downplay its value. Historically, the United Kingdom gave up this role to its own detriment. Many in the euro area believe that reserve currency status is automatic. However, without a degree of fiscal responsibility and self-restraint in economic policy, it is far from guaranteed. The end of today’s concept of reserve currencies would mark the end of the post–Bretton Woods system. I can imagine it happening – but not the full consequences it would bring.

By contrast, assessing the current domestic macroeconomic situation is less complicated. The economy clearly remains dual in nature, and its different segments would at first glance require different interest rates. This is, however, quite normal. At a deeper level, there is a broad balance that the policymakers should not attempt to disrupt through excessive activism. I agree that short-term corporate lending rates in koruna are relatively high (Chart 1), so the May 2025 repo rate cut made sense primarily in that segment. Otherwise, however, credit data and asset market indicators do not suggest the need for looser monetary or financial conditions.

Figure 1: Interest rates in the Czech economy (%)

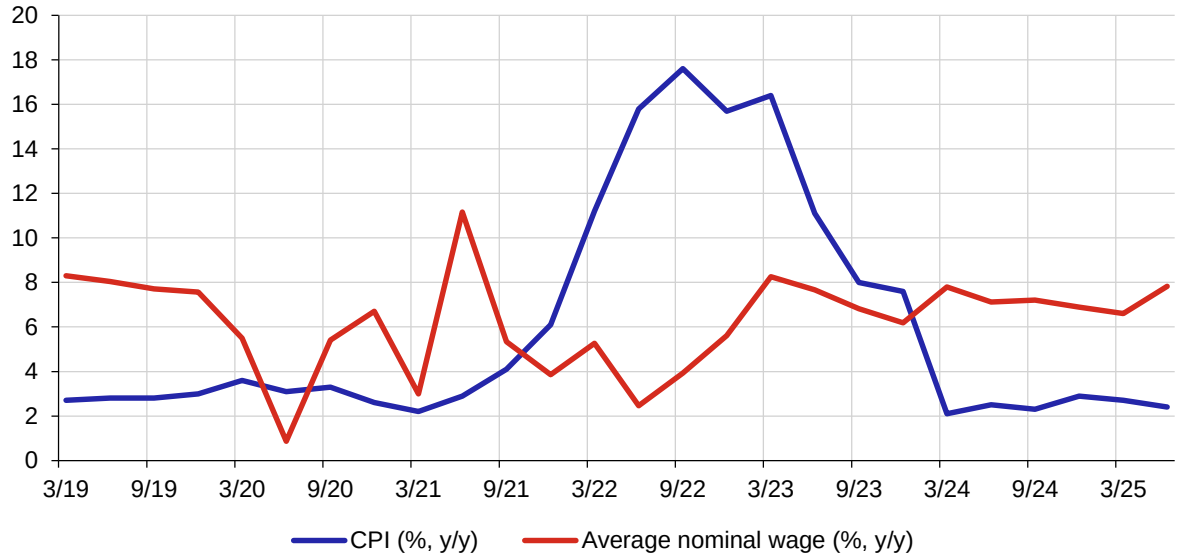


Source: ARAD CNB

External conditions, in my view, point rather toward lower rates. Domestically, however, pro-inflationary pressures persist. In particular, price growth in services continues to represent a significant inflationary risk. A moderately restrictive monetary policy therefore still seems appropriate. In today's uncertain environment, it is important to fine-tune cautiously, avoid binding commitments driven by fear, emphasize dedication to price and financial stability, and maintain readiness to respond flexibly.

Unsurprisingly, I see the labour market as a key factor for the future course of monetary policy. Wage pressures are strong, and broader demographic developments may create a long-term environment prone to such pressures. The CNB forecasts have long assumed that labour market tensions will ease – but this process is very slow and difficult to predict. Whatever happens in the economy, full employment persists, and the unemployment rate remains almost unchanged. This is the case even when macroeconomic variables that should affect or relate to unemployment change quite significantly.

Figure 2: Inflation and wage dynamics in the Czech economy



Source: CZSO

At first glance, this puzzle can be explained in a rather straightforward textbook way: that economic policy aims at full employment and adjusts its settings in a forward-looking way, effectively enough to achieve it. A similar hypothesis exists in monetary policy area. The governor of the Bank of England Mervyn King argued in 2005 that it was unsurprising that inflation remained unchanged despite changes in interest rates – because a smart central bank would adjust rates precisely to keep inflation at target. He called this the "Maradona theory of interest rates". Today we know that things are more complex – behind seemingly puzzling macroeconomic phenomena often stand structural, non-cyclical changes, which we still do not fully understand.

The interest rate trajectory in our May 2025 forecast reflects inflation at target, expected to remain there through 2026. Naturally, this points to a 3% rate. Deviations upward are also natural, as the forecast is the result of a partly technical process and assumptions. At the same time, we identify some risks of higher inflation both in the medium and longer term, which we consistently communicate. Should inflation occasionally fall below and at other times exceed the target, our risk assessment would change. However, inflation has remained above target for many years, except for the last month, so we are far from a "normal" regime.

The accompanying statement therefore says that "the CNB Board assessed the risks and uncertainties to the inflation outlook as being on balance slightly pro-inflationary. Domestically, persistent risks include the inertia of price growth in services and food. Any additional rise in overall public sector spending would increase the risk of inflationary fiscal policy. Higher wage demands in both the private and public sectors also represent an inflationary risk. Over the longer horizon, potential acceleration of money creation due to a stronger revival in credit activity – particularly in real estate – is a risk. Rising barriers to international trade pose risks to global growth, though their long-term inflationary effects remain unclear. The risk of significantly weaker performance of the German economy is partly mitigated by the fiscal stimulus planned by the new German government".

Conclusion

Before I conclude my introductory remarks, I would like to touch one issue that will certainly discussed at this conference. Number of analysts argue that we should almost mechanically follow the steps of the ECB and keep the EUR/CZK Euro interest rate differential stable. Here, the historical memory is instructive – more than 20 years ago the foreign investors were telling us that we could not have lower rates than the Fed, Today the suppose that we should avoid having higher rates than the ECB. However, the ECB is in a very different situation – both economically and institutionally – with a much broader mandate, in which – for example – climate policy objectives play a significant role. I have recently seen several research papers suggesting that lower ECB rates support innovation, particularly in green transformation investments. The CNB has no such mandate – nor do we observe any indication that the public or political representation would want to assign it to us. Our mandate is price stability. And through the joint action of monetary policy and macroprudential policy, we contribute to maintaining confidence in the value of the Czech koruna and safeguarding the stability of the macroeconomic environment.

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Miroslav Singer, Jan Bureš and Vojtěch Šmajer participated in the following panel. The discussion focused on the trade policy of the United States and its impact on the global foreign trade and the financial markets, especially on the bond market. Further on there was a deep discussion on the role and policy of the central banks where FED and ECB policies were discussed. Special attention was paid to the monetary policy of CNB and the expectations of future development of interest rates.

In recent years, the foreign trade policy of the United States has become the subject of intense debate. During his first term, President Donald Trump often portrayed international trade as something that weakens America and costs American workers their jobs. However, this view is overly simplistic. In reality, global trade has allowed the U.S. to import goods that were lacking in the domestic economy while focusing production on higher value-added industries. Over the past two to three decades, this has contributed to faster growth in average real household income in the U.S. compared to many other advanced economies.

The issue lies in how this growth has been distributed. Although average income has risen, the gains have not been shared evenly. A greater share of profits has gone to capital rather than labour, leading to a widening gap between rich and poor— more so than in Europe. This is largely a matter of institutional design, social policy, and other structural factors. In this

context, Trump offered a vision of renewed industrialization, emphasizing the need to bring employment back to manufacturing.

The debate over economic direction is not limited to the U.S. In developing countries, the question arises whether they should follow the traditional path of industrialization or skip directly to a service-based economy. The U.S. itself is now experiencing a strong wave of reindustrialization. In recent years, many new factories have been built — not primarily due to tariffs, as one might assume, but because of legislative initiatives such as the Inflation Reduction Act introduced under the Biden administration. Combined with cheap energy and generous tax incentives, these measures have attracted numerous European companies to invest in the U.S. They are drawn not only by favourable production conditions but also by access to relatively low-cost energy as a key production factor.

On the other hand, trade wars and the introduction of tariffs create significant uncertainty for businesses. Companies considering investment in the U.S. face difficult questions: How long will tariffs remain in place? How high will they be? And should they be factored into long-term strategic decisions?

Another key aspect of the global economic landscape is the situation in government bond markets. Particularly in advanced economies, shifts are emerging and they have major implications for fiscal policy. A case in point is Japan: yields on 30-year government bonds recently reached 2.5%, an unprecedented level by historical standards. Given Japan's extremely high public debt, this severely limits fiscal flexibility. For years, such debt levels were sustainable only because of exceptionally cheap financing. Once interest rates start rising, however, the entire fiscal equation changes, and the ability to finance debt over the long term is significantly weakened.

As for U.S. monetary policy, the dollar is not expected to come under substantial pressure in the medium term. Current economic shocks are mostly stagflationary—growth is slowing while inflation remains elevated. This creates major uncertainty around the future of U.S. public finances and forces the Federal Reserve to act with exceptional caution when setting interest rates. Financial markets themselves play a disciplining role, lending only to entities with sufficiently profitable projects. This dynamic was already visible in 2022, when, contrary to economists' expectations, the U.S. avoided a recession, while bond markets continued to rein in fiscal policy. Long-term investors are increasingly cautious, weighing whether capital lent for 30 years will actually be repaid.

The European Central Bank (ECB) presents a specific case. It maintains institutional independence, though its transparency is somewhat lower than that of some other central banks. Nonetheless, there is broad consensus that the ECB would be prepared to support member states in the event of widening budget deficits—for example, due to higher defence spending.

The Czech Republic faces its own challenges in shaping monetary policy. Two factors are crucial: labour market conditions and the exchange rate of the Czech crown. The Czech economy is characterized by low public debt, relatively stable growth, and a long-standing conservative approach by the Czech National Bank. However, different sectors of the economy require different levels of interest rates—for instance, the real estate market and the service sector respond differently to inflationary pressures. Meanwhile, signs of cooling in the labour

market suggest that real wages are unlikely to grow at the pace seen in previous quarters. Labor productivity has also stagnated over the past four years, posing another structural challenge.

It should be noted that any potential need for a major shift in Czech monetary policy is unlikely to arise from domestic factors but rather from external pressures. These are difficult to predict, as they can be either inflationary or stagflationary in nature. For example, if tariffs were to restrict U.S.-China trade and Europe failed to respond quickly, a surge of goods from China could flow into the European market—creating deflationary rather than inflationary pressures.

2. Panel 2: Impacts of extraordinary events on public budgets

Jan Mertl

Speakers and their Affiliations:

- Vladimír Bezděk, Chairman of the Board of Directors, AVANT Investment Company
- Tomáš Holub, Deputy Minister, Ministry of Finance of the Czech Republic
- Robin Maialeh, Vice-Rector for Science and Research, Škoda Auto University
- Lenka Farkačová, Economist and journalist, Department of Economics and Management, VŠFS
- Jaroslav Vostatek, Professor of Finance, Department of Finance, VŠFS

Panel discussion has been opened and moderated by Jan Mertl, associate professor at the Department of Finance, VŠFS.

The second panel was attended by five panellists representing the Ministry of Finance, an investment company, social science research institute and academia staff. The introduction was made by two short presentations containing essential facts about the development of public finances in the past period (Assoc. Prof. Holub - Deputy Minister of Finance, Ing. Bezděk - Avant investment company). The discussion focused on the impacts of extraordinary events on public revenues (taxes and insurance premiums), the pension system, financing of the public health insurance system, employment, the functioning of the labour market and forms of employment or economic activity. The panel also included an assessment of the balance of public budgets in relation to the development to date.

Introduction

The fiscal position of the state has, in recent years, been shaped by a combination of extraordinary events and long-term structural pressures. Large deficits have become a recurring feature of the budget, prompting close examination of their origins. Some of these imbalances can be traced to temporary shocks, such as the pandemic, which required emergency spending to protect public health and the economy. Others are embedded in the design of revenue and expenditure systems, making them harder to reverse. This raises a series of descriptive questions: what proportion of the deficit is cyclical versus structural; how debt servicing costs influence the budget; and how fiscal frameworks can be designed to allow flexibility in crises without eroding long-term discipline.

Demographic change, particularly the ageing of the population, is a slow but powerful force shaping public finances. As life expectancy rises and birth rates remain low, the share of retirees in the population increases, placing greater demands on pension systems, health care, and long-term care services. The questions here are not only about numbers, but about structure: how the ratio of workers to retirees will evolve; whether retirement ages should adjust automatically to life expectancy; how older workers can be supported to remain in the labour force; and what preventive health strategies could reduce the intensity of age-related spending.

Public expenditure priorities form another layer of complexity. Pensions and health care already consume a large share of the budget, but other areas — such as infrastructure renewal, defence obligations, and the energy transition — also require sustained investment. This leads to questions about how governments decide between competing needs, how they measure the long-term returns of different types of spending, and how they protect essential investments from being crowded out by short-term political pressures or urgent but temporary demands.

The tax system is the main channel through which governments raise the revenue needed to fund these commitments. Its structure — the balance between direct, indirect, and property taxes — affects both the stability of revenues and the distribution of the tax burden. Recent adjustments to personal income tax and social insurance contributions have had limited impact on the fiscal gap, prompting questions about whether the current mix is optimal. There is also the matter of adaptability: how the system can respond to economic changes such as digitalisation, cross-border work, and the growth of platform-based employment, while maintaining fairness and efficiency.

Social protection systems, particularly sickness insurance, came under renewed scrutiny during the pandemic. Gaps in coverage for self-employed individuals highlighted the unevenness of the safety net. This raises descriptive questions about the scope of coverage — whether sickness insurance should be mandatory for all workers — and about contribution rates, benefit levels, and the integration of sickness insurance with other forms of social protection. The design of such systems must also consider how to encourage compliance and prevent misuse without creating barriers to access.

The pension system itself is subject to pressures from both demographic change and inflation. Indexation mechanisms, which adjust benefits in line with prices or wages, protect retirees' purchasing power but can significantly increase fiscal costs during periods of high inflation.

This prompts questions about whether these formulas should be modified, how to balance fiscal sustainability with income security for retirees, and what role supplementary pension savings might play in reducing reliance on the public system. Early retirement provisions also raise questions about equity and labour market effects.

Health care financing must reconcile the goal of universal access with the need to control costs. Ageing populations and advances in medical technology are likely to increase spending, leading to questions about the optimal balance between public and private funding, the potential role of optional or supplementary services, and strategies for maintaining quality without unsustainable growth. The pandemic experience also raises the question of how health systems can be made more resilient to future shocks, whether through stockpiles, flexible staffing, or investment in research and surveillance.

Housing policy has emerged as both a social and fiscal issue. Rising housing costs have increased demand for public support, such as housing allowances, and have broader implications for social stability and economic mobility. This leads to questions about the most effective ways to improve affordability: whether through expanding supply via public investment, reforming planning regulations, or supporting demand through subsidies and mortgage products. The effectiveness of tools like multi-generational mortgages, and their potential unintended consequences, is also part of the discussion.

The questions – or better say problem areas and challenges, as they are ongoingly and inherently present in reality – for scientists and policy makers that outcome from abovementioned issues can be summarized as follows:

- What are the main drivers of the current budget deficit? Are they cyclical or structural, and what pace of consolidation is realistic?
- How can public debt be stabilised while meeting multi-year commitments such as defence, ageing society and energy investments?
- How can the high share of mandatory and quasi-mandatory spending be managed to increase fiscal flexibility?
- Should the retirement age be linked to life expectancy? How could we take into account healthy life expectancy? How should indexation be adjusted in high-inflation periods?
- How will ageing affect the ratio of workers to retirees, and what policies can support older workers' employment?
- What is the optimal balance between public and private funding, and how can quality be maintained without unsustainable cost growth?
- Should sickness insurance be mandatory for all workers, including the self-employed, and how should contributions and benefits be set?
- Is the current tax mix optimal? Which taxes could be adjusted or introduced to ensure stable revenues while maintaining equity?
- How will remote work, cross-border employment, and changing skills demand affect taxation and social insurance?
- How should limited fiscal resources be allocated among pensions, health, infrastructure, defence, and the energy transition?
- How can fiscal policy shift from reactive crisis management to a strategic, priority-driven approach?

Extraordinary events as fiscal stress tests

Extraordinary events are best understood as exogenous shocks to the fiscal system. They usually reduce the revenue base while simultaneously increasing expenditure needs. During the pandemic, for example, many economies experienced a dramatic contraction in value added tax and corporate income tax receipts, at the very moment when health systems and furlough schemes required additional resources (IMF, 2021). Similarly, the energy price surge in 2022–2023 forced European governments to deploy extensive subsidy and compensation schemes in order to protect households and firms from inflationary pressures (European Commission, 2023).

These dynamics underline that extraordinary events act as fiscal stress tests, exposing structural weaknesses that might otherwise remain hidden. Overreliance on cyclical revenues, limited fiscal buffers, and rigid expenditure commitments make budgets particularly vulnerable. As Blanchard (2019) has argued, fiscal policy in advanced economies must not only stabilize demand but also prepare for shocks by maintaining credible and sustainable debt paths. In this sense, fiscal resilience cannot be treated as a temporary concern; it must be embedded into long-term budgetary planning.

Fiscal situation in Czechia

Over the past half-decade, the Czech Republic's public finances have been tested by a sequence of extraordinary events that have left a lasting imprint on both the budget balance and the debt trajectory. The first major shock came with the COVID-19 pandemic, which pushed the general government balance into a deep deficit. This deterioration was driven partly by one-off emergency measures and partly by a weakening of both the structural and cyclical components of the budget. The fiscal consolidation that began in the immediate aftermath was abruptly interrupted by the Russian invasion of Ukraine and the subsequent energy crisis. These events required further large-scale interventions to shield households and businesses from price shocks, delaying the return to pre-crisis fiscal conditions.

By 2024, a government consolidation package had reduced the headline deficit to around 2.2% of GDP, with the structural deficit just under 2%. Under the fiscal rules, this structural gap must be brought below 1 % by 2028. Public debt, which had been close to 30% of GDP before the pandemic, now stands in the mid-40% range. While this remains comfortably within the Maastricht limit and compares favourably with many EU peers, the fiscal space is narrower than in the past. The debt path is also shaped by multi-year commitments, including a legislated exemption allowing defence spending to remain above 2% of GDP for at least eight years, and the financing of the Dukovany II nuclear power project.

A central theme in the data is the expenditure side. Pensions are the largest single component. Surpluses in 2017–2018 were used for above-standard benefit increases, and the suspension of the link between retirement age and life expectancy has worsened long-term sustainability. The inflationary surge of 2021–2023 triggered automatic indexation that sharply lifted the average replacement rate from under 40% before the pandemic to nearly 50%. This prompted extraordinary legislative action to limit the increase and the adoption of a pension reform package in 2023–2024. Even so, demographic ageing will continue to exert upward pressure on the system.

The broader spending profile reflects both cyclical and structural drivers. Emergency measures during the pandemic and energy crisis lifted expenditure ratios sharply, and while consolidation has partially reversed this, spending remains above pre-crisis levels. On the revenue side, the consolidation package restored receipts to roughly their pre-COVID share of GDP, but with a changed structure. The abolition of the "super-gross" wage base for personal income tax — a decision supported across the political spectrum — reduced revenues significantly, and its long-term effects are still being absorbed. Smaller adjustments, such as the 0.6% employee contribution to sickness insurance introduced in 2024, have improved the balance of that subsystem, illustrating how targeted changes can stabilise individual components of the public finances.

Looking forward, the fiscal outlook is shaped by several unavoidable pressures. Ageing will increase costs for pensions, health care, and long-term care. Defence and infrastructure investment will require sustained funding. The energy transition will demand large-scale capital spending. At the same time, the tax system may require structural changes to ensure adequate and stable revenues, with attention to the balance between different tax types, the distribution of the burden, and the capacity to adapt to economic changes such as digitalisation, cross-border work, and new forms of employment.

The discussion also underlined a political-economic asymmetry: rapid fiscal expansion is politically and administratively easy, but consolidation is slow and difficult. Between 2018 and 2019, strong economic growth was not used to build fiscal buffers; instead, spending expanded. This pattern continued into 2020–2021, with the pandemic response adding to the momentum. The fiscal expansion of those years contributed to the domestic demand component of inflation, which then combined with external shocks from war and energy prices. The budget for 2026 is identified as a critical test of whether the state can shift from reactive, crisis-driven measures to a more strategic, priority-driven approach. This would involve clearly identifying what is and is not a priority, aligning spending with defined policy goals, protecting reforms that improve long-term sustainability, and basing decisions on evidence rather than short-term political considerations.

In sum, the current Czech fiscal position is not yet in crisis by EU standards, but the combination of high mandatory spending, demographic trends, and recent policy choices leaves little room for complacency. The challenge is to move from managing immediate shocks to planning for the structural realities of the coming decades — a shift that will require both political will and sustained public engagement.

Public budgets and financial markets

Extraordinary events also affect the relationship between public budgets and financial markets. Governments often face a paradoxical dual pressure: they must increase borrowing to finance widening deficits, while at the same time investor confidence may weaken, leading to higher sovereign risk premia. This was evident during the European sovereign debt crisis of 2010–2012, when doubts about repayment capacity resulted in escalating borrowing costs for several member states (De Grauwe and Ji, 2013). By contrast, the pandemic demonstrated that under conditions of accommodative monetary policy and strong institutional credibility, states could finance unprecedented fiscal expansions without immediate solvency crises. The interaction between extraordinary events and financial markets illustrates the feedback

loop at the core of fiscal governance. Budgets stabilize the economy during shocks, but the scope of this stabilization depends on whether markets are willing to finance governments at reasonable costs. In turn, market sentiment is influenced not only by debt levels but also by the perceived quality of fiscal institutions and the clarity of long-term strategies. Transparency, timely communication, and credible medium-term fiscal frameworks therefore play a central role in anchoring expectations (OECD, 2022).

Policy responses and fiscal trade-offs

Government responses to extraordinary events typically unfold in two phases. The immediate priority is stabilization. This involves emergency spending measures such as direct transfers, subsidies, enhanced healthcare outlays, or liquidity guarantees. The medium- and long-term stage then requires structural adjustment through tax reforms, targeted consolidation, and debt management strategies. The transition between these phases is politically delicate, since premature austerity can undermine recovery, while prolonged deficits may erode fiscal credibility.

Historical experience confirms the difficulty of balancing these trade-offs. After the global financial crisis, several European countries introduced consolidation measures that, while restoring fiscal discipline, arguably prolonged stagnation (Stiglitz, 2016). In contrast, the post-2020 fiscal response was marked by an unprecedented willingness to use expansionary policy, supported by supranational instruments such as the EU Recovery and Resilience Facility. This illustrates that fiscal strategies must remain context-sensitive: the sequencing of emergency support and consolidation cannot be standardized but requires careful calibration to prevailing economic and financial conditions.

Intergovernmental dimensions of extraordinary events

Extraordinary events often reveal asymmetries within multilevel fiscal systems. Central governments usually bear the responsibility for large-scale stabilization policies, yet regional and local governments face immediate service delivery pressures, frequently with more limited revenue autonomy. The pandemic underscored this imbalance: municipalities across Europe experienced dramatic declines in local taxes while being obliged to sustain essential services such as healthcare provision, education, or social support (Allain-Dupré et al., 2020).

This experience points to the importance of intergovernmental fiscal coordination and well-designed transfer mechanisms. Without adequate burden-sharing arrangements, extraordinary events risk creating vertical fiscal imbalances that undermine the functioning of decentralized governance. Fiscal federalism literature consistently highlights the necessity of ensuring that subnational governments are equipped with either sufficient resources or compensatory transfers to manage crises effectively (Oates, 1999). In Czechia, this has been seen as the disproportion between the balance of the government budget and regional budgets, where the government budget during the extraordinary events experienced large deficits, while many regional budgets have good balance.

The Czech fiscal experience from extraordinary events

The Czech Republic provides a relevant case study of how extraordinary events reverberate through public budgets. Like many European states, Czechia entered the pandemic with

relatively sound public finances, characterized by a debt-to-GDP ratio below the EU average and a tradition of fiscal discipline (Ministry of Finance of the Czech Republic, 2019). However, the twin shocks of the COVID-19 crisis and the subsequent energy price surge profoundly altered this trajectory.

Between 2020 and 2023, Czechia experienced the fastest deterioration of its fiscal balance in modern history. Pandemic-related measures, including compensation schemes for businesses, wage subsidies, and expanded healthcare expenditure, pushed the general government deficit above 6% of GDP in 2020. Energy compensation packages in 2022–2023 further strained public accounts. At the same time, structural factors such as demographic change and generous pension indexation increased medium-term expenditure pressures (OECD, 2023).

Revenue developments provided only partial relief. While VAT and income tax collections rebounded with the post-pandemic recovery, the abolition of the "super-gross wage" tax base in 2021 permanently reduced personal income tax revenues, narrowing fiscal space. The combined result was a structural deficit that persisted even after the acute phase of the crisis, raising concerns about long-term sustainability.

Financial markets, however, remained broadly supportive of Czech government borrowing. Thanks to low initial debt and the credibility of Czech fiscal institutions, government bond yields stayed manageable, even as borrowing requirements increased substantially. Nevertheless, the return of higher interest rates in 2022–2024 meant that debt servicing costs began to rise more visibly, reinforcing the need for credible consolidation strategies. Czech fiscal policy thus illustrates many of the broader themes discussed in this chapter. Extraordinary events created both acute expenditure needs and permanent structural shifts in the revenue–expenditure balance. The key policy challenge lies in sequencing: while fiscal expansion was indispensable during the pandemic, credible medium-term consolidation is now necessary to prevent debt ratios from rising on a sustained basis. As the Ministry of Finance has emphasized, restoring fiscal stability requires a combination of expenditure discipline, pension reform, and efforts to broaden the tax base (MFCR, 2024).

Long-term implications for budgetary and fiscal policy

While extraordinary events are temporary by definition, their fiscal consequences can persist longer. Debt accumulation is one of the most obvious outcomes, as large-scale crisis borrowing translates into higher long-term interest obligations. Beyond debt, however, these events frequently shift the composition of public spending. Healthcare, defence, or energy security tend to gain prominence and can lead to permanent expansions in baseline expenditure.

Another lasting implication is institutional reform. Extraordinary shocks often act as catalysts for the introduction of new fiscal rules, stabilization funds, or supranational coordination mechanisms. The creation of the European Stability Mechanism after the sovereign debt crisis and the adoption of the Recovery and Resilience Facility in response to the pandemic exemplify how crises can reshape fiscal architecture (Buti and Carnot, 2018). Yet these reforms also carry the risk of crisis-driven inertia, where temporary emergency measures become politically entrenched and difficult to reverse. Policymakers must therefore remain vigilant in

ensuring that extraordinary spending remains targeted, time-limited, and transparently managed.

Lessons for fiscal governance

Several broad lessons can be drawn from recent extraordinary events. First, fiscal buffers must be built during economic upturns to provide room for maneuver in downturns. Second, reliance on narrow or cyclical tax bases should be avoided to reduce vulnerability. Third, transparency and clear communication are indispensable for maintaining market confidence. Fourth, supranational coordination—particularly in the European context—offers a means of mitigating asymmetric shocks and pooling fiscal risk. Finally, governments should invest in resilience-enhancing capacities, such as healthcare infrastructure, digital transformation, and green energy, which reduce the fiscal cost of future crises by addressing vulnerabilities at their root.

For Czechia specifically, the current fiscal challenge illustrates that temporary expansions can quickly solidify into structural deficits if not countered by institutional reforms. The lesson is that resilience must be underpinned not only by fiscal space but also by long-term reforms that adapt public finances to demographic, energy, and technological transitions.

Conclusion

Extraordinary events remind us that public budgets are not merely annual accounting exercises but essential instruments of societal resilience. Their role extends far beyond balancing revenues and expenditures: they stabilize economies, protect vulnerable groups, and sustain market confidence in times of uncertainty. Yet they also face enduring challenges, from debt accumulation to shifting expenditure priorities and institutional inertia. The Czech case demonstrates that even fiscally conservative economies are not immune to sudden deterioration when extraordinary events strike. The combination of pandemic-related spending, tax policy changes, and energy crisis interventions transformed a historically disciplined budget into one facing persistent deficits. Restoring sustainability without undermining growth is thus the central fiscal challenge for the coming decade.

The discussions at the Financial Markets and Flows 2025 conference confirm that the design of fiscal policy in the face of extraordinary events must integrate both immediate responsiveness and long-term sustainability. Achieving this balance requires careful sequencing, credible communication, and a willingness to adapt institutional frameworks to evolving challenges. In the final analysis, the capacity of public budgets to withstand extraordinary events is a cornerstone of economic stability and an essential condition for the functioning of financial markets and societies at large.

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3. Panel 3: Effects of energy sector changes on entrepreneurs

Lubomír Lízal

Speakers and their Affiliations:

- Tomáš Hüner, Member of the Energy Regulatory Office board
- Jessica Johnson, Nuclear Europe, a think tank based in Brussels promoting the nuclear energy sector in Europe
- Jan Lučan, Member of the board of the Československá obchodní banka (ČSOB)
- Libor Němeček, Director of Mergers and Acquisitions at Agrofert Group

Panel discussion has been opened and moderated by Lubomír Lízal, Associated Professor at VŠFS and ČVUT.

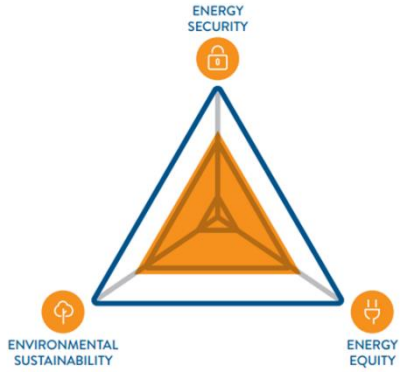
*The third panel focused on the **critical interconnection between financial markets and energy issues**, drawing parallels between the challenges and opportunities faced by both sectors and their interdependence, namely issues related to regulations in both sectors and consequent interconnection issues in financing. The discussion explored, in particular, how energy policies, technological advancements, and geopolitical shifts profoundly impact investment decisions and economic stability due to energy transition. Specific focus was on effects of regulation development in both sectors. This chapter builds on the discussion, but the views are solely of the author and should not be attributed either to any institution or speakers of the conference.*

Introduction - the energy trilemma

A foundational concept guiding any energy discussion should be the “energy trilemma”, which seeks to achieve **affordability** (sometimes also referred to as **equity** or **costs**), **sustainability**, **and security** in energy supply. Simultaneously achieving all three is a complex challenge, necessitating careful cost-benefit analyses in policymaking and investment. This inherent difficulty means trade-offs are often unavoidable as simple straightforward cost-benefit analysis does not suffice, and the choice is not one-dimensional but reflects political choices that might vary over the regions as well as over time.

A critical interconnection between financial markets and energy issues has been explored, drawing parallels between the challenges and opportunities faced by both sectors and their interdependency, namely issues related to regulations in both sectors and consequent interconnection issues in financing. The discussion explored, in particular, how energy policies, technological advancements, and geopolitical shifts profoundly impact investment decisions and economic stability due to energy transition. Specific focus has to be put on effects of regulation development with interconnected consequences in both sectors.

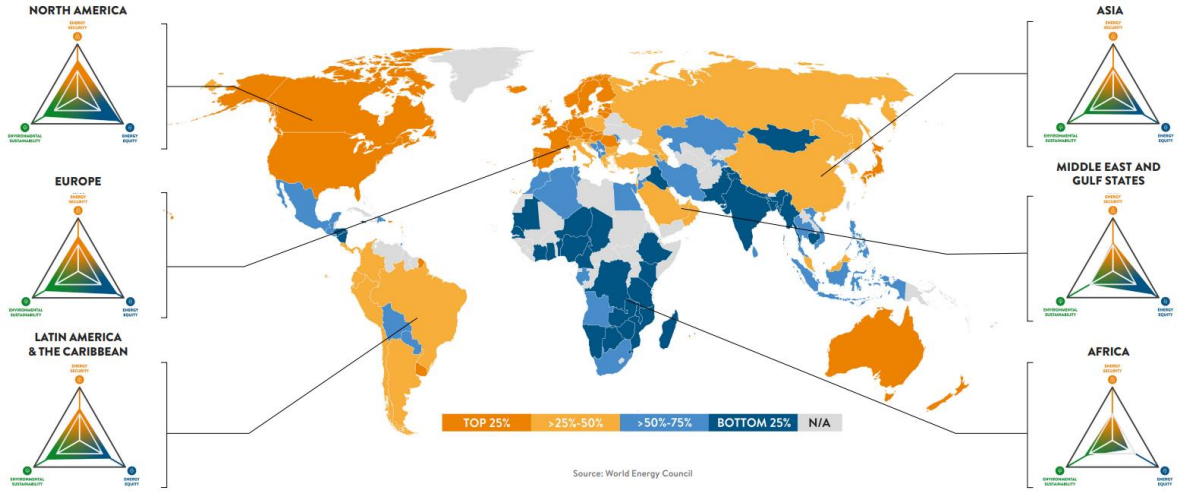
Figure 3: The energy trilemma scheme



Source: WEC (2018)

How difficult it is to achieve the right balance can be illustrated with global differences where the less developed world is lagging behind in all three dimensions. The WEC Index (2018, 2013) serves as a benchmarking tool across regions and countries. The index can be used by policymakers to compare and evaluate effects of energy policies over time and regions. The China is often cited as the fastest RES adopter, yet it also relies on classical carbon based (and nuclear) means of electric generation. Unlike other world regions EU has put emphasis on sustainability as it has been believed that the other two vertices were almost achieved and would not be compromised. However, after the attack on Ukraine and blackout in Spain the pertinent question is whether these beliefs of uncompromised equity and security were not ill-founded. This chapter shall shed light on the changes we witness.

Figure 4: The WEC index



Source: WEC (2023)

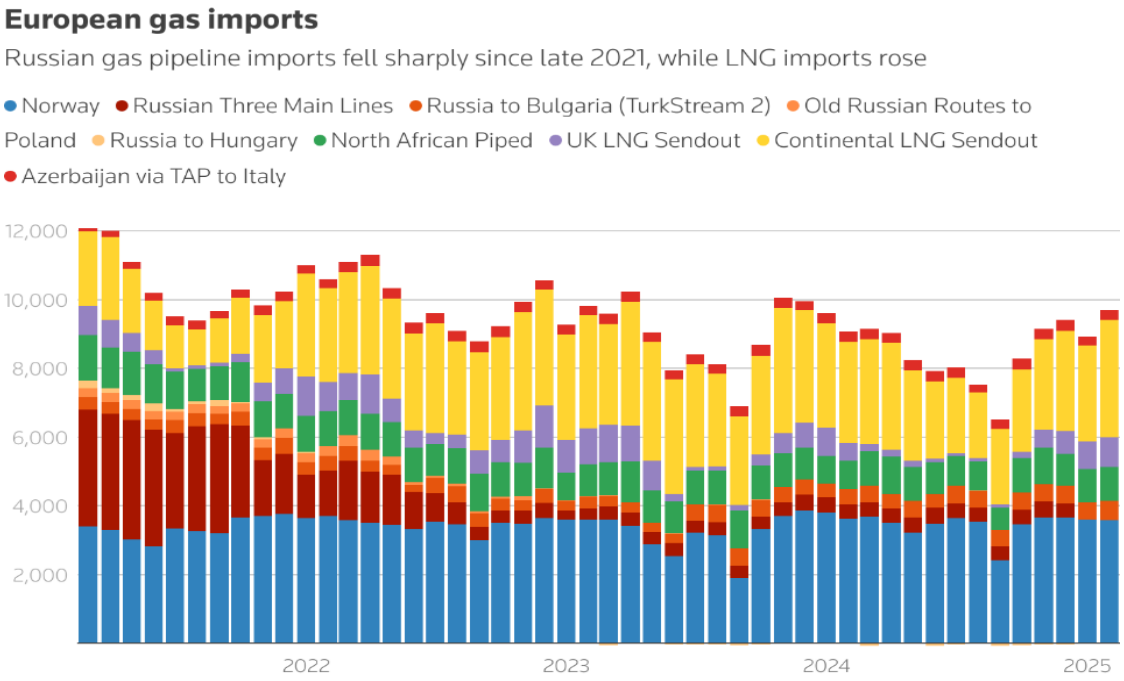
Czech Republic have got lately an overall score of 78 and a rank of 12 in the 2023 World Energy Trilemma Index. Due its exporting abilities the Czech Republic is classified in best category A in Energy Security, and in B (middle above average category) in both Energy Equity and Environmental Sustainability vertices.

Energy independence and geopolitical imperatives

The concept of energy independence is critical security issue, especially given Europe's historical and recent vulnerabilities. Lessons from the 1970s oil crisis, which led to "going nuclear" for self-sufficiency, have not lost their relevance today. In this light we can evaluate the concept of EU energy transition that has been partly fueled by cheap Russian gas supplies. That anti-nuclear (peace) movement was financed from Russia is a known fact (e.g., CIA, 2007). Yet the top EU decision makers are reluctant to acknowledge (EP, 2022a, b) that these motivations were present and such security issues do exist (Stegen, 2011). Energy dependency poses a real threat, and its denials were EU self-imposing security and economic vulnerabilities.

The potential security risks materialized. Russia's invasion of Ukraine served as a stark and severe reminder of Europe's external energy dependency and the vulnerabilities inherent in relying on external, potentially hostile, sources. Russian gas imports have fallen dramatically, from 45% of EU imports in 2021 to 19% in 2024.

Figure 5: European gas imports 2021-2025



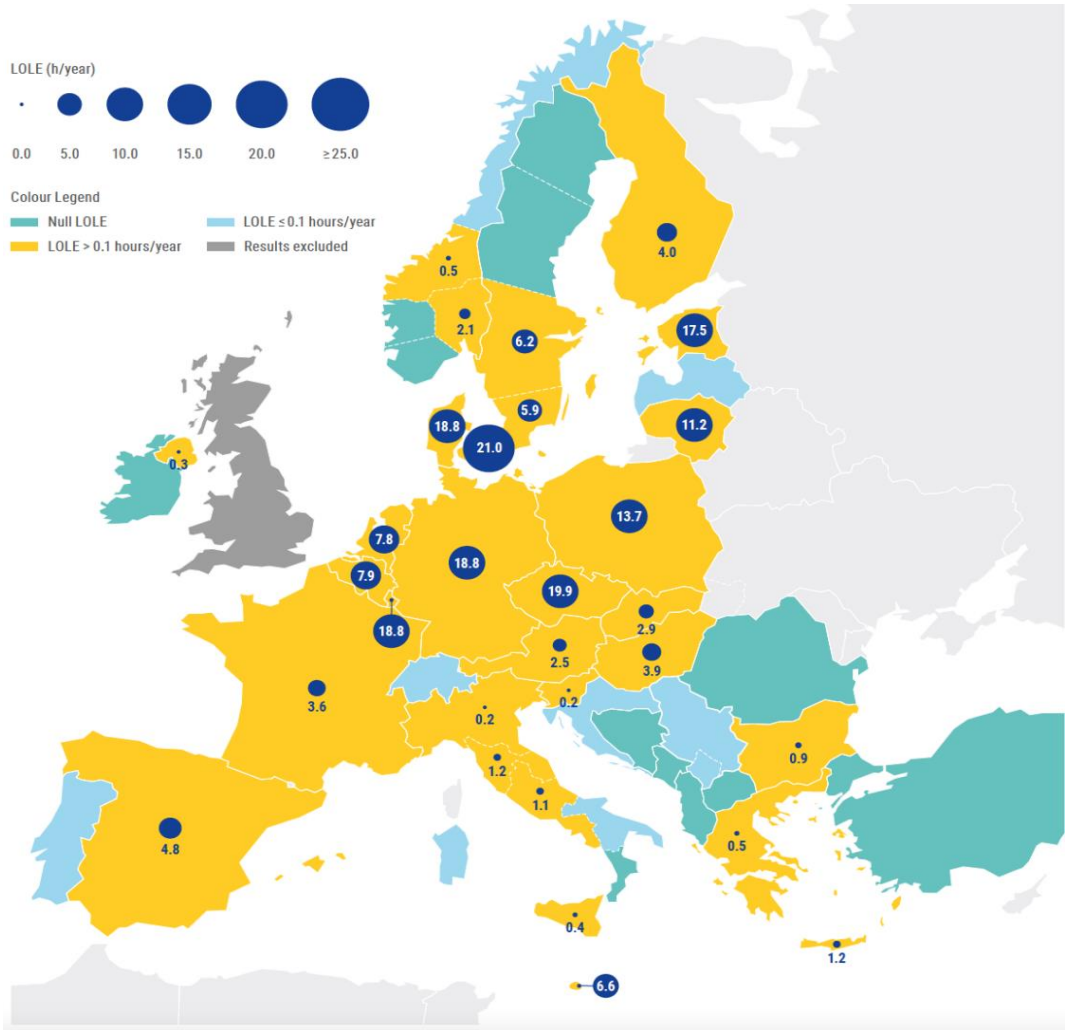
Source: Reuters, https://www.reuters.com/sustainability/climate-energy/eu-set-out-plan-phasing-out-final-russian-gas-supplies-2025-05-06/

This geopolitical event triggered a significant policy shift aimed at both gas source reshuffling and increasing European capacity in nuclear fuel (uranium enrichment and conversion) and essential components, thereby reducing reliance on potentially problematic geopolitical counterparties.

The Czech Republic faces a unique and urgent challenge: phasing out coal production within 7-12 years without having commenced construction on new nuclear sources. This creates a severe time crunch, forcing decisions while facing a shift from electricity exporting country to deficient one, highlighting both economic and security vulnerabilities within several years. ENTSO-E (2024) report shows that the Czech Republic will be, in 2028, the second worst region in terms of energy deficiency/security measured by metric LOLE.[1]

[1] LOLE represents the number of hours per annum in which, over the long-term, it is statistically expected that supply will not meet demand.

Figure 6: LOLE metric, Europe



Source: ENTSO-E (2024)

Renewable energy sources and grid challenges

The intermittent nature of sources like wind and solar poses significant grid stability challenges, necessitating massive investments in grid infrastructure and storage solutions. In essence, until we have massive and economically viable long-term storage of electric energy we must rely on balancing production and consumption at any time.

Despite these challenges, solar technology has advanced to be viable without subsidies in some European countries. Combining solar with battery storage and hydrogen generation can mitigate risks and enhance project viability by smoothing the risk curve. However, it has to be reiterated that renewables alone cannot guarantee the 24/7 stable supply required by energy-intensive industries. Theoretically, combining solar with battery storage and hydrogen generation can mitigate risks and enhance project viability but the economics of these projects is detrimental, and we still lack efficient, economically viable, long-term storage technologies to couple it with intermittent resources.

Renewables, particularly solar and short-term storage systems, face also considerable technological risk due to rapid innovation cycles, making long-term viability predictions

difficult. New, more efficient technologies can quickly emerge, potentially disadvantaging older installations.

Natural gas and its strategic importance

Beyond electricity generation and heating, natural gas is an irreplaceable chemical input for critical industries, such as fertilizer production. Yet the main challenge for natural gas in Europe is its relatively high price compared to global markets, which significantly undermines both European industrial competitiveness as well as its necessary primary agriculture input.

Thus, using gas purely for electricity generation can be seen as a "luxury" given its other essential industrial applications. However, if we must constantly balance demand and supply, gas is the only cheap and sufficiently flexible source available to deliver large volumes of dispatchable electricity today.

Energy-intensive industries, such as chemical production, require stable and reliable energy sources 24/7. Stoppages are immensely costly (e.g., millions of euros and weeks for a modern units to shut down and restart). This economic pressure leads some European industries to seriously consider transferring energy-intensive parts of their production outside Europe, importing intermediate products (like ammonia) back for final processing. This ensures competitiveness while maintaining some production in Europe, also for food security reasons related to fertilizers.

Hydrogen is a potential means of energy storage and transportation, but it requires huge infrastructure investments and faces storage and safety challenges. Ammonia, with its higher energy density and safer transport capabilities, was presented as a more promising energy carrier, especially for the chemical industry, which already uses it extensively. Ammonia is thus often seen in the chemical industry as a more promising energy carrier due to its higher energy density and safer transport than hydrogen.

In terms of a general security mentioned earlier, reliance on natural gas from any politically unstable regions presents a substantial risk to energy security. The only long-term solution is diversification.

Energy investment landscape and risks

Investors universally demand predictability, stability, and a clear long-term vision. The energy sector and energy investments are no exception to these rules. Financing long-term projects, be it highways or nuclear plants, requires conditions such as predictability, guarantees of viability, and technical fitness for long operational periods.

On the contrary, new geopolitical and self-introduced regulatory uncertainties in Europe, exacerbated by rapid policy shifts (like the Green Deal), can deter investments, potentially leading energy-intensive industries to relocate production outside Europe.

The long-term nature of energy projects (e.g., like 100-year bridges) necessitates not only planning for all the common business risks but also for future policy shifts. And this particular component, the unmeasurable risks (or uncertainties) of changing the playing field retroactively, makes all risk premia excessively high.

Key risks for investors, in addition to the major policy risks mentioned above, include technological risk (rapid obsolescence in renewables/storage), grid risk (uncertainty about the

grid's capacity to handle new, diverse energy inputs), and market risk (lack of long-term off-take agreements).

Europe has demonstrably underinvested in its energy system for decades, often for ideological reasons. This has led to the current scramble to deploy new capacity, which cannot happen overnight. Decarbonization efforts, while necessary for environmental goals, entail significant costs that directly impact Europe's industrial competitiveness. Industries in Europe are losing ground to global competitors due to high energy prices.

ESG (environmental, social, and governance) and finance

ESG regulations are increasingly shaping the financial landscape, presenting both business opportunities and new compliance requirements and costs for banks and industries. Effective ESG reporting is often seen and resented as a crucial tool for managing significant risks and opportunities, extending beyond traditional financial statements to encompass climate change impacts, human rights, and reputational factors. This "de-risks" future decisions and attracts long-term capital.

The complexity of ESG reporting, particularly for smaller and medium-sized enterprises (SMEs) in supply chains, could not be just a challenge, requiring significant capacity and IT investments, but detrimental competitive disadvantage on the world market. There's an ongoing debate on whether excessive EU pressure on environmental aspects might harm European economies while other global players like India, Russia, China, and the USA produce significant greenhouse gases with less stringent regulations. We should be cautious, the past narrative that “green” firms would be more profitable has been after quite a long time resolved in favor of the opposite: financial performance improves environmental one (e.g., Earhart and Lizal, 2006) and only the financially strong and profitable firms could afford to be greener than the rest. The very same might happen with ESG, the ESG firms underperform according to FT (2023), but that shall not be surprising – as part of the ESG comes from the good environmental performance in the previous causality dispute.

However, the importance of quality data for any business decision is unquestionable. The discussion touched on sustainable finance as a mechanism to create a less risky investment profile for projects (e.g., high-speed rail) that contribute to sustainability, thereby attracting institutional investors like pension funds. The upcoming "digital product passport" for common and construction products, which will include information like emissions footprint, indicates that without meeting these ESG-related data requirements, products may not even be sellable in the future. Should this be true, then blockchain technology will become a natural instrument providing publicly accessible traceability and verifiability of various inputs in production chains.

Conundrum solution and the role of nuclear energy

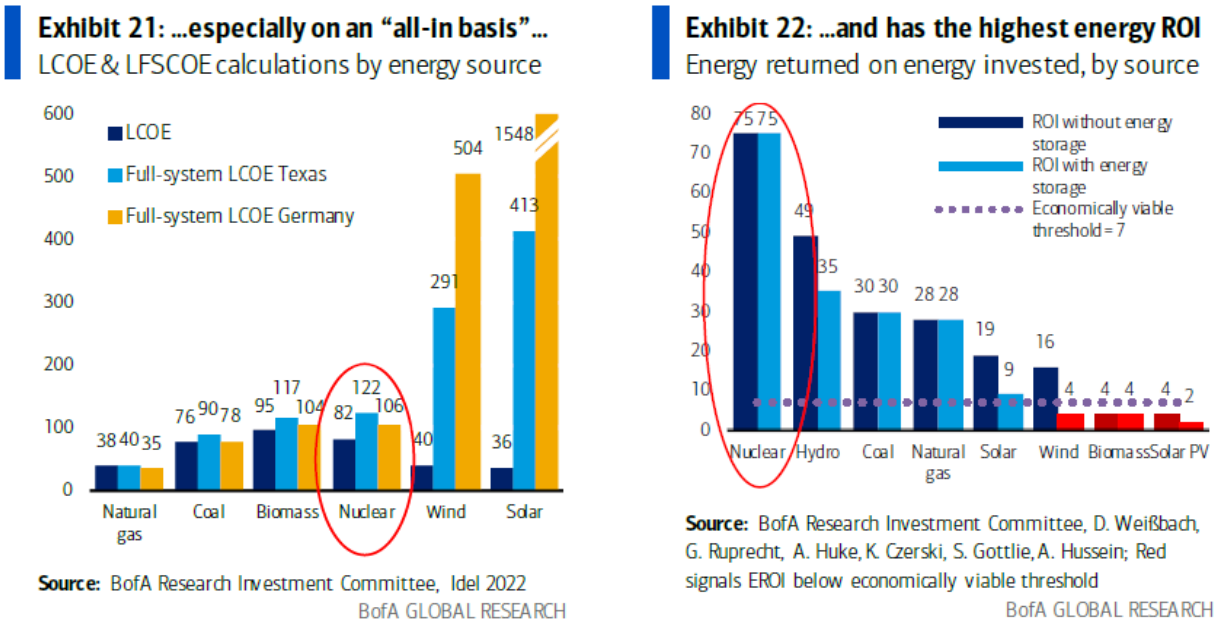
Nuclear energy is increasingly recognized as a vital component for security of supply and cost reduction, particularly during periods of energy crisis. It offers a stable, non-intermittent source of power. While nuclear projects come with high upfront costs, they boast a very long operational lifespan (60-80 years for new reactors). This long-term stability makes them attractive to certain investors, such as pension funds, who prioritize predictable, long-term returns over short-term gains.

A clear, long-term vision from the EU is essential to provide the investment certainty needed to politically de-risk nuclear projects and attract the significant private financing required. The nucler industry needs equal level playing field. We can note a positive shift in the EU's approach, moving towards a more "technology-neutral" stance and initiatives like pilot programs for Power Purchase Agreements (PPAs) for nuclear. Recently, there is also shift in German positions (FT, 2025).

Small Modular Reactors (SMRs) represent a growing area of innovation, offering lower upfront costs and significant versatility – yet their major disadvantage currently lies in the same legislation as for large projects and in higher costs in terms per unit of installed MW. However, SMRs can be integrated into industrial clusters to provide industrial heat, facilitate decarbonized hydrogen production, and offer greater operational flexibility, including the ability to ramp up and down output. The "Mankala model" from Finland, where industries invested in nuclear plants, can be cited as an example of downstream users directly investing in SMRs.

According to BoA (2022) the nuclear option is the best economic choice when we do consider also induced costs of the technologies (be it costs of backup, grid upgrade or pollution).

Figure 7: LCOE and LFSCOE calculations by energy source; Energy returned on energy invested by source



Source: BofA Research Investment Committee (2022)

Policy conclusions

The so-called Energy Transition suffers from similar types of policy design and implementation failures as have been identified both for liberalization of network industries (Bergman et al, 1998, Lizal, 2000) and for the economic transition in Central and Eastern Europe by "Nobel" laureate J. Stiglitz (Stiglitz, 1999a, 1999b, and Ellerman and Stiglitz, 2001). In this respect the main "political economy" recommendations are:

1. Sequencing and pacing of the reforms matter. In particular, one can directly compare the Chinese approach that making electric energy cheap (building new coal plants and using fossil fuels) fosters quick market BEV adoption in lower and middle-income class. The EU approach makes electricity more expensive and thus even with subsidies making BEV affordable only to high-income class and preventing massive adoption.
2. Pay attention to the theory of the second best and avoid policy contradictions to make policies long/term sustainable and credible. The contradictory policies (making electric energy dear when cheap electricity fosters transition in transport) are violating these consistency (no contradiction) rules as well.
3. Apply standard cost-benefit approach in impact studies to identify conflicting priorities, creating policy deadlocks in later stages (as new incumbent groups emerge during the process) and properly distinguish redistribution (with no additional effect) from new financing (with limited absorption abilities and crowding out effects).

Nuclear energy's ability to provide a stable base load is critical for energy-intensive industries that require 24/7, uninterrupted power, as any stoppage incurs immense financial and operational costs. Extending the operational life of existing nuclear fleets was identified as a "no regret" and "least cost" option, offering a cost-effective way to maintain secure energy supply.

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4. Panel 4: Sustainability of financial flows in the European Union and the Czech Republic in the context of ESG

Hana Březinová

Speakers and their Affiliations:

- Peter Krištofík, professor Matej Bel University
- Martin Štěpáník, director ESG Škoda Group
- Peter Dovolil, manager ESG PWC
- Petr Buchtyar, consultant CzechTrade
- Anna Zora Kloužková, team leader for climatic change EnviTrail

Panel discussion has been opened and moderated by Hana Březinová, dean of the Faculty of Economic Studies, VŠFS.

Sustainability is intertwined with all the expert panels of our conference. In 1957, the Treaty of Rome established the EEC for the purpose of economic integration. It took over 20 years for the Accounting Code to be created so that we could understand each other thanks to harmonized financial statements. For thirty-five years, we reported similar information and generally understood each other. But the published information was not enough and its users began to demand its adjustments, changes and expansion. The requirements even went so far that related reports with financial statements were created, which contain not only financial but also non-financial information. However, Directive 34 of 2013 is amended even several

times a year (ESRS, ESRD, Omnibus). Currently, we are stepping around ESG reporting and trying to fulfill the overly broad ambitions of the European Commission. Is the system of directives, regulations and standards optimal? Isn't it too bureaucratic? Can we create models, software and procedures so that we can say that the sustainability report is harmonized and the information presented benefits users?

The common thread of the entire conference Financial Markets and Flows was sustainability in all areas. The year 2025 brought the issuance of the first sustainability reports according to CSRD and SFDR. They were prepared as related reports with financial statements in financial institutions (banks, insurance companies) and in large accounting entities and their groups. In the Czech Republic, there were 27 consolidated sustainability reports.

At the same time, in April 2025, the European Commission approved a proposal for amendments to the existing reporting regulations as part of the so-called Omnibus. This is a response to the excessive bureaucratic burden that EU legislation has brought in the area of ESG. The European Commission has moved reporting under the CSRD forward by two years and is trying to narrow the set standardization of the required data. The existing Directive 2013/34/EU has been fundamentally amended on an ongoing basis. The original legal act aimed at harmonizing financial statements and consolidated financial statements in EU Member States has been expanded to include a total of four related reports. The previous management report (annual report) has acquired a separate part, the sustainability report. Other related reports are the Report on Payments to Governments and the Report on Income Taxes.

The purely financial information previously required by users of financial statements has been significantly expanded to include non-financial information. This non-financial information is required from three areas, i.e. E (Environmental), S (Social), G (Governance). Each of these areas requires experts who must be able to decide on data collection, processing, analysis and drawing conclusions in a given area. Experts must be able to work in technical fields (energy, waste recycling, chemistry, physics, engineering, automotive, mining, manufacturing, food, agriculture), but also prepare materials for economists and managers who can evaluate the data obtained with the help of applied informatics and artificial intelligence. They must apply the previously published and required data according to ESRS to their environment. Social experts must focus on the employees of the company and the companies in their value chain. However, their task is also to analyse the impact on the social environment and the population in the region where the company operates. They pay attention to the impact on communities and the rights of consumers of their products. They must again connect with financial experts who process financial statements and management reports. The management area is faced with the analysis of significant risks of the company, their optimal management and their connection to financial information. They address corporate culture, compliance with laws and the quality of customer-supplier relationships. The laboriousness of ESG reporting is evidenced by the fact that the first official sustainability reports far exceed the previous management reports (annual reports) in their scope. When obtaining information, they go back to the past and make predictions of future developments. The horizon is 2030, when the commitments to which the European Union committed itself in the Paris Agreement should be fulfilled. The Czech Republic is also a signatory to it.

Their task is also to analyse the influence of the social environment and the population in the region where the company operates. They pay attention to the impact on the surrounding population and the scope of employment. Again, they must connect with financial experts who process financial statements and management reports. The management area is faced with the analysis of significant risks of the company, their optimal management and linking them to financial information. The fact that the first official sustainability reports far exceed the previous management reports (annual reports) in their scope speaks to the laboriousness of ESG reporting. When obtaining information, they go back to the past and make predictions of future developments. The horizon is 2030, when the commitments to which the European Union committed itself in the Paris Agreement should be fulfilled. The Czech Republic is also a signatory to it.

Panellists from the academic level (Peter Krištofík, professor at Matej Bel University), the engineering industry – rolling stock for transport (Martin Štěpáník, ESG Director of Škoda Group) and consulting activities (ESG Manager PWC Petr Dovolil) discussed with the Dean of the Faculty of Economic Studies, Hana Březinová, and the audience the issue of the relationship between performance and ESG, and vice versa, between ESG and performance. With an introductory theoretical output, Peter Krištofík explained possible conflicts between the implementation of sustainability in the energy sector, the acquisition of material resources, production methods, trading systems and their impact on the performance indicators themselves. The discussion also focused on the specification of indicators that individual ESRSs have brought to determine performance and assess sustainability. As a result, the net turnover indicator had to be changed in EU member states. Until now, this term has been used for total revenues for the period under review. The net turnover indicator has now been adjusted according to the area in which the business corporation or group operates. Operating revenues are primarily taken into account. The profit and loss statement for 2024 already reported net turnover according to the new calculation. This was followed by performance indicators in ESG reporting.

In the production of rolling stock, low-emission vehicles, especially those powered by electricity, have already been operating effectively, making a significant contribution to environmental protection. The new ESG legislation has now given these companies a real "green light" to further develop zero-emission technologies, such as hydrogen propulsion, and energy-efficient designs. In addition to their own development, companies have also begun to pay more attention to the material composition of components from suppliers, and will be able to demonstrate their sustainability throughout the entire production chain today or in the near future.

The strategy focused on sustainable development has not only brought significant challenges to the Škoda Group, but also opened the way to new business opportunities. Thanks to the top quality and ecological properties of the products, interest in their production has increased both on the domestic market and abroad. Modern ecological solutions that the Škoda Group is actively developing significantly strengthen its position in the field of environmentally friendly public transport and increase the trust of customers and partners.

Sustainability requirements represent a significant challenge on the one hand, but also a great opportunity on the other. As Martin Štěpáník, Director of ESG at Škoda Group, emphasizes, ESG is an integral part of the business activities of the entire group.

Our principles are based on a responsible approach – not wasting money in the production or operation of our products, treating employees fairly, supporting their loyalty and developing long-term partnerships with business honor within supplier-customer relations. These principles are firmly rooted in our DNA and represent the basis for the long-term stability and prosperity of the company.

At the same time, ESG-related reporting provides us with an opportunity to show all these activities in a comprehensive and structured form, thereby strengthening the trust of existing partners and reaching new clients.

On the other hand, the main challenges include, for example, detailed monitoring of our value chain. It must be set up in a way that provides the necessary transparency, but at the same time does not bring a disproportionate additional burden on our suppliers.

The Škoda Group is an innovator in the field of sustainable mobility and regularly spends over 2 billion crowns a year on research and development in this area. One of the innovations was the automatic train control system, which works as an “autopilot” – ensuring starts, driving and braking according to the timetable and track profile. Thanks to the optimization of speed and braking, it can reduce energy consumption and, for example, in Latvia, our Škoda 16Ev unit achieves savings of up to 15%.

The Škoda Group also pays great attention to the environmental impacts of its products throughout their entire life cycle. Their EPD (Environmental Product Declaration) for the ForCity Smart Artic X34 tram shows a very high level of recyclability (93%) and a 98.4% usability (sum of recyclability and further energy recovery of residual parts). The Škoda Group also reached a new milestone in the field of alternative fuels when it started testing the new generation of its H'CITY hydrogen bus in Prague's integrated transport. The anti-collision system, which is an important innovation in the field of traffic safety, helps prevent injuries and damage to vehicles and is an important step in the development of autonomous trams. The value of its contribution is also evidenced by the Česká hlava award.

The Škoda Group is increasingly focusing on sustainable next-generation transport and solutions for data-connected transport infrastructure for smart cities of the future using 5G connectivity. A key project in 2024 was the demonstration of the Smart Depot ecosystem in Tampere with automated operation of Škoda trams in a driverless depot. Work continued on the development of a fully autonomous tram in cooperation with universities. It has obtained certification for the TBL1+ train protection system for the Belgian railway network and is ready to upgrade it for ETCS.

2024 was a period of transformation with a focus on stabilising production and streamlining supply chains. The key strategic markets remain the Czech Republic, Slovakia, Finland, Germany, the Baltic countries, Bulgaria, Italy and Poland. The Škoda Group expanded its global presence by establishing partnerships with Hyundai Rotem and Hyundai Motor Company and is analysing further opportunities in Central Asia and India. The acquisition of the Czech company Cegelec further strengthened the group's activities in the area of environmentally friendly electrical equipment.

The Škoda Group won several major contracts in 2024. Ongoing projects also made progress: the production of trams for Prague, Bergamo and Kassel was launched, and the first vehicles were delivered to Frankfurt and Cottbus. The world's longest tram, the Škoda 38T, was handed

over to the city of Mannheim, and new trams were put into operation in Bonn and Bratislava. The tram designed for Bonn won the Red Dot Design Award. The production of metro sets for Sofia also started. The first Czech battery trains began operating in the Moravian-Silesian Region, and deliveries of 110 RegioPanter sets were completed under contracts with Czech Railways. The operation of ComfortJet trains, developed and manufactured in a consortium with Siemens Mobility, began on the Prague-Berlin route. Deliveries of suburban trains for Latvia were also completed, and the first units were delivered to Estonia.

In the trolleybus segment, the longest trolleybus in the Czech Republic – the Škoda 24m – was put into operation on the route to Prague Airport. Deliveries of new trolleybuses to Vilnius continued and orders for Pardubice and Prešov were completed. Škoda Group supplied traction motors for trolleybuses in Landskrona. Modernisation projects included the renovation of trams for Gothenburg, ÖBB couchette cars, South Moravian DMUs and Lithuanian double-decker units.

In 2024, the volume of new orders increased to EUR 1.7 billion. With the increase in production, the number of employees increased to approximately 10 thousand (including Temsa). During the year, the work stock increased to more than EUR 3.5 billion. Investment expenditure reached EUR 66 million, including research and development expenditure.

Even large business corporations and their groups cannot do without qualified advisors and consultants. ESG manager Petr Dovolil and his team at PwC deal with this issue. For him, ESG issues are a crucial topic for effective capital allocation, where the perspective of profitability and liquidity must cope with the challenges of new sustainability risks and their effective management. It is no longer possible to rely solely on the financial lens in financial management, especially in relation to longer-term investments. This must be meaningfully expanded to include an appropriate range of significant non-financial aspects in the approach of due diligence. These aspects of sustainability can have negative impacts for a given company due to the deteriorating environment and have significant impacts on its financial performance.

The risks, but also the opportunities, of climate change and the risks of resource availability (material, energy, human, etc.) are real, not symbolic or theoretical (see the increased incidence and intensity of natural disasters and their damages, the increasing "price of carbon", the poorer availability of critical raw materials and water, negative demographic trends, the price and availability of property insurance, etc.). For corporate management, the challenge of effectively managing risks and opportunities in the area of sustainability is not an option, but a regular part of its fiduciary duties. However, to do this, it needs useful data and information in the area of sustainability, not only about the companies it manages, but also about their supply chains, where a significant part of the risks can accumulate.

A key tool for determining what is relevant to businesses in the area of sustainability is dual materiality analysis. It allows businesses to focus on those that are truly significant for the business in terms of financial or impact from a wide range of sustainability topics. It is also worth recalling the amended CRD IV (Capital Requirements Directive) from 2013 and the CRR (Capital Requirements Regulation) regulating the banking sector. The CRR II regulation, which is directly applicable, concerns capital requirements. Banks must develop targeted ESG-

related action plans, with the remuneration of bank management also depending on the fulfilment of set ESG targets.

The European Commission's efforts through the Omnibus strategy are beneficial for businesses. The European Commission will review the scope of the information required by 2024, based on the suggestions of its Member States and the 300 sustainability reports already published. It has already stated that it will not insist on ESRS for SMEs, and in July 2025 it issued a recommendation to use the Voluntary Sustainability Reporting Standard for SMEs (VSME) developed at the end of December last year by the European Financial Reporting Advisory Group (EFRAG). However, supply chains include companies of different sizes. Financial institutions and large companies and groups will continue to require underlying information from their business partners in order to properly prepare a sustainability report and manage their businesses responsibly. Relaxing the ESRS implementation timeline will help prepare information that companies have not previously reported in their reporting. The reason is that this information has not been possible to find out, especially in the supply chain.

To prepare a sustainability report, it is advisable for companies to have a high-quality model in which to create reporting. Many years of experience in processing harmonized financial statements using business software, IT applications, and the use of artificial intelligence in data collection and reading must also be included in the ESG reporting module. It will not happen right away. It is necessary to work out individual information requirements and create programmable inputs from them according to corporate information systems. While financial statements work with financial information and the logic of double-entry accounting, which is supported by mathematical models, this is not the case with ESG reporting. Just like in the management report (annual report), it is a combination of financial and non-financial information. In most cases, however, this was information that resulted from accounting or common corporate information systems. These are already stable.

Sustainability reporting is starting to develop its own appropriate model. Even though reporting is standardized in ESRS, it is mostly non-financial information, or financial information that is generated and reported outside of accounting systems. For this reason, it will take many years for the principles, methods and procedures for processing sustainability reports to become established. Large companies and groups are aware of this situation. They are building separate departments focused on ESG. However, these departments will usually not be enough, as communication with the creators of corporate information systems is appropriate. This is a question of both the content and the form of data collection and processing and their extraction for reporting. Some groups of companies are creating consulting firms to provide ESG advice, calculate carbon footprints, and develop appropriate algorithms for individual ESG agendas.

According to ESRS, tables, overviews, and graphs can be processed, which many business corporations have done in their reports. Some standards have templates that can be used. Some companies have started to develop software for processing ESG reporting. However, this is not easy. Non-financial information is much more difficult to process into certain compatible sets that could then be consolidated. It is difficult to create a common qualitative indicator where the information would be comparable, harmonized in content, and ultimately understandable.

The situation is good within the Chamber of Auditors of the Czech Republic. It started to address the need for training its members in ESG reporting and their verification in a timely manner. Large audit firms are aware that they are the ones who will primarily verify the related reports with financial statements. Therefore, they have established cooperation in the area of sustainability with large companies, where they verify financial statements. This also applies to groups of companies. Large audit firms have the advantage of international cooperation. Therefore, they organize ongoing training for their auditors and assistants. The Czech Chamber of Auditors also has extensive educational activities. In addition, it has prepared tests that serve to recognize the knowledge of existing auditors. Not every auditor will therefore be able to verify a sustainability report. They must have ESG certification from KAČR or their large audit company, confirmation that they have met the training and test requirements. At the same time, KAČR is preparing a methodology for auditors to prepare for their work. Ongoing cooperation between ESG reporting creators and auditors is important. It is necessary to agree on the method of using ESRS, the application of their scope and the ability and possibility of disclosing information. This can often be internal information that the company is not interested in disclosing, providing to its competitors. There may also be a situation where the company is unable to obtain all the necessary information within the supply chain in a timely manner.

Conclusion

For this reason, most EU Member States and major companies welcomed the change to the current legislation. The Omnibus will thus allow them to better prepare for the obligations related to the preparation of the sustainability report.

The conference participants agreed that they want to meet and solve continuously emerging problems not only in financial institutions, but also in manufacturing and trading corporations.

The authors in the following part of this book focused on economics, finance, and financial management also in relation to sustainability.

There are no specific references in this panel's discussion content.

Part Two

Deeper insight into presented topics by selected participants

In the following part, selected topics that have been presented and discussed at the conference are included, based on the willingness of participants to contribute with their expanded and deepened research results in a form of the chapter in this scientific monograph.

5. Co-opetition in financial markets

Ondřej Černík

The concept of co-opetition was described by Nalebuff and Brandenburger (1996), who attempted to analyse and describe it in more detail. They derived the concept using game theory, which allows them to go beyond simplistic notions of competition and co-operation in order to arrive at the benefits of co-opetition. This chapter seeks to extend it and describe opportunities for utilizing Pareto improvements and mutual benefits resulting from collective action in financial markets. A simple microeconomic graph of the financial market shows the feasibility of collective action by two competitors. This is co-opetition, as described outside the financial markets.

Based on the main thesis and described using game theory, this previously unused approach offers an analysis of optimal competitive relationships in terms of profit for co-operative competition. Co-opetition in itself prevents zero-sum games, i.e. the mutual elimination of competitors in the financial market. The results are generally presented as simply as possible and using mathematical apparatus that places acceptable demands on readers who are not mathematically proficient.

Co-opetition combines the advantages of both competition and cooperation with a new dynamic that can be used not only to generate higher profits, but also to change the trend of financial market development to the benefit of the players involved. We must not forget that this is cooperation between competitors, which can be very risky or even destructive. There are situations where co-opetition is stable and unstable, as shown. This naturally leads to higher requirements for communication and co-opetition control in financial markets, since once the advantages are lost, the co-opetition may immediately end in a conflict or antagonistic situation between competitors. This approach shows when it is opportune for competitors to cooperate. How co-opetition is feasible and where its risks arise. This provides recommendations for further practical research in financial markets.

5.1 Introduction

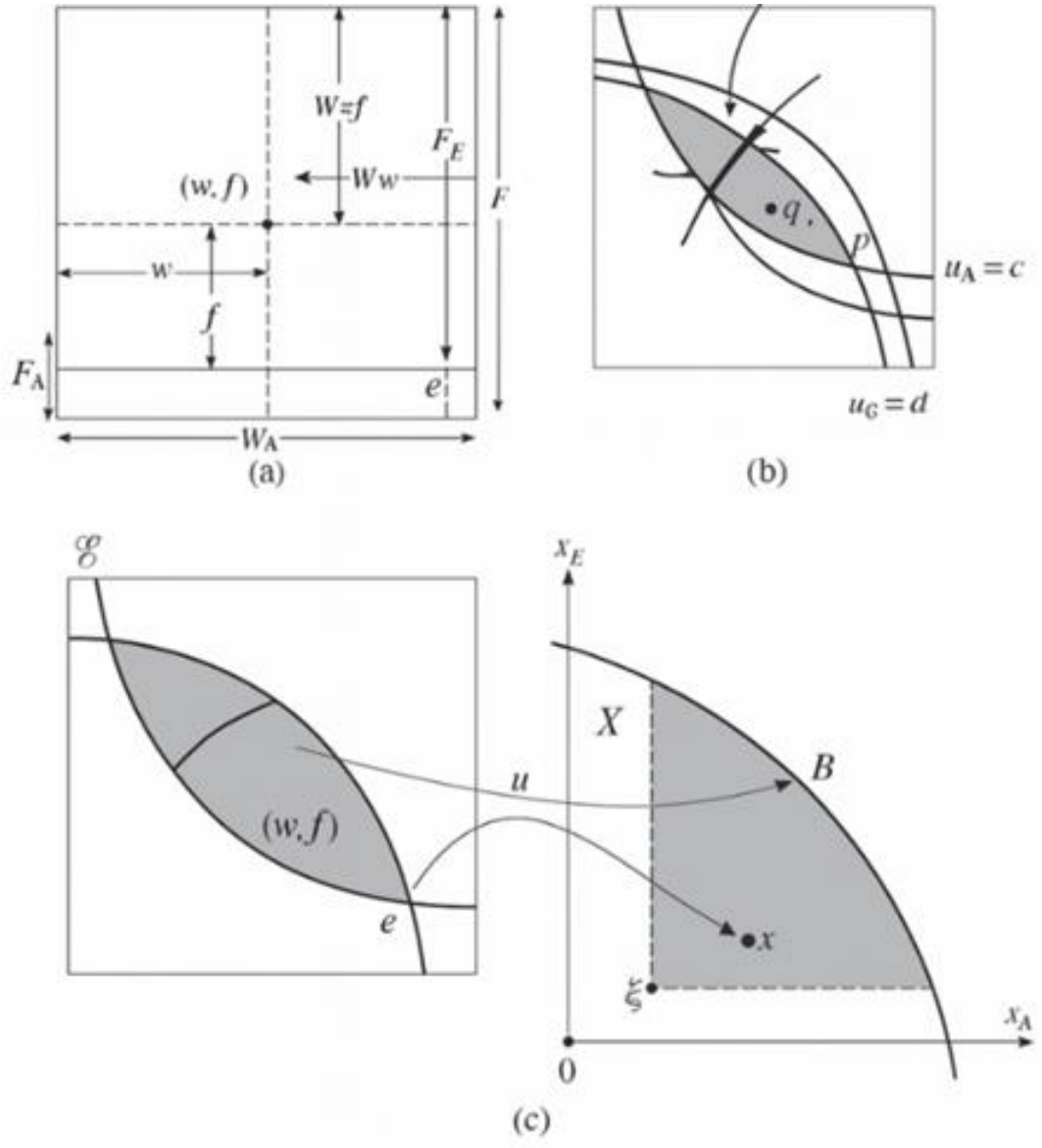
How can we model the decision-making of two players (competitors) who have different preferences but must act under conditions of limited resources? In this chapter, we will show how this problem can be approached using game theory and preference theory tools – and why Edgeworth's box diagram is still one of the clearest ways to express the possibilities of negotiation, compromise, and equilibrium.

When presenting the theoretical tools that are the subject of our interest, we will also show why it is necessary to pay close attention to financial markets. The main reason is deeper: financial markets reflect the relationship between ideas about the future and today's decisions. This relationship is also key to the development of economic theory itself, which is increasingly leaning towards a connection with game theory.

Game theory, based on the neoclassical approach, bases decision-making on utility maximization. However, as we know, utilities are subjective, often experienced, and not always easily quantifiable. Therefore, preference theory is used to model them, primarily in

its axiomatic form, which was first formulated by von Neumann and Morgenstern (1944). Another approach has proven successful in practice: indifference analysis, i.e., the description of preferences using indifference curves that connect combinations of goods that have the same value for a given subject. This method works very well with a graphical tool known as the Edgeworth box diagram (1881). Ken Binmore (1994) shows that the Edgeworth box plot is directly related to Nash's bargaining problem. This graph clearly shows the possible ways of dividing two goods between two players while respecting their individual preferences.

Figure 8: Edgeworth box diagram



Source: (Binmore, 1994)

Figure 8 shows the sides of a rectangle on the left side correspond to the quantity of goods. The points at opposite ends of the rectangle (bottom left and top right) are the inverted origin of the coordinates corresponding to the amount of goods obtained by one and the other consumer, in game terminology the player (Binmore names them "Adam" and "Eve", their payoffs are denoted as xA, xE in the total quantities).

Each point inside the rectangle corresponds uniquely to the distribution of goods among the players. The rectangle plots the indifference curves of one and the other player, i.e. the points at which each player benefits equally from different combinations of the two goods. The graph shows (and it can be seen at a glance) that only at the points of contact of the indifference curves is the requirement of collective rationality satisfied, i.e. that neither player can improve without the other player being harmed.

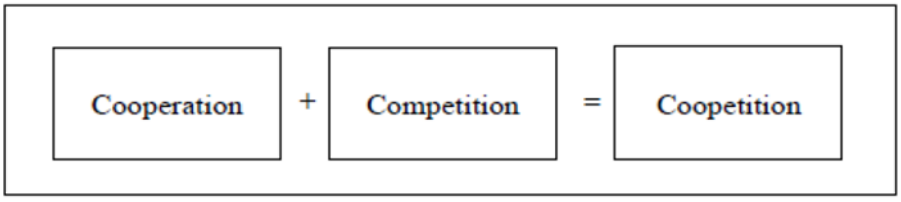
At the intersection of the indifference curves is the starting point of the bargaining problem (the point of disagreement, or the starting point, labeled as "e" on the left and "ξ" on the right in Binmore's figure). In the right part of the figure, the same is represented as a Nash (S, d) bargaining problem (Nash, 1950). The curves, which are terminated by arrows on both sides, express the connection between the left and right parts of the figure. Point B is one of the possible solutions to the Nash bargaining problem.

My colleague Radim Valenčík and I have (Černík, Valenčík, Wawrosz, 2020) already discussed the advantages and benefits of collective action by players in the financial markets. I thought of extending this situation to the issue of competitors and their cooperation, i.e. co-opetition. I summarize in this introduction to the issues studied the common knowledge, referring to these findings in Section 1.2 The two-component model of the financial market. To understand this chapter, it is necessary to acquire a basic knowledge of this introduction and the literature cited, including the basics of cooperative and non-cooperative game theory.

5.2 Co-opetition in financial market

Co-opetition describes the relationship between players combining cooperation and competition. In recent years, it has become a strategy for business practice, leading to an increase in the number of publications in academic journals. However, it should be noted at the outset that, despite growing interest, research on co-opetition remains fragmented, which is reflected in the varying use of the concept of co-opetition, the lack of a general definition, and the lack of a necessary context for its appropriate application in the financial market. Therefore, this study seeks to demonstrate its suitability for collective action in the financial market.

Figure 9: Benefits and risks of co-opetition



Source: (Nalebuff, Brandenburger 1996)

Situations arise on financial markets between owners of investment funds and investment opportunities. Creditors demand investment opportunities and offer investment funds, while debtors demand investment funds and offer investment opportunities, but they compete with each other on the market. The highest collective return from co-opetition is achieved when

the marginal return of the last investment opportunity used by both the debtor and the creditor is the same.

5.2.1 Methodology

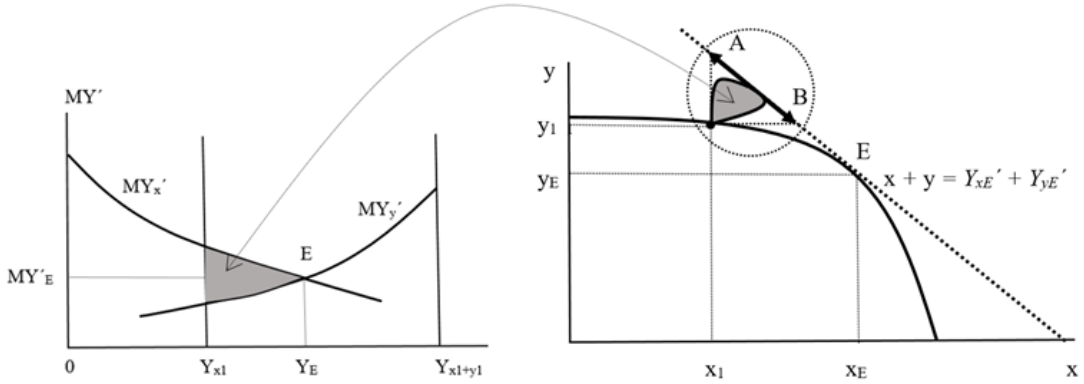
This unreleased approach is largely based on game theory, which offers an analysis of optimal competitive relationships from a profit perspective for co-opetition. It can also be used to predict interactions between competitors and provide recommendations on their possible behaviour, which are essential for taking the necessary measures. Co-petition itself prevents zero-sum games, i.e. the mutual elimination of competitors in the financial market. By examining the assumptions, rules of the game and equilibrium states, game theory provides everything necessary to evaluate and understand the situation in which a player finds themselves and to recognise the possible constraints and interactions that arise from this situation. The results are usually presented as simply as possible and using mathematical apparatus that places acceptable requirements on non-mathematical readers.

5.2.2 The two-component model of the financial market

On the left side of Figure 10 is a microeconomic model of the financial market in terms of the marginal quantities of investment opportunities and investment resources (consisting of current income); the grey area highlights the Pareto improvement area, which is given by the fact that the investment resources of one player are used to realize the more profitable investment opportunities of the other player.

On the right-hand side, the same is expressed in total quantities (x, y). The dotted line represents the set of points of maximum sum of payoffs, and the Pareto improvement area is also highlighted in grey.

Figure 10: The two-component model of the financial market



Y_x, Y_y = y is the current income of one and the other player,

Y_{x1}, Y_{y1} a specific amount of investment funds (current income) available to the players

$_{xy}Y´$= x, Y´= y is the future income of one and the other player (which are also the returns on the investment opportunities available to the players)

MYx´ = MYx´(Y), MYy´^{2} = MYy´^{2}(Y) are the marginal return functions of the investment opportunities available to the players and, simultaneously, the supply and demand curves of investment funds and investment opportunities.

Source: Černík, Valenčík (2021a, p. 17)

The left-hand side of the figure is a microeconomic model of the financial market in marginal terms of supply and demand of investment opportunities and investment funds (consisting of current income); the grey area highlights the area of Pareto improvements given by the fact that one player's investment funds are used to realize the more profitable investment opportunities of the other player.

The right-hand side is the same expressed in total quantities (x, y). The dotted line shows the set of points of the maximum sum of payoffs; the area of Pareto improvements is also highlighted by the grey area.

The bolded line with arrows at the ends shows the set of all points that satisfy the requirements of attainability, individual rationality and collective rationality.

$(MYx'^{1}(Y))' < 0$, $(MYy'^{2}(Y))' < 0$, are the first derivatives of the marginal return function of the investment opportunities available to the players, which means that the above functions are non-increasing, i.e. the players exploit the investment opportunities according to their rate of return, which can also be seen as a condition of the players' individual rationality

$$Y_x' = \int_{Y_{x1}}^{Y_{x2}} MY_x'(Y)dY \quad (1.1)$$

$$Y_y' = \int_{Y_{y1}}^{Y_{y2}} MY_y'(Y)dY \quad (1.2)$$

Is the total future income of player 1 and player two when exploiting investment resources in the interval $[Y_{x1}, Y_{x2}]$, respectively in the case of player 2 $[Y_{y1}, Y_{y2}]$,

If each player exploits only his own investment funds and his own investment opportunities, their future income will be:

$$Y_{x1}' = \int_{Y_0}^{Y_{x1}} MY_x'(Y)dY \quad (1.3)$$

$$Y_{y1}' = \int_{Y_0}^{Y_{y1}} MY_y'(Y)dY \quad (1.4)$$

The second player will have the same income in this case:

$$Y_{y1}' = \int_{Y_{x1}}^{Y_{x1+y1}} Y_{y0}' - MY_y'(Y)dY \quad (1.5)$$

Regarding the two images (Fig. 3), we see some relatedness but also important differences. The similarities and differences are mainly in the following:

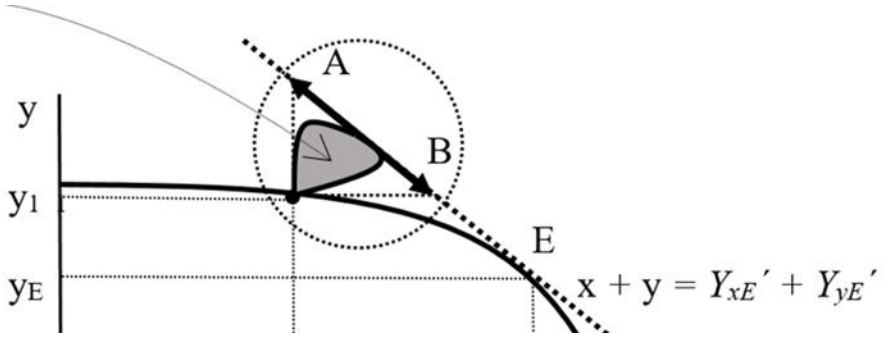
- Both models describe a situation where the left-hand side of the picture expresses the same thing in the marginal (incremental) quantities to the right-hand side in the total quantities. Both figures imply that there are many payoff distribution points among players that satisfy

the requirements of feasibility, individual and collective rationality (the problem of ambiguity of solutions without additional conditions).

- There is a significant difference in goods entering the market in terms of their future.

In one case, it is goods, in the other case it is investment funds and investment opportunities (especially in the case of investment opportunities, it is a significantly different commodity).

Figure 11: Detail of the benefits of collective action - co-opetition



Source: author

We obtain the grey filled area as the set of all Pareto improvement points, where the entity (player) that has less profitable investment opportunities provides its investment funds to the other entity (player). The bold closed curve that bounds this part of the area corresponds to the points that bound the set of Pareto improvements in the double figure on the left. There is only one of this bold closed curve with the line of the maximum sum of payoffs (the arrow points to it). But even if one of the players enforces the distribution most favourable to him and the players find themselves at the point to which the upper arrow points, they can, by repeated negotiation, get back to the line of maximum payoff sum, in this case closer to point A. If the player with payoff y continually enforces his maximum payoff, the players would end up at point A. Similarly, in a stronger position, players may end up at point B. That way the players would behave like pure competitors. If we consider the relationship (co-opetition) between two players (competitors) who exchange repeatedly and over a long period of time some two commodities (or one commodity and money) in a collective action, the dual graph containing the representation of the market through marginal variables (Edgeworth's box graph) and through aggregate variables (Nash bargaining problem) becomes the basis of a dual graph containing the representation of the financial market through marginal variables (supply and demand of investment funds and investment opportunities) and through aggregate variables (distribution of surplus). Of course, this is only the basis.

In the problems of payout distribution in game theory literature, which are often described with the distribution of proceeds from a joint action, this can be expressed in two ways:

(a) An approach based on the assumption that there is a set of mutually acceptable distributions that is a subset of the set S, and the solution must belong to this set.

b) A combined final payoff function that takes into account the fact that what one or the other player (competitor) gains from the distribution of payoffs also influences the evaluation of the payoff by the other player.

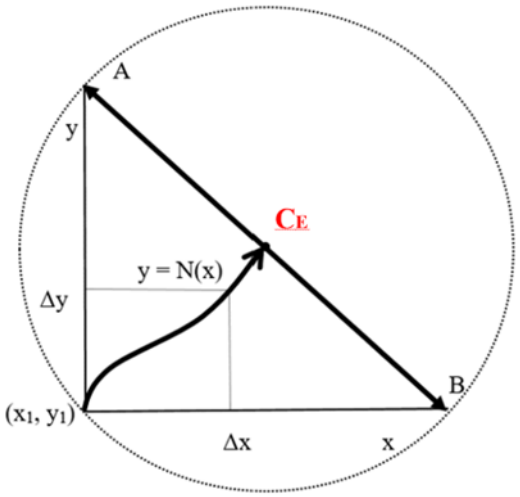
5.3 Properties of co-opetition in the financial market

Based on the financial market model (supply and demand for investment funds and investment opportunities) understood as cooperative game theory (Cernik, Valencik 2021), we can illustrate the advantages and risks of co-opetition in the figure below.

This implies the following: In the set of payoffs that represent an improvement over the initial state, if collective action – co-opetition – occurs and payoffs are divided, we distinguish those elements of the set that are accepted by both competitors and those that are unacceptable to one or both competitors. We call this set of payoffs the set of payoffs resulting from co-opetition, i.e., a set whose elements are distributions that do not allow any of the players to improve their position relative to the initial state.

If this set takes the form of a relationship between the payoffs of two players in which an increase in the payoff of one player must be compensated by a clearly defined increase in the payoff of the other player, we can speak of a co-opetition function (y=N(x)) and its curve, see Figure 12 below.

Figure 12: Co-opetition as an equilibrium point



x, y - competitors' payoffs

S - set of available payoffs (formed by the surface of the triangle {(x1,y1), A, B})

y=N(x) - function of payoffs resulting from co-opetition

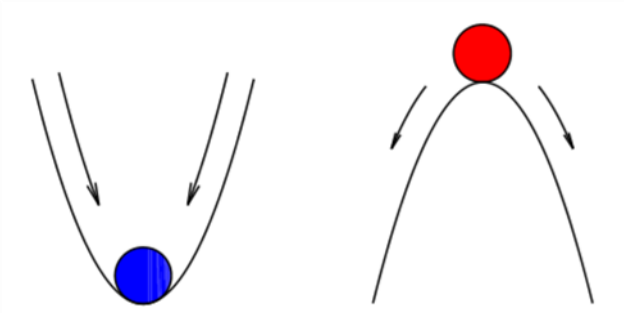
CE - equilibrium point, or point that satisfies the conditions of individual rationality, collective rationality, feasibility, and co-opetition

Source: author

It should be noted that these are different reference points, different ways of looking at the problem through the eyes of competitors, different approaches that may be stable or highly

unstable. In most cases, the benefits of co-opetition between competitors in the financial market will decrease as the deviation from this joint action increases.

Figure 13: Stable and unstable coopetition



Source: author

From Figure 13, we can deduce that with increased intensity of players to deviate from co-opetition, the risk arising from the instability of the CE point in the situation shown in red in the figure on the right will increase. Another main conclusion from the graphical model is that in markets with alternative states, a short-term optimal deviation leading to higher benefits from a strategic point of view may be myopic, as from an economic point of view it tends to be on the edge of co-opetition collapse for competitors. In fact, co-opetition collapses, and it is likely that in such situations there will be a greater number of reasons for failure. In general, this is harmful to the efficient use of the financial market and the quality of the market environment, but the effects described can be particularly dramatic for markets with alternative areas of stability, where co-opetition is often chosen as a "last evil" after clashes between competitors. In such markets, high levels of deviation and system collapse to states with low levels of overall utility, and thus welfare, resulting from collective action, can occur relatively frequently.

5.4 Discussion of results

The approach chosen is largely from game theory, which offers an analysis of optimal competitive relationships in terms of profit for co-opetition. It can also be used to predict interactions between competitors and provide recommendations on their possible behaviour, which are essential for taking the necessary measures. Co-petition itself prevents zero-sum games, i.e. the mutual elimination of competitors in the market. By examining the assumptions, rules of the game and equilibrium states, game theory provides everything necessary to evaluate and understand the situation in which a player finds themselves and to recognise the possible constraints and interactions that arise from this situation. Many of these problems have suitable mathematical models based on well-developed theory. Although mathematical concepts and results are the theoretical starting point, the main objective of this work is not to explain mathematics, but to present practical interpretations to which formal results lead. The main criterion was the clarity of my contribution. Every mathematical model begins with definitions and axioms, and to understand the important results, it is first necessary to absorb a certain amount of auxiliary knowledge that describes

the connections between the model's starting points and conclusions. The results are generally presented as simply as possible and using mathematical apparatus that places acceptable demands on non-mathematical readers.

5.5 Conclusions

The original idea of focusing on pair stability in models of mutual comparison of utilities from co-opetition is that if a pair of competitors desire mutual agreement (collective action) despite being prevented from doing so by rules such as market mechanisms, then perhaps their sets of strategies will be large enough to find a way to agree with each other. However, if only one of the competitors is interested in pairing, it may be difficult for the unfortunate competitor to find a way to bypass the trading platform and force pairing with an unwilling cooperative partner or an unwilling competitor. This means that the investment opportunities offered will not be realized through collective action by two competitors, i.e., co-opetition.

This view could focus on determining whether a competitive and volatile financial market is a mechanism that brings about allocation that is efficient for cooperation between competitors.

The chapter was developed in response to the need to systematically conceptualize co-opetition within the context of financial markets and to demonstrate that this concept can be formally analysed using bargaining models and the geometric interpretation of Pareto efficiency. A two-player bargaining structure was introduced to illustrate how mutual interdependence between competing market participants can generate cooperative outcomes even in environments driven by competition. The aim of the chapter was to identify the conditions under which cooperation between competitors may constitute a rational strategy and to show how such relationships can be modelled within the microstructure of financial markets. In doing so, the chapter provides a foundation for further scholarly discussion and subsequent research in this field, to which the author has devoted several years of ongoing work.

Acknowledgement

Special thanks for preparation and consultation meetings to Associate Professor Radim Valenčík.

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6. Velocity of money in the digital economy: an agent-based model calibrated with Czech data (2000–2025)

Hana Lipovská, Jana Bobošíková

In this chapter we examine the impact of digitalization and fintech innovations on the velocity of money in the Czech economy between 2000 and 2025. An agent-based model (ABM), calibrated with Czech macroeconomic, household, and payment system data, distinguishes between income velocity and transaction velocity. Two extreme scenarios are simulated: a traditional cash-based economy and a fully digitalized economy with instant payments and minimal cash usage. Results show that transaction velocity more than doubles in the digital scenario (≈ 39 vs. ≈ 18), driven by reduced transaction delays, increased payment frequency, and smaller average transaction sizes. B2B payments exhibit the largest acceleration due to just-in-time settlements, followed by consumer and government transfer flows. The findings suggest that widespread fintech adoption can substantially alter money demand, potentially amplifying monetary policy transmission and inflation dynamics. Policy recommendations include integrating digitalization indicators into central bank monitoring, ensuring financial inclusion, and regulating payment platforms to mitigate stability risks. The study demonstrates the methodological value of ABM for capturing micro-level circulation mechanisms invisible in aggregate data.

6.1 Introduction

The velocity of money — the number of times a unit of currency circulates within an economy over a given period — is a crucial indicator of monetary dynamics. The classical quantity theory of money is based on the equation $M \cdot V = P \cdot Y$, where M represents the money supply, V the velocity of circulation, P the price level, and Y real output. Traditionally, velocity V was assumed to be relatively stable, influenced primarily by payment habits and transaction technologies. However, empirical evidence challenged this assumption; notably, in the 1970s, financial innovations and inflationary expectations led to significant fluctuations in velocity, prompting economists to seek new approaches for modelling money demand.

In the last two decades, the global economy has witnessed another fundamental shift in the payment landscape — the rise of the digital economy and fintech innovations. Digital payments—from online banking and card transactions to mobile wallets, QR codes, cryptocurrencies, and potential Central Bank Digital Currencies (CBDC)—radically accelerate and simplify financial transactions. Mobile applications enable payments within seconds, 24 hours a day, irrespective of geographic distance. This contrasts sharply with traditional methods, where money transfers could take days and involved physical handling of cash or lengthy banking procedures. Fintech startups and innovations such as instant payments, peer-to-peer transfers, and contactless payments significantly reduce transaction costs and friction within the circulation of money. From a macroeconomic perspective, this raises a critical question: How does digitalization affect the velocity of money?

In this context, the Czech Republic presents an intriguing case study. Between 2000 and 2025, the country transitioned from a predominantly cash-based economy to an increasingly cashless society. At the turn of the millennium, cash transactions dominated, and interbank

transfers typically took 1–3 days. However, after 2010, internet banking, contactless cards, and later mobile payments expanded rapidly. According to statistics from the Czech National Bank and the Czech Banking Association, the number of cashless transactions per capita grew annually at double-digit rates. By 2020, Czech banks introduced an instant payment system enabling interbank transfers within seconds, and fintech applications (e.g., Revolut, Apple Pay) gained millions of users. The COVID-19 pandemic further accelerated this trend—many merchants and customers switched to contactless payments for hygiene reasons and concerns over physical cash handling.

These changes suggest that the average duration during which money remains idle between transactions is decreasing. Previously, cash revenues could remain unused in cash registers for several days before being spent or deposited into accounts; nowadays, funds are frequently reinvested or spent immediately. Consider a simple scenario: traditionally, an employee receives a salary, spends part of it in cash at a store the next day, the merchant deposits revenue into the bank after two days, and the bank credits funds to the supplier's account—this entire cycle spans approximately 4–5 days, during which money lies idle. In contrast, in the fintech model, the salary is instantly deposited into an account and transferred via mobile application to the merchant within minutes, who then immediately uses the funds to order supplies—completing the entire cycle within hours. Consequently, the same unit of currency circulates more frequently within a week (e.g., 5–7 times compared to 2–3 times traditionally).

From a macroeconomic perspective, a higher velocity of money VV, with a constant money supply, would imply higher nominal GDP or upward pressure on prices if not accompanied by increased real output. Central banks recognize this potential. For example, analyses by the International Monetary Fund (IMF) suggest that the introduction of digital currencies (CBDC) or the expansion of non-bank payments could accelerate velocity, as money would no longer remain idle with holders between transactions. This could facilitate the same volume of transactions with a smaller money supply, necessitating new considerations for central bank operations and the use of monetary aggregates as nominal targets. Concurrently, literature reviews indicate that the relationship between payment digitalization and money velocity is not linear—some studies on emerging economies find a robust positive impact (e.g., a long-term positive correlation between digital payment volume and *V*), while others highlight potential complications such as shifts in money demand, substitution between cash and deposits, or increased volatility in VV due to technological shocks.

The aim of this chapter is thus to deepen understanding in this domain by: (1) conducting a comprehensive review of international research on the velocity of money in the digital economy, emphasizing fintech impacts, payment innovations, and potential introduction of digital currencies on money circulation and monetary policy, and (2) presenting an agent-based model (ABM) to simulate and quantify money velocity in the Czech economy, distinguishing key segments of monetary flows. This model facilitates experimenting with scenarios (traditional vs. fintech economies) and directly observing impacts on velocity, which are otherwise challenging to measure. With calibration to Czech data (2000–2025), model outcomes can be compared to empirical indicators (M1–M3, cashless transactions, etc.) and implications for the Czech National Bank (CNB) discussed.

The structure of the chapter is as follows: Section 2 provides a literature review of studies on money velocity in the context of digital innovations, encompassing academic publications with impact factors and analyses from institutions such as the IMF, BIS, and ECB. Section 3 outlines the methodology—construction of the agent-based model, agent characteristics, model equations, and data calibration sources. Section 4 describes the analysis conducted—simulation scenarios and evaluation procedures. Results are presented and discussed in Section 5, detailing quantitative findings from simulations, their comparison with empirical data, and fintech's impact on monetary dynamics (including policy implications). The conclusion (Section 6) summarizes key findings, offers recommendations, and outlines avenues for future research.

6.2 Literature review

The velocity of money in the context of financial digitalization has attracted significant attention from economists, central banks, and international institutions. This section summarizes insights from selected studies and reports. Initially, we focus on general conclusions regarding the impact of digital payments on money circulation, followed by more specific topics such as implications for monetary policy, inflation, and financial stability.

Digitalization of Payments and Velocity of Money: Increasing evidence indicates that the proliferation of digital payment instruments accelerates money circulation. Gurnani (2024) states that modern payment systems (mobile payments, internet banking, digital wallets, QR payments, contactless cards, etc.) eliminate delays and logistical costs associated with cash transactions, thus increasing the frequency with which money circulates in the economy. This enhances liquidity and fosters economic activity. The authors also note that digital payments support financial inclusion and transparency by reducing cash dependency and curtailing the shadow economy.

Similarly, international institutions have observed accelerated velocity associated with digital forms of money. The IMF highlights that the adoption of CBDC or private electronic money can increase money velocity, as transactions become more convenient and faster—resulting in shorter holding periods between payments. Consequently, fewer monetary units are required to facilitate the same transaction volume if electronic payments are instantaneous. According to BIS Bulletin No. 3 (Auer et al., 2020), the COVID-19 pandemic accelerated the shift towards digital payments, potentially creating lasting changes in payment habits. Thus, pandemic-induced behaviours (such as preference for contactless payments) might lead to permanently higher velocity, as fewer transactions are slowed by cash handling.

Academic research from various countries confirms that financial innovations correlate with changes in velocity. For example, Ocansey et al. (2024) analyse Ghana and cite several studies: Alhassan and Islam (2021) found a positive long-term relationship between money velocity and third-party payment development (i.e., fintech payments). Kayongo and Muvawala (2020), examining Uganda, concluded that financial innovations ultimately lead to increased money velocity. Mata and Roldão (2021) identified cointegration between income velocity of money, interest rates, and institutional factors in Portugal, suggesting complex determinants of velocity over time. A general consensus emerges that greater accessibility of payment methods and convenience in electronic transactions tend to accelerate money circulation.

Dasaklis and Malamas (2023), for instance, argue that digital payments reduce the propensity to hold cash, thus increasing money circulation.

Nevertheless, the literature highlights differentiation between narrow and broad monetary aggregates. Some studies predict varying impacts on narrow aggregates (currency in circulation, transactional deposits) versus broader definitions of money. Chen and Fortunati (2023) conclude that digitalization might decrease the velocity of broadly defined money while potentially increasing velocity for currency and transactional money due to cheaper and faster payments. This is logical: digital innovations incentivize individuals to hold less cash and spend more, accelerating currency circulation, but could simultaneously increase broader liquid asset holdings (e.g., due to convenient savings options). Empirical investigations for advanced economies (e.g., Ardakani, 2023), using dynamic models, suggest that rapid money supply growth might reduce velocity (reflecting quantitative easing and reserve accumulation), yet technological payment innovations generally boost velocity over the long run.

Implications for Monetary Policy and Inflation: Money velocity is crucial for the effectiveness of monetary policy transmission mechanisms. Historically, central banks occasionally used monetary aggregates (M1, M2) as intermediate targets for monetary policy, assuming stable money demand and predictable velocity. If digitalization disrupts these relationships, policy management could become more challenging. The IMF Fintech Note (Das et al., 2023) highlights that introducing CBDC and digital money could affect monetary policy transmission through multiple channels: increased competition among banks for deposits (as clients shift funds to CBDC), changes in bank liquidity, and increased velocity that can either amplify or dampen interest rate impacts.

Some authors caution that rapidly rising and unstable velocity could complicate inflation control. Ocansey et al. (2024) summarize that increased availability of payment methods might induce greater endogenous velocity fluctuations, causing mismatches between money supply growth and price levels. In other words, inflation might exhibit higher volatility given a velocity instability for a targeted money growth rate. Thus, monetary authorities are recommended to monitor and maintain relatively stable money circulation, potentially through communication strategies and policies mitigating substantial shifts in money-holding preferences.

An increase in velocity due to fintech might parallel a reduction in demand for real money balances. If individuals hold money briefly and spend faster, fewer monetary units can service the same nominal GDP. A fixed monetary base could then result in higher prices (inflation), compelling central banks to counterbalance either by slowing money supply growth or increasing interest rates. Empirical isolation of these effects is complex, given influences such as interest rates, expectations, and structural economic changes. Gurnani (2024) acknowledges that impacts of payment digitalization on monetary policy and inflation remain an active area of research, not fully clarified. However, existing evidence indicates central banks in low-digitalization economies might experience significant velocity changes when transitioning to digital payments, necessitating adjustments to their operational frameworks.

Financial Stability and Other Considerations: Digitalizing money circulation presents new challenges for financial system stability. Higher velocity might indicate quicker deposit withdrawals; for instance, mobile banking enables rapid fund transfers, potentially accelerating bank runs during crises. BIS (2023) emphasizes balancing benefits of faster,

cheaper payments against risks to financial stability and integrity. Experts advocate regulatory oversight for new payment systems, licensing non-bank providers, insuring deposits in electronic wallets, and limiting CBDC holdings to prevent destabilizing rapid large-scale monetary transfers.

Conversely, there is potential for positive impacts: faster money circulation can indicate a more efficient financial system with better resource allocation. Studies (e.g., Frost et al., 2020) suggest instant payments improve credit access, exemplified by Brazil's PIX system expanding financial services to underserved clients. Long-term productivity and potential economic output could thereby rise, translating higher velocity into real GDP growth rather than inflation. Overall, the literature consensus is clear: the digital economy significantly reshapes money circulation, warranting focused attention from central banks and researchers (e.g., comprehensive CBDC economics review by Kiff et al., 2020, and BIS surveys tracking digital currency developments).

In conclusion, broad agreement exists that fintech innovations accelerate transactions and potentially increase money velocity. Evidence arises from empirical studies (across various countries and methodologies) and theoretical considerations (modern circulation models, money demand analyses). Concurrently, further research is needed, particularly regarding differential impacts across monetary aggregates (M1 vs. M2), endogeneity issues (whether higher velocity causes or results from economic changes), and broader policy implications. We contribute by simulating micro-level dynamics, offering a bottom-up perspective on how digitalization influences money circulation mechanisms.

6.3 Methodology (agent-based model)

Quantitatively addressing the question of the impact of the digital economy on the velocity of money requires a model capable of capturing the micro-level behaviours of economic actors and their interactions within monetary circulation. Therefore, we employ an agent-based model (ABM), simulating a large number of individual agents (households, firms, etc.), each following specific rules. This approach captures behavioural heterogeneity (such as varying levels of fintech adoption) and emergent macro-level properties (such as aggregate velocity resulting from all executed transactions). This section describes the model construction: agent types and their roles, behavioural and decision-making rules (including model equations), parameters, and calibration using Czech data, concluding with definitions of simulation scenarios.

6.3.1 Agent types and model structure

The model includes four primary categories of agents, representing key economic sectors involved in monetary circulation:

• *Households* (consumers): Represent individuals or families who receive income (wages, social benefits) and spend it on goods and services. In the model, they act as consumers purchasing from firms (B2C transactions) and recipients of wages from firms or transfers from the government.

• *Firms* (businesses): Produce goods and services. In the model, firms sell products to households (B2C) or other firms (B2B, subcontracting), pay wages to households, and pay

taxes to the government. They also purchase inputs from other firms (B2B) and can take loans from financial institutions.

• *Financial Institutions* (banks and fintech companies): Facilitate payments and provide loans. They manage monetary transfers between other agents (maintaining household and firm accounts) and may introduce new fintech services (mobile payments, P2P lending, etc.). For simplicity, the central bank is initially included within this sector (managing monetary base and interest rates).

• *Government* (government and central bank): Collects taxes from households and firms, distributes transfers to households (benefits, pensions), and carries out public expenditures (e.g., procurement from firms). The central bank, as part of the government, sets monetary policy—interest rates, adjusts the monetary base, and may influence fintech sector regulation.

The model structure and interactions are depicted schematically (see Table 1). Households pay firms for goods and services; firms pay other firms for input supplies; firms and households interact with banks for deposits, withdrawals, and loans; the government makes payments to households and firms (transfers, public expenditures) and collects taxes. Financial institutions provide payment infrastructure—i.e., transfers between accounts, transaction clearing—and compete with cash as a medium of exchange.

Table 1: Main Agent Interactions in the Monetary Circulation Model

From (Payer)	To (Recipient)	Event/Transaction Type
Household	Firm	Purchase of goods/services (B2C payment)
Firm	Firm (supplier)	Input payment (B2B payment)
Firm	Household	Wage payment
Government	Household/Firm	Social transfers, public procurement
Household/Firm	Government	Tax payments
Bank/Fintech	Household/Firm/Government	Payment intermediation (transfer)
Bank	Household/Firm	Loan issuance, loan repayment
Central Bank	Bank	Monetary policy operations (refinancing, reserves)

Source: author

Within this schema, monetary flows are tracked. For analytical purposes, we particularly distinguish the following aggregated flows: B2C (household expenditures with firms), B2B (inter-firm payments), wage payments (firm to household), and government transfers (government to household or firm minus taxes). Collectively, these represent the majority of monetary circulation in the economy.

6.3.2 Agent behavioural rules

Each agent is characterized by a set of attributes (state variables) and decision-making rules (functions). Below, we describe the primary elements for each agent category:

(a) *Households* (Consumers): Key attributes include income (wage or other, exogenously given or determined by firms' wage functions), savings (cash or bank holdings), consumption preference rate (proportion of income typically spent), fintech capability (an index from 0–1 reflecting fintech tool adoption), and inflation expectations (affecting consumption/saving behaviour). Households make two main decisions each time step:

• Consumption vs. Savings Decision: This is modeled by the equation:

$$Expenditure = \alpha \times \frac{(Income + Current\ Savings)}{Expenditure} \quad = \alpha \times \ (Income\ Current\ Savings\}$$

where α represents consumption preference $(0 - 1)$. The remaining amount is saved. Households adjust α based on inflation expectations; for instance, if expected $inflation > 5\%$ households increase α to mitigate value loss, thus increasing money velocity endogenously under certain conditions (e.g., low-interest policies or technological consumption incentives).

• Choice of Payment Method: Households can pay traditionally (cash, standard bank transfer) or via fintech innovations (card, mobile app, QR code). A probabilistic decision model assigns each method a utility or weight based on three factors: (i) friction (time and administrative effort), (ii) method availability, and (iii) habitual preference. Each household is assigned preference weights derived from surveys. Friction and availability are general method characteristics (see Table 2). Households evaluate available methods at each transaction and select one proportionally to weighted utilities.

• Duration of Money Holding: This crucial concept describes how long households hold money before spending. It emerges from the above decisions: cash users might spend gradually, resulting in longer holding times. Fintech users quickly circulate their funds. Simulation assigns distributions of holding times between cash and digital funds based on fintech capability. Households with high fintech capability (index > 0.7) use immediate payments, spending new income within 0.2–1 day; traditional households take 2–5 days. These values reflect empirical transaction delays (seeTable 2, CNB/CBA data).

Table 2: Household Payment Method Parameters

Payment Method	Average Friction	Availability	Habitual Weight (example)	Typical Circulation Delay
Cash	0.5	0.9	0.2	2–5 days
Bank transfer	0.9	0.7	0.1	1–3 days
Card payment	0.3	0.95	0.4	1–2 days
Mobile (NFC)	0.2	0.8	0.25	0.1–0.3 day
QR payment	0.1	0.5	0.05	0.05–0.2 day

Source: author

Note: Parameters are calibrated from Czech surveys (CBA, CNB). Higher friction implies less convenience; availability of 1 indicates universal acceptance; habitual weight reflects individual preference. Circulation delay denotes the time before spent money re-enters circulation.

(b) Firms: Firm attributes include inventory levels (finished goods/raw materials), liquidity (cash and account balances), input costs, revenue, payment cycle duration, and fintech adoption (index 0–1). Decision-making processes:

• Receipt of Payment: Payments from customers or other firms increase liquidity immediately. Cash payments remain in registers briefly, digital payments are instantly available.

• Payments to Suppliers: Firms monitor inventory levels; if below thresholds, firms order inputs, triggering B2B transactions. Firms immediately pay invoices if liquidity permits and fintech adoption is high (>0.8, payment delay ~0.2 day); otherwise, standard terms of 3–7 days apply.

• Investment Decisions: Excess liquidity triggers investment decisions, modeled as immediate outflows if liquidity exceeds thresholds, shifting funds to banks or other agents.

• Payment Innovations: Firms invest in fintech infrastructure when experiencing transaction growth, increasing fintech adoption and payment speed.

(c) Financial Institutions (Banks/Fintechs): Attributes include reserves, loan portfolios, interest rates, transaction fees, and fintech index. Functions include:

• Loan Provision: Banks lend to qualifying agents, increasing agent liquidity and bank loan portfolio. This generates new money (deposits).

• Payment Intermediation: Banks/fintechs process account transactions. Institutions with fintech index > 0.9 execute transfers within minutes; otherwise, traditional clearing takes 1–2 days.

• Innovation Decisions: Banks invest in technology as client transactions grow, increasing fintech indices and accelerating payment processing.

(d) Government/Central Bank: Responsible for taxes, expenditures, transfers, and monetary policy. Attributes include tax rates, transfer volumes, expenditure budgets, monetary base (M0), interest rates (CB repo rates), and fintech regulations.

• Tax Collection: Periodically collects taxes, temporarily withdrawing funds from circulation until re-spent on expenditures.

• Transfers and Expenditures: Distributes collected funds via social benefits and public procurements, immediately available digitally in digitalization scenarios.

• Monetary Policy: Adjusts interest rates based on inflation against targets, indirectly influencing bank lending. The monetary base remains stable unless adjusted through policy interventions.

• Fintech Regulation: Government supports or restricts fintech development, potentially influencing fintech adoption and indices via subsidies or regulations.

The model integrates these agent decisions into a complex system. Each simulation step (weekly intervals, providing sufficient granularity) updates agent states and records all transactions.

6.3.3 Calibration and data inputs

To ensure realistic model outcomes, rigorous calibration using real-world data was essential. We employed a combination of official statistics, surveys, and literature-based estimates:

• Macroeconomic Data (GDP, monetary aggregates M1–M3, price levels): Sources: Czech National Bank (CNB), Czech Statistical Office (CSO). We utilized quarterly data from 2000–2025. These figures verify results by comparing simulated nominal GDP and money supply with actual data and establish model initial conditions. For instance, initial money supply (M1 in 2000) matches real historical values. Money supply growth emerges endogenously from credit activities and central bank (CB) policies, tuned so that the simulated M3 in 2025 in a non-fintech scenario aligns closely with actual figures.

• Household Structure and Income: Source: CSO (EU-SILC microdata), income distribution, and household composition data. From this, we created a representative household sample—categorized by income deciles, each with distinct consumption behaviours. Lower-income groups exhibit higher consumption propensities (higher α); higher-income groups prefer savings/investments. Fintech adoption also partly correlates with demographics—young, wealthier households display higher fintech capability indices, consistent with survey findings (younger generations favor mobile payments).

• Consumption Behaviour: Source: Family account statistics (CSO), providing data on consumption baskets, purchase frequencies, etc. From these, we derived average transaction frequencies. Households thus execute transactions at realistic intervals (e.g., weekly for groceries, monthly for utilities), generating total transactions per household—aligned with proxy indicators (transactions per capita).

• Payment Behaviour and Fintech Adoption: Sources: Czech Banking Association (CBA) and CNB payment surveys (e.g., Digital Payments 2022 Report, CNB Payment Statistics). These detail transaction shares by method (cash, card, mobile), internet banking usage, and transactions per person annually. CNB data include card transactions (physical and online), and bank transfers. CBA provides statistics on mobile payments (Apple Pay, Google Pay), QR payments, etc. We directly applied these to parameters in Table 2 (availability, habits). For instance, in 2020, the average Czech made ~220 non-cash transactions annually (~150 card, ~70 transfers), approximating 4–5 weekly transactions per household in the model. Cash payment shares declined from ~80% (early 2000s) to ~30% (post-2020), reflecting increasing fintech adoption.

• Velocity and Delay Parameters: These indirectly measurable parameters were estimated to replicate observed characteristics. For example, average transaction values decreased with widespread card use (smaller frequent payments increase velocity). Card transactions per capita rose, average transaction sizes fell, indicating faster circulation. According to CBA, non-cash transactions reached ~300 per person in 2025, our fintech scenario target. Typical cash delays (2–5 days) come from surveys indicating merchants deposit cash roughly twice weekly, and households maintain cash reserves. Conversely, delays in instant payments (mobile, QR) are negligible, allowing continuous circulation.

• Synthetic Data (Agent-Generated Simulation Data): Besides real data, we generated numerous synthetic transactions (agent-based data). For instance, a fully fintech scenario simulation produces about 10 million transactions annually among ~10,000 agents (scaled to Czech population size). Aggregated synthetic data closely matched macro-statistics after

calibration, enabling measurement of otherwise elusive metrics (e.g., average circulation delay).

Calibration was iterative—parameters were adjusted until the baseline scenario (around 2015 fintech penetration levels) reproduced key empirical indicators: (i) annual money velocity V (GDP/M2) approximately 1.5–1.8; (ii) cash transactions around 50%; (iii) transactions per person ~200 annually; (iv) average cash turnover ~3 days. After calibration, we created traditional (minimal fintech, increased friction, higher cash use) and fully fintech (index ~1, instant payments, nearly 0% cash) scenarios. These extremes illustrate maximal potential effects clearly, though partial adoption scenarios are also feasible.

6.3.4 Definition of velocity in the model

We clarify the definition of money velocity used in our model due to varying interpretations in literature. Traditionally, velocity relates nominal GDP to money supply (M1 or M2). Our model calculates a similar measure: for each simulation year, the nominal product sum (household expenditures, firm investments, government spending—akin to GDP) divided by average money supply (M2) yields income velocity (GDP velocity), comparable to empirical GDP/M2.

However, our model also calculates transaction velocity—incorporating all monetary transactions, including non-final GDP transactions (e.g., inter-firm input payments). Formally, each period t defines:

Vt=sum of all monetary transaction values during period *t* divided by average money supply during period *t*

$$tV_t = \frac{\sum all\ monetary\ transaction\ values\ during\ period\ t}{average\ money\ supply\ during\ period\ t}$$

This metric follows Irving Fisher's transactional exchange equation, crucial for our focus as fintech primarily accelerates transactional flows in supply chains, increasing payment frequency without immediately affecting final GDP.

We distinguish V^{GDP} (income velocity relative to GDP) and V^{TRANS} (transaction velocity). Typically, $V^{TRANS} > V^{GDP}$, since it includes multiple monetary circulations involved in final goods production. Empirically, V^{GDP} declined from 2 (1990s) to 1.2–1.3 recently in the Czech Republic due to relaxed monetary policies and liquidity preferences. Hypothetically, significant fintech acceleration might increase V^{GDP} unless matched by equivalent increases in real balances demand.

Our model primarily reports V^{TRANS}, directly reflecting transactional impacts. Still, comparisons with traditional V^{GDP} provide context. For validation, we confirmed the simulated nominal product-to-M2 ratio approximates 1.5 initially, increasing under full fintech conditions (reflecting reduced money holdings relative to GDP).

With model parameters defined, we proceed to analyses and scenarios.

6.4 Simulation analysis

In this section, we describe the simulation procedures and analysis methods used. The analysis aims to identify differences in monetary circulation and related indicators between traditional and digitalized economy scenarios. The process is as follows:

6.4.1 Scenario settings

Two primary scenarios were defined:

• Scenario A – Traditional Economy (Baseline): Represents low fintech penetration, resembling conditions in the Czech Republic around 2000. Parameter settings include cash transactions comprising ~90–100%, absence of instant payments, several-day transfer periods, payments mainly conducted manually during working hours. Fintech indices for households, firms, and banks are close to zero. Households frequently withdraw cash, and firms settle payments with extended terms. Total transactions are lower due to higher friction and a preference for fewer, larger cash transactions.

• Scenario B – Digital Economy (Optimal Fintech Case): Reflects maximum adoption of modern payments, analogous to a hypothetical situation around 2025+, with most transactions conducted digitally. Parameters include cash transactions <5% (marginal), universal bank support for instant transfers available 24/7 (settled within minutes), widespread adoption of mobile wallets and cards for small transactions, and firms integrating payments into their accounting systems for rapid invoice settlements. Fintech indices approach 1 for most agents.

Although intermediate scenarios (e.g., conditions from 2010, 2020) were also simulated to verify trends, the present study focuses primarily on contrasting scenarios A and B to clearly illustrate differences.

6.4.2 Simulation and horizon

Each scenario was simulated over one year (52 weeks) with a sufficient preliminary "warm-up" period to stabilize the model. Output data were aggregated into annual indicators (total annual transactions, etc.). Due to stochastic elements (e.g., random payment method selection), multiple simulation runs (typically 30) were performed, and results were averaged to ensure robustness. Variance between runs was minimal, given the large number of agents and the law of large numbers.

6.4.3 Measured indicators

In addition to the velocity measures V^{TRANS} and V^{GDP} for each scenario, we monitored other key indicators:

- Transaction structure: percentage representation of various payment types (volume and number of cash, card, mobile transactions, etc.).
- Average transaction size: to examine if digitalization increases the frequency of smaller payments.
- Transaction frequency per agent: average number of household transactions per time unit.

- Average monetary delay: average interval between receiving and subsequently spending money.
- Ratio of money supply to GDP: inversely analogous to velocity, $\frac{M2}{GDP}$.
- Sensitivity to shocks: scenarios testing hypothetical situations, such as sudden fintech confidence drops (prompting shifts back to cash) or central bank monetary injections.

6.4.4 Comparison with empirical data

For validation purposes, we calculated V^{GDP} for each scenario and compared it against actual Czech Republic values. Additionally, we compared simulated transactions per capita with real statistics from CNB and CBA for relevant periods, and the simulated cash transaction shares with survey data (approximately 20–30% in 2022). These comparisons ensure our fintech scenario remains realistic and the baseline accurately represents historical conditions.

6.4.5 Analysis limitations

The model abstracts several aspects. For instance, we explicitly omit modeling the foreign sector (external money circulation), multiple investment asset classes (limited to cash, bank deposits, and generic investments), and comprehensive endogenous price level dynamics (inflation is model-input rather than output; goods prices remain fixed for nominal GDP simplification). Agents do not exhibit behavioural changes beyond predefined rules (e.g., cultural resistance to cashless transactions). However, these simplifications should not significantly affect qualitative velocity outcomes.

With this analytical framework described, we now present our simulation results.

6.5 Results and discussion

This section presents the primary quantitative outcomes of our model for both scenarios (traditional vs. digital economy), followed by an interpretation in the context of literature and empirical data. We analyse their implications, underlying causes, and the resulting impacts on economic theory and policy.

6.5.1 Key quantitative findings

Velocity of Money (V): In scenario A (traditional), the transaction velocity (V_A^{TRANS}) was approximately 18.4, meaning money circulated around eighteen times annually, accounting for all transactions. Conversely, scenario B (fintech) resulted in V_B^{TRANS}≈39.2, more than doubling. This stark difference confirms expectations that digitalization significantly accelerates monetary circulation. For comparison, GDP-related velocity yielded V_A^{GDP}≈1.5 and V_B^{GDP}≈3.2. The baseline value (~1.5) aligns with the actual M2 velocity in the Czech Republic (2010–2015), whereas a figure exceeding 3 represents historically unprecedented levels since the early economic transition. While practical constraints (e.g., changes in money demand) could moderate this increase, the model indicates substantial potential for rising velocity under digitalization.

Transaction Structure and Volume: In the traditional scenario, the model averaged approximately 50 transactions per person weekly (including all minor transactions). In the

fintech scenario, this rose to about 120 weekly transactions, translating to ~2600 vs. ~6240 annually. Although these numbers significantly exceed current empirical levels due to comprehensive inclusion of all economic transactions (including B2B), the trend clearly demonstrates digitalization's potential to significantly increase transaction frequency.

Average Transaction Size: Average transaction size decreased from approximately CZK 800 (scenario A) to CZK 300 (scenario B). This illustrates payment granularization, reflecting lower transaction friction. Similar empirical trends have been observed with the advent of contactless payments in Czech Republic banking statistics.

Money Holding and Delay: Average holding periods between transactions decreased from ~2.7 days in the traditional scenario to ~0.5 days in the fintech scenario. Reduced delays highlight digitalization’s efficiency, nearly eliminating frictional lags between receiving and spending money.

Breakdown by Transaction Type:

- B2C segment saw transactions triple in frequency in the fintech scenario, though total spending volume remained similar. Higher velocity arose from reduced cash and bank balances, as households managed liquidity dynamically.
- B2B segment exhibited the most substantial velocity increase due to nearly real-time invoice settlements and just-in-time payments facilitated by digital processes, significantly shortening monetary circulation cycles.
- Wage payments and government transfers showed moderate but meaningful reductions in delays, driven by faster digital disbursements and potentially more frequent payroll distributions.

Monetary Supply and Credit Impacts: The fintech scenario did not inherently reduce nominal money supply; M2 slightly increased due to smoother credit flows and economic activity. However, velocity significantly rose due to disproportionately larger transaction volume increases compared to monetary supply growth, underscoring IMF assertions that digital payment systems and CBDCs could substantially elevate velocity, necessitating proactive central bank management.

6.5.2 Discussion of results in context

Fintech as a Velocity Accelerator: Results confirm fintech's role in significantly accelerating monetary circulation, aligning qualitatively and quantitatively with empirical literature findings.

Complementarity vs. Substitution: Digital payments appear to expand monetary transactions rather than purely substituting cash, enabling more frequent smaller transactions and enhancing monetary activity without necessarily increasing total consumer expenditures.

Velocity Stability and Monetary Policy: Increased digitalization could heighten velocity volatility. Simulated disruptions (e.g., reduced fintech adoption) caused rapid velocity drops, underscoring financial system resilience and redundancy needs. Central banks may therefore maintain cash-based alternatives alongside digital systems.

Comparison with Czech Empirical Data: Historical Czech data indicate declining M2 velocity until recent slight recovery, coinciding with rising fintech adoption. Our model suggests fintech innovations likely contributed to stabilizing or reversing velocity trends observed empirically since 2018.

Implications for Inflation and Monetary Policy: Higher velocity driven by digitalization could necessitate central bank actions (e.g., limiting monetary supply growth) to maintain price stability. New instruments, such as interest-bearing digital currencies, could offer effective velocity regulation.

Political-Economic Consequences: Results support governmental digitalization initiatives by highlighting enhanced monetary circulation efficiency and potential economic activity gains without necessarily requiring additional monetary supply expansions. However, inclusive policy measures must ensure equitable fintech adoption across demographic segments to prevent digital exclusion.

Comparisons with Other Studies: Our model aligns with literature demonstrating positive relationships between digital payment growth and velocity increases. Unlike some literature suggesting broader money aggregates might experience velocity reductions, our simulation observed continuous circulation and limited monetary accumulation tendencies.

Limitations and Future Directions: Real-world complexities (implementation costs, competitive banking dynamics, and speculative liquidity holdings) were not explicitly modeled, providing avenues for future model refinements. Nonetheless, our findings corroborate the transformative role of fintech, challenging traditional monetary velocity paradigms and underscoring the importance of revising liquidity monitoring and management practices.

6.6 Conclusions

Digitalization is fundamentally reshaping the way money circulates among economic agents. We have advanced the understanding of this phenomenon by combining a literature review with an agent-based simulation focused on the velocity of money. The main findings can be summarized as follows:

- Fintech significantly increases the velocity of money: Our agent-based model, calibrated on Czech data from 2000 to 2025, demonstrates that in a fully digitalized scenario, money velocity more than doubles compared to a traditional economic scenario. The acceleration primarily results from the elimination of delays in payments (instant transfers, continuous operations) and an increased frequency of smaller transactions facilitated by modern technologies. This supports the hypothesis that digital innovations (mobile payments, online banking, CBDC, etc.) act as accelerators of monetary circulation.
- Changing paradigms of money demand: Traditional macroeconomic models assumed stable relationships among money supply, expenditures, and prices. However, increasing accessibility of payment methods leads to declining money demand (liquidity holdings) even with unchanged income levels, as people hold fewer funds due to instant payment availability. This raises the velocity of money, indicating that central banks, including the Czech National Bank (CNB), should reintegrate velocity

monitoring into their monetary analyses. Indicators of digitalization, such as the share of non-cash transactions or the volume of electronic money, could serve as early signals of changes in velocity, potential inflationary pressures, or necessary policy adjustments.

- Segmentation of monetary flows: Detailed analysis reveals the greatest fintech benefits in B2B transactions and inter-firm payment cycles, where the financial cycle significantly shortens, and in consumer payments, where barriers to frequent expenditures disappear. These sectors could thus become focal points for monetary policy, emphasizing the rotation speed of money in commercial activities rather than cash holdings, which increasingly become marginal.
- Monetary and financial stability: Accelerated money circulation presents dual impacts. Positively, it enhances economic efficiency by ensuring more productive use of money. Negatively, it potentially makes the system more susceptible to shocks (rapid deposit outflows, increased velocity volatility). Central banks should preempt these risks through regulations for the fintech sector (e.g., reserve requirements for electronic money, wallet balance limits, ensuring uninterrupted payment systems). New tools, such as variable interest rates on CBDC, might regulate excessive transaction speeds according to economic needs.
- Policy implications for the Czech Republic: Continued support for financial digitalization (e.g., developing a national digital currency, fintech startup promotion, digital state payments) could enhance economic dynamism. Nevertheless, education and inclusivity must ensure all citizens benefit from fintech innovations without succumbing to the digital divide. Concurrently, CNB must closely monitor potential changes in historical monetary relationships (such as stable linkages between monetary aggregates and inflation) and adapt its models and forecasts to a new normal.
- Originality and methodological contributions: we demonstrate the utility of agent-based modeling for detailed exploration of money circulation aspects unattainable by aggregated data alone. This approach enables estimating average delays in payment types and simulating extreme scenarios (e.g., a 100% cashless economy), otherwise difficult to achieve. Future enhancements could incorporate international dimensions (effects of global digital currencies on small open economies) or micro-level payment data for even more precise calibration.

In conclusion, financial digitalization is not merely a technological innovation but fundamentally alters monetary circulation dynamics. Economists and policymakers should thus closely monitor money velocity in this new era, potentially even more diligently than in traditional textbook scenarios, given the substantial scope of potential changes demonstrated by our study.

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7. Economics of productive consumption and positional investing

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This chapter investigates the interplay between the economics of productive consumption and positional investing within financial markets. Traditional neoclassical models often overlook how consumption impacts future income and how social positions influence reciprocal relationships among economic agents. A key question is what prevents investment opportunities from being utilized based purely on their rate of return, aiming for an optimal distribution of benefits. The aim is to demonstrate the distinct differences in economic system efficiency when positional investing is present versus absent. It seeks to derive the phenomenon of positional investing deductively from the Pareto optimum definition for investment markets and to provide theoretical tools for its analysis and to address the transformation of property advantage into a tool for discrimination.

The research integrates two main areas: the economics of productive consumption (which extends the neoclassical economic model by focusing on consumption that contributes to future production and human capital) and the issue of positional investing (where one subject uses its position to suppress the investment opportunities of another subject). The methodology involves comparing two-component models based on the Nash bargaining problem, applying game theory, and extending microeconomic models of investment fund supply and demand to include investment opportunity generation. The Pareto optimum is defined for both original and extended models. The relationship between cooperative and non-cooperative strategies is expressed through two-matrix games, distinguishing them by the type of Nash equilibrium.

The research clarifies the contradiction between individual and collective rationality, demonstrating that not every distribution is acceptable to both players. It shows that social status can influence the distribution of market and non-market goods, and that positional investing reduces system efficiency. By transforming games involving positional investing into two-matrix games, the Pareto and Nash equilibria are shown to be distinct, whereas they merge in games without positional investing, making cooperation advantageous. This implies a significant difference in the efficiency of economic systems with and without positional investing. The analysis identifies losses arising from unused investment opportunities by one player due to suppression by another, and from sacrificing resources.

7.1 Introduction

The modern economic landscape is characterized by complex interactions among various agents. Traditional neoclassical economic models often provide a simplified view, particularly regarding the dynamics of consumption and investment. This chapter delves into two interconnected areas of research: the economics of productive consumption and the phenomenon of positional investing. The economics of productive consumption extends the neoclassical framework by recognizing that current consumption can significantly influence future income and overall economic performance through its impact on production, growth, and human capital. Concurrently, positional investing examines situations where individual incomes and actions are not neutral in forming reciprocal relationships, allowing some actors to leverage their social or property advantages to suppress others' claims.

A fundamental question that arises in this context, originally formulated in 2021, is: "What prevents investment opportunities from being used based on their rate of return?". This inquiry stems from an elementary model of investment fund supply and demand. The search for an answer has led to the development of an original system of models and theoretical tools within the economics of productive consumption and positional investing, demonstrating the deep interconnectedness of these two fields. This chapter aims to further refine these models, particularly by incorporating the generation of investment opportunities, which plays a crucial role in fostering cooperative behaviour among economic agents.

The contribution of this work lies in its deductive derivation of the positional investing phenomenon, contrasting with previous empirical approaches. By specifying the definition of the Pareto optimum for the market of investment funds and opportunities, this chapter illuminates the stark difference in efficiency between economic systems where positional investing operates and those where it does not. Through the application of game theory, especially the analysis of two-matrix games, we show that in the presence of positional investing, Pareto and Nash equilibria diverge, whereas in its absence, they merge, promoting cooperation. The insights gained offer valuable tools for analyzing real-world economic situations, including the design and implementation of reforms.

7.2 Subject and methods

This chapter leverages a two-component model of the supply and demand of investment resources and investment opportunities, integrating theoretical foundations from the economics of productive consumption as an extension of neoclassical economics. The central methodological innovation is the deductive derivation of positional investing, distinguishing it from prior empirically based analyses.

The research employs the following methods and procedures:

- A microeconomic model of investment fund and opportunity supply and demand, extended to account for how investment opportunities are generated.
- Defining the Pareto optimum for both the original and extended models of investment fund and opportunity supply and demand.
- Utilizing tools to express the optimum through marginal variables.
- Expressing the relationship between cooperative and non-cooperative strategies via two-matrix games and differentiating them by the type of Nash equilibrium.
- Interpreting the results in the context of current issues and future perspectives.

For simplicity and without limiting the validity of the core conclusions, a two-player case is primarily considered.

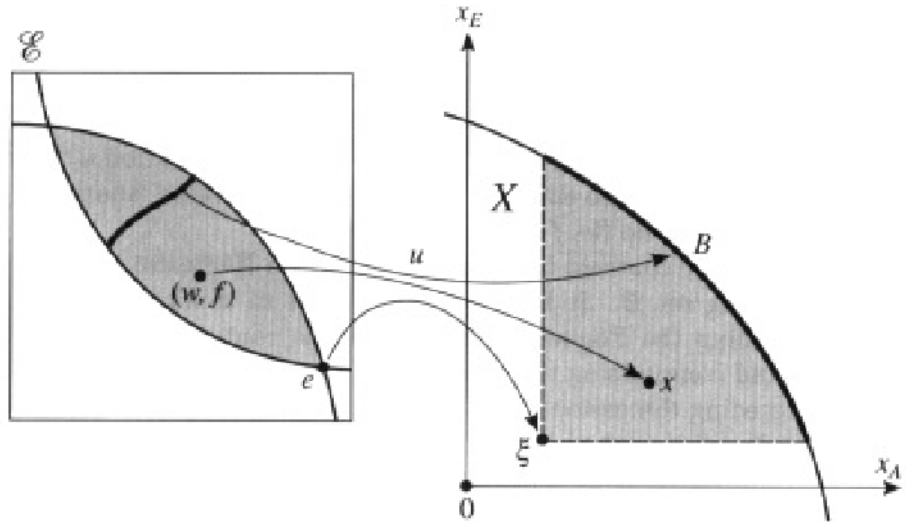
7.3 Comparison of two-component graphs based on neoclassical economics and economics of productive consumption

Research in this area has shown that comparing two two-component graphs is the most effective approach to achieve the stated objectives.

The Edgeworth Box Plot and the Nash (S,d) Bargaining Problem

The first graph combines the Edgeworth box plot, which describes the market in marginal quantities, with a graph in total quantities that converges with the Nash (S, d) bargaining problem.

Figure 14: A two-component model of the consumer goods market in K. Binmore



Source: Binmore (1994, p. 74, figure 14)

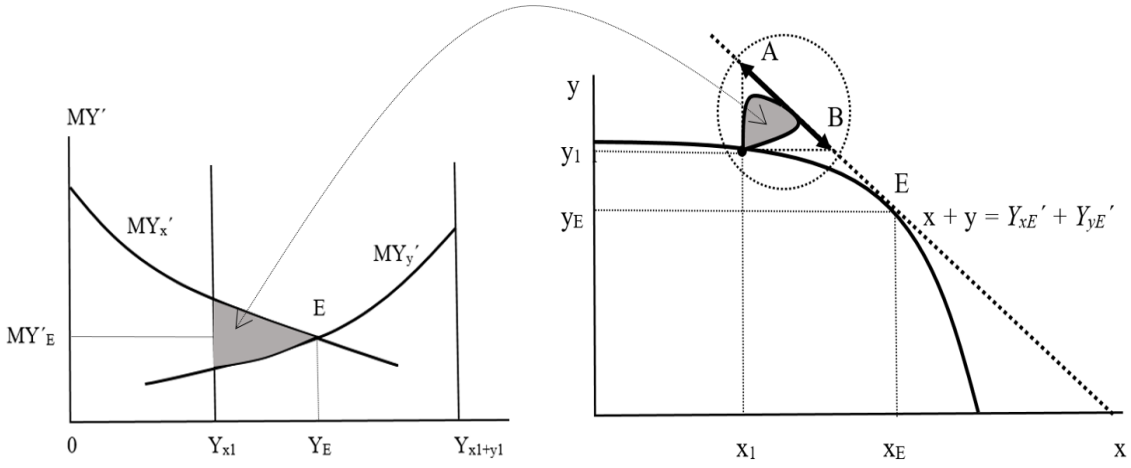
- The sides of the rectangle in the left part of Figure 14 represent the quantities of goods.
- The points at opposite ends of the rectangle (bottom left and top right) are the inverted origins of the coordinates corresponding to the quantities of goods obtained by each consumer (player), with payoffs denoted as xA, xB in total quantities.
- Every point within the rectangle uniquely corresponds to a distribution of goods among the players.
- Indifference curves for both players are plotted within the rectangle, showing combinations of two goods that yield equal utility for each player.
- Only at the tangency points of the indifference curves is the condition of collective rationality met, meaning no player can improve their position without worsening another's.
- The intersection of the indifference curves represents the starting point of negotiations (the point of disagreement, labeled "e" on the left and "ξ" on the right in Binmore's figure).
- The right part of the figure illustrates the same concept as the Nash (S, d) bargaining problem.
- The curves with arrows show the relationship between the left and right parts of the figure.
- Point B is one of the possible solutions to the Nash bargaining problem.

Binmore (1994, p. 91) notes that "individual rationality is the requirement that no player receive less than his level of security". This concept implicitly links to the phenomenon of positional investing.

7.4 Two-component model of the financial market

A similar two-component model can be applied to the financial market, as previously presented at a conference in 2021 (Černík, Valenčík 2021, s. 17).

Figure 15: Two-component model of the financial market



Source: Černík, Valenčík (2021, p. 17)

Already in the 1920s, Pigou (1928, p. 29) noticed the following: "There is investment in human capital and investment in physical capital. Once we realize this, the distinction between the consumption economy and the investment economy becomes blurred. Consumption is to a certain extent an investment in personal productive capacity". He was not alone. Neumann (1945-1946) made the transition to a productive consumption economy by reducing all goods to 'intermediate goods.' Friedman, M. (1957 The Theory of the Consumption Function) by stating that households use their present income to create assets consisting of human and non-human capital so as to maximize the present value of future income (here the inspiration of Pigou is quite obvious).

- The left side of Figure 15 depicts a microeconomic model of the financial market in marginal quantities, showing the supply and demand of investment opportunities and funds (derived from current income). The shaded area highlights the region of Pareto improvements, where one player's investment funds are used to realize more profitable investment opportunities of another player.
- The right side of Figure 15 expresses the same in total quantities. The dotted line indicates the set of points with maximum sum of payoffs, and the shaded area again represents Pareto improvements.
- The bold line with arrows at its ends represents the set of all points satisfying the requirements of attainability, individual rationality, and collective rationality.

In a consumer goods market, each consumer (player) is indifferent to the utility of the other player. This contrasts with financial markets where the generation and realization of investment opportunities are critical.

7.5 The phenomenon of positional investing

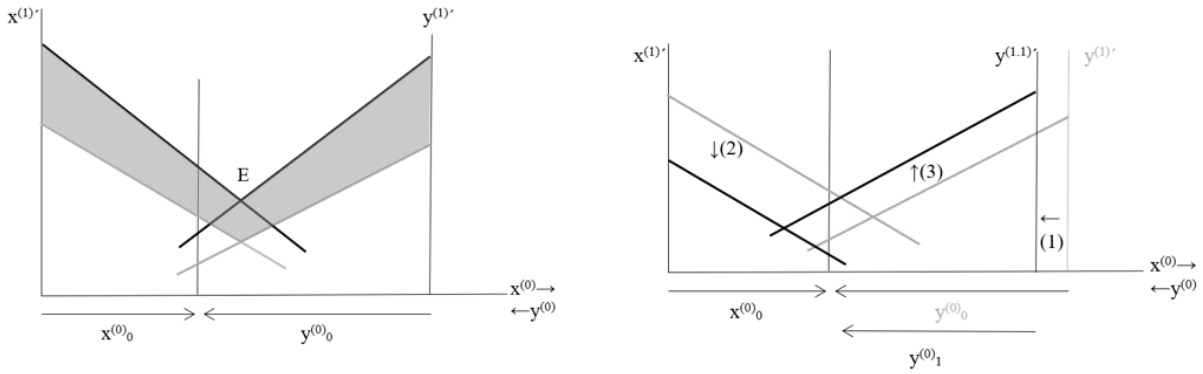
Positional investing is defined as the transformation of a property advantage into a privilege, serving as a tool for discrimination by the advantaged party against others. This phenomenon permeates the entire economic system, taking various forms but sharing a common basis: the suppression of investment opportunities available to one entity by another who uses positional investing, thereby increasing the profitability of their own investment opportunities, even if it reduces the overall system's efficiency.

The research identifies distinct differences between real situations tending towards an extended Pareto equilibrium and those influenced by positional investing. This distinction helps in understanding the unrealized investment opportunities in systems where positional investing is at play.

When positional investing occurs, there is an overall decline in investment opportunity due to two distinct causes:

- The more profitable investment opportunities of one player are replaced by the less profitable investment opportunities of a player who takes advantage of positional investing.
- The total amount of investment funds in the system is reduced by the part of the investment funds of the player who uses the positional investing option to invest in the position. (This is shown in the right part of Figure 16 below.)

Figure 16: Differences in the efficiency of systems without and with positional investing



Source: author

Losses arising from positional investing include:

- Loss from not utilizing investment opportunities that could have been generated by player X.
- Loss from suppressing investment opportunities of player X.
- Loss from the fact that investment opportunities of player Y, which could have been generated by player Y in the case of cooperative behaviour, have a lower return than the increase in returns of player Y as a result of suppressing investment opportunities of player X.
- Loss from sacrificing resources that could have been used to realize investment opportunities generated by player Y in the case of cooperative behaviour.

7.6 Game theory and cooperative behaviour

To answer how to achieve cooperative behaviour, the framework of non-cooperative games can be used, particularly by transforming real situations into two-matrix games. These games allow distinguishing between situations where players benefit from cooperation (Pareto equilibrium coincides with Nash equilibrium) and those where the Nash equilibrium is based on players improving their payoffs by transitioning to a cooperative strategy.

The development of the basic model of investment funds and opportunities, incorporating the generation of investment opportunities, represents a significant theoretical advancement. This approach emphasizes that the path to cooperative behaviour among economic agents involves situations where a cooperative strategy is not only a Pareto but also a Nash equilibrium for all players.

The current level of human society suggests that solving many contemporary problems lies in increasing productive services focused on developing, preserving, and utilizing human capabilities (e.g., education, healthcare, social work) and the gradual dominance of this service sector, which contributes synergistically to society's innovation potential. This necessitates creating conditions at local and global scales for games where cooperation is beneficial to all participants, consistent with the extended Pareto optimum in financial markets.

7.7 Conclusions

The research presented clarifies the fundamental contradiction between individual and collective rationality, highlighting that not every distribution of benefits is acceptable to all players. It firmly establishes that social status can significantly influence the allocation of both market and non-market goods, and, crucially, that positional investing inherently reduces the overall efficiency of an economic system.

By synthesizing the theoretical foundations of the economics of productive consumption with the analysis of positional investment, this work provides essential tools for understanding how a property advantage can be transformed into a privilege and, consequently, into a mechanism for discriminating against others. The deductive derivation of positional investing and its implications for the divergence of Pareto and Nash equilibria in non-cooperative scenarios offers a robust theoretical framework for further research and practical application.

The findings underscore the importance of fostering cooperative economic environments. Realizing an extended Pareto optimum, where investment opportunities are generated and exploited based on their returns regardless of ownership, maximizes the long-term returns from sequential investment opportunities. This requires a shift towards reforms that create conditions for such optimal functioning, particularly through the design and implementation of effective mechanisms. The future direction of societal development is inherently linked to promoting productive services that enhance human potential, thereby fostering an environment where cooperation is not just desirable but strategically advantageous for all economic actors.

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8. Current trends in prudential banking regulation

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Prudential banking regulation has evolved significantly since the 1980s in response to financial crises, market developments, and the increasing complexity of banking activities. The chapter aims to provide an overview of current prudential banking regulation, summarize recent regulatory trends, and explore possible future directions for regulation development.

The study uses a review and analysis of regulatory texts, supervisory reports, and academic literature, focusing primarily on the European Union context.

Key findings include an increase in regulatory scope and complexity, growth of cross-sectoral regulation, harmonisation efforts, emphasis on proportionality, and emerging simplification initiatives. Challenges such as regulatory overload and stakeholder conflicts are also identified.

To enhance effectiveness, prudential regulation should focus on clarity, proportionality, simplification, legal certainty, and greater use of technology. A balanced approach is necessary to maintain financial stability while reducing burdens on institutions.

The chapter offers a comprehensive and up-to-date synthesis of current trends and future directions in prudential banking regulation, combining analytical review with the author's nearly 25 years of professional experience in banking regulatory practice. This perspective enables the author to critically reflect on regulatory developments and propose realistic, recommendations valuable to policymakers, supervisors, and financial institutions.

8.1 Introduction

The aim of this chapter is to present an overview of the elements of current prudential banking regulation against the background of recent historical developments (since about the 1980s). Another objective is to summarise the current trends in banking regulation, to reflect on possible directions of its future development and to motivate the discussion on this complex topic. It should be clarified that the research does not deal with the regulation of rules of conduct and consumer protection. Given the general nature of this research, which is intended to provide some perspective, some simplification is sometimes applied in terms of the individual rules of banking regulation.

The motivation for this research is a certain frustration evident in the communities of regulators/supervisors and supervised entities about overregulation including the associated increase in complexity, and at the same time a perceived scepticism about the possibilities of improvement in future developments, which the author of this research perceives from her own experience. It is therefore advisable to take stock of where we are and consider what to do next.

In order to explain the current and future trends in the development of banking regulation, it is necessary to start first with a brief historical excursus, explaining why these regulations came into being, gradually moving on to how they have developed in recent years, where we are now and what the way forward may be in the various alternatives.

8.2 Historical development of banking regulation

8.2.1 National regulation and the origins of bank licensing

Prior to the emergence of international regulation, various forms of banking regulation existed at the national level. The first and simple forms of bank supervision can be traced back to the 17th century with the emergence of central banks, or even earlier, but modern bank regulation and supervision did not emerge until the 19th century. An important milestone was reached in 1863 with the passage of the National Currency Act in the United States, which was immediately amended to the National Bank Act in 1864. This Act introduced mandatory federal banking licences for so-called national banks, which were regulated by the newly created Office of the Comptroller of the Currency (OCC). Banks that wanted to issue national currency (national bank notes) had to obtain a license. Minimum capital requirements (at the time fixed amounts, not ratios) and rules for operations were set (Tufts, Moloney, 2022a; Tufts, Moloney, 2022b).

In Europe, regulation of the banking sector has long been a separate national affair, with rules varying according to the legal traditions and economic needs of each country. According to the CNB: "Financial market regulation in the Czech Republic dates back to the second half of the 19th century. However, regulation itself, with exceptions in the case of public monetary institutions, was initially carried out only at the level of licensing and authorization; only later did institutions for close and remote supervision come into being. While the licensing activity was concentrated in Austria-Hungary and then in Czechoslovakia in a single state institution (the Ministry of the Interior), the actual supervision (auditing activity) was carried out by self-governing auditing associations, which were established either completely autonomously or, on the contrary, compulsorily." (CNB, [cited 2025-02-13]).

In general, countries with market-based economies have gradually, especially since the 19th century, introduced licensing, minimum capital requirements, transparency and supervision of banks. The usual aim has been to prevent banking crises, or to limit their impact, and to protect customer deposits. Another important reason is to protect against potential public spending that might be needed to support failing banks. The reason for the development of regulations was almost always crisis phenomena. More broadly, the aim of banking regulation is to prevent market failures that arise from information asymmetries, externalities and excessive risk-taking. Joseph Stiglitz (1994), for example, has prominently explored the idea that market failures are likely to be more pervasive in financial markets and that there exist forms of government intervention that will not only make these markets function better but will also improve the performance of the economy.

8.2.2 Basel Concepts - Historical motives for the Basel I concept

In the period prior to the emergence of Basel I (i.e. the first global concept of banking regulation), there were several crises that exposed the weaknesses of the banking system:

- The collapse of the fixed exchange rate system (Bretton Woods system in 1971), where the subsequent volatility of exchange rates increased the risk of bank losses. (See Šálený, 2013)

- Serious disturbances in international currency and banking markets, namely the collapse of Bankhaus Herstatt in West Germany in 1974. (See Basel Committee on Banking Supervision, 2025) The cause was the large losses it suffered as a result of the speculative foreign exchange positions it took. (European Central Bank, 2007)
- The onset of the Latin American debt crisis in the early 1980s heightened concerns that the capital ratios of major international banks were deteriorating at a time of rising international risks. (Basel Committee on Banking Supervision, 2025)

These events demonstrating financial instability in the 1970s and 1980s suggested that banks often held insufficient capital relative to the risks they were taking. In cross-border operations, these risks are easily spilled over internationally and cause a nasty domino effect. However, at the time there was no international standard, and different countries had different capital standards for banks, opening the door to regulatory arbitrage - banks could move operations to countries with looser rules. In the 1980s, Japanese banks dominated the world rankings by asset size, accounting for two-fifths of international banking assets by the late 1980s, and a significant portion of these assets were located in US and UK branches (see Federal Reserve, 1989). This was compounded by the general trend of financial deregulation in Japan (see Basel Committee on Banking Supervision, 2001). According to Lall (2009), US banks complained about competition from Japanese banks, which had lower capital levels.

However, bank failures also occurred at the national level. In the advanced US economy, more than 1,600 banks insured by the Federal Deposit Insurance Corporation (FDIC) were closed or received FDIC bailouts between 1980 and 1994. Given the relatively low capital ratios at many large banks and the increase in failures, supervisory agencies in the US advocated the introduction of explicit capital standards and agreed in 1985 on a single system that would apply to all banks. Final risk-based capital requirements went into effect in 1992 (See Federal Deposit Insurance Corporation, 2025).

The international impact of instability has led to pressures for common rules, officially to prevent destabilisation of the global banking system.

However, one cannot ignore the geopolitical context at the time, e.g. vis-a-vis the Japanese banks mentioned above. At the turn of 1974 and 1975, the Basel Committee on Banking Supervision (BCBS) was established by the G10 countries - Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden and the United Kingdom - together with Switzerland and Luxembourg - see Council on Foreign Relations (2025).

As noted by Lall (2009), the Committee's first proposal, in 1975, set out rules specifying the obligations of home and host country regulators towards cross-border banks. It was only later, in 1988, that the BCBS adopted the concept of capital adequacy, referred to as Basel I, and it became the first international framework for bank capital adequacy. Its main official objective was to set minimum capital requirements and to harmonise rules across jurisdictions, thereby strengthening the stability of the banking sector and contributing to the prevention of banking crises. From the outset, the rules were designed for internationally active banks. It explicitly set capital requirements only in respect of credit risk, although it also allowed for certain types of market risk, namely interest rate risk or so-called securities investment risk. Basel I required banks to hold at least 8% of capital against so-called risk-weighted assets, half of which was to

be covered by top-quality tier 1 capital. The length of the document, which is less than 30 pages, is noteworthy (Basel Committee on Banking Supervision, 1988).

8.2.3 Basel II: Moving to a model-based approach

Another turning point came in 2004, when the Basel II approach was introduced after some 4-5 years of prior preparation and public consultations (Basel Committee on Banking Supervision, 2004). Its main qualitative change was the introduction of internal risk models for credit and operational risk, whereas models had been allowed for market risk earlier after the adoption of an improved version of Basel I.

The Basel II concept introduced a three-pillar structure, with Pillar 1 representing minimum capital requirements for credit, market and operational risk. The model-based approaches were intended to provide greater risk sensitivity and incentivise banks to better manage risk. Therefore, the concept was set up to incentivize in some capital savings. However, the bank had to invest in internal infrastructure, model development, hire qualified personnel and had to go through challenging approval procedures and ongoing supervisory oversight of the models.

The Pillar 2 focuses on banking supervision processes and risk assessment not covered by the first pillar. It includes the Internal Capital Adequacy Assessment Process (ICAAP), where the bank assesses whether its capital is adequate for the risks it takes. It also includes the external oversight of the authorities that assess and control the bank's internal risk management processes, the so called supervisory review process (SREP). This pillar requires banks to have effective systems to manage all relevant risks and an adequate capital base to cover them.

The Pillar 3 focuses on transparency and disclosure of information that enables market participants (investors, analysts and the public) to assess the financial health and risk profile of the bank. The aim is to increase market discipline and improve investment or trading decisions with the bank based on the disclosures.

Basel II was again designed for internationally active banks at all levels within a banking group, including on a fully consolidated basis. The objectives are similar to those of Basel I, i.e. to strengthen the soundness and stability of the international banking system while maintaining sufficient consistency in capital rules so as not to be a significant source of competitive inequality for internationally active banks. Depositor protection is also mentioned as one of the main objectives. The model approaches introduced into regulation have taken inspiration from the management systems of leading internationally active banks, adapting regulation to advanced practice. The size of the document has also increased to about 240 pages.

At the time of the introduction of Basel II, supervisors expected banks to be rather restrained in introducing advanced model approaches, but the opposite was true. In the EU, Basel II was introduced in 2007, and larger banking groups have been asking for permission for a model-based approach for credit risk and sometimes for operational risk virtually from the beginning. Thus, the more advanced model-based approach started to be used in the EU for a decisive share of banking sector exposures. Regulation has probably led to a much wider use of models than natural developments would have brought about. This process has provided many insights into risks and has undoubtedly contributed to their better measurement and management. However, models also have a number of drawbacks, including the need for

sophisticated tools and detailed, high-quality data, the fact that some risks may be difficult to quantify or predict, etc.

Another challenge was the fact that soon after the introduction of Basel II, without having had time to actually put its pros and cons into practice, the development brought the global financial crisis. The Basel II concept came to be blamed for causing this crisis. For example, Lall (2009) points to the decline in capital requirements due to models in quantitative impact studies. He criticises a number of aspects of Basel II, including that it favours large banks that can take advantage of the models and does not bring competitive equality. It also considers that market risks and securitisation are insufficiently covered. Lall may be right in many respects. However, Basel II had been in place for a very short time in the EU in 2007-2008 when the global financial crisis erupted, and had not yet been implemented in the US. In contrast, the risks mentioned above by Lall, together with the use of Pillar 2, could have been better covered under Basel II if it had been strictly adhered to.

8.2.4 Basel III: Response to the financial crisis and regulatory tightening

In response to the global financial crisis that began around mid-2007, the international financial community as well as policymakers began to look for the causes of the crisis. While the causes could often be traced back to a lack of supervision, the changes have largely affected regulation. These included not only prudential rules (including capital requirements) for the narrower sense, but also, for example, accounting rules, the institutional and geographic scope of regulation of financial firms, a new regime for resolving banking crises, the introduction of regulation of credit rating agencies, rules on remuneration of bank employees, and the addition of a macroprudential aspect to regulation.

A comprehensive programme of financial reforms to increase the resilience of the global financial system and reduce the likelihood of future crises while maintaining its openness and inclusiveness was initiated by the G20, which established the Financial Stability Board in 2009 to coordinate the development of this programme and monitor its implementation (see Financial Stability Board, 2017).

As far as the Basel concept is concerned, there were several stages of changes that were gradually developed since about 2009 and, with some delay, were gradually implemented in individual jurisdictions since about 2011.

The main changes brought about by Basel III can be summarised as follows (for initial source, see e.g. Committee on Banking Supervision, 2010 and Basel Committee on Banking Supervision, 2017 or for a consolidated text see Basel Committee on Banking Supervision, n.d.):

- Improving the quality of banks' regulatory capital, in particular strengthening the role of common equity tier 1 (CET1) capital, which has the best loss-absorbing capacity.
- An overall increase in capital requirements where they were perceived to be insufficient, e.g. for securitised exposures, trading book exposures, counterparty credit exposures arising from derivatives (Credit Valuation Adjustment risk), repo and banks' securities financing activities.
- Various model restrictions aimed at increasing minimum capital requirements. These include the scope of application of the models, as well as so-called input floors (i.e. minimum values for certain risk parameters) and aggregate output floors. Overall,

these constraints aim to reduce the variability of capital requirements set by the models.

- The introduction of softer capital requirements in the form of so-called capital buffers, such as the conservative capital buffer, the countercyclical capital buffer, and the capital buffer for systemically important institutions. These new elements are part of the so-called macro-prudential measures.
- New leverage ratio - this is a different form of capital requirement, but one that avoids so-called risk weighting and should therefore not be subject to model risk.
- The new liquidity requirements - Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) - are intended to ensure a better short- and long-term liquidity position for banks.
- Additional rules for systemically important banks (G-SIBs) - higher capital requirements for large banks with global systemic importance.

It should be noted that since the Basel III approach has been developed in stages, some of the later stages have come to be referred to by some authors as Basel IV, but this is not the correct term.

8.3 Main areas of prudential regulation

8.3.1 Prudential regulation in the narrow sense

It is clear from the above overview that prudential regulation has expanded over time. As regards capital requirements, which form the backbone of prudential regulation, these have been extended from credit risk to other risks, but prudential regulation has begun to extend beyond pure capital requirements or capital adequacy. The concept of capital adequacy has gradually fallen into disuse, and the term capital requirements is more commonly used to refer to the capital requirements that are part of prudential regulation of banks.

In particular, the following elements can be included in prudential regulation of EU banks (opinions on this definition may differ, the sources being in particular the Regulation (EU) 2013/575 and the Directive 2013/36/EU; some rules may be specified on national basis):

- Licensing rules and related requirements e.g. initial capital.
- Rules for an internal management and control system (governance) that includes the management of all relevant risks, including outsourcing risk or, better, third party risk, remuneration rules for employees who can influence the institution's risk profile (material risk takers), fit and proper rules ensuring that individuals holding key positions (especially in roles of governance or senior management) are qualified, capable, and trustworthy. More specifically, e.g. the Czech Decree No. 163/2014 Coll., § 31, as amended, requires the ongoing management of reputational risk, strategic risk, risk associated with sources of capital and funding, risk associated with group membership including risk of transactions with members of the same group, risk associated with hedging and asset encumbrance, market infrastructure risk, non-standard operations risk, the risk of operations involving a non-transparent or otherwise potentially risky counterparty or geographic area, the risk of operations with non-supervised financial services providers, the risk of operations involving a non-

Member State, the risk of the regulatory environment, the risk of the political environment, contagion risk and systemic risk.

- Large exposure limits - limiting excessive concentration of credit risk to individual clients, economically related groups or sectors.
- Leverage ratio - setting a minimum required ratio of capital to total assets, regardless of risk weight
- Capital requirements for core banking risks - credit, market and operational risks (Pillar 1) and, in Pillar 2, for risks not covered at all or insufficiently covered by Pillar 1.
- Eligibility of credit risk mitigation, which reduces the capital requirement credit risk.
- Capital buffers - a macro-prudential element to strengthen the stability of the banking sector.
- Liquidity ratio requirements, namely the NSFR (Net Stable Funding Ratio), i.e. the long-term funding to ensure liquidity stability, and the LCR (Liquidity Coverage Ratio) - the requirement for sufficient short-term liquidity.
- Rules on asset acquisition and financing - e.g. prohibition on acquisition of qualifying holdings outside the banking sector.
- Classification of exposures - including definition of default, rules for non-performing exposures (NPEs) and provisioning.
- Requirement for consolidated regulation and supervision - for supervision of banking groups and financial conglomerates.

8.3.2 Other areas of bank regulation

In addition to prudential regulation of banks in the narrow sense, the EU has extended regulation to other areas of banks' (and, where appropriate, non-banks') activities in order to strengthen the stability and resilience of the financial system. We can speak of prudential regulation in a broader sense.

- AML (Anti-Money Laundering) – measures against money laundering and terrorist financing.
- Crisis management – introduction of crisis resolution plans and mechanisms for the orderly failure of banks.
- Digital resilience - protection against cyber threats and technological disruptions.
- Consumer protection - regulations aimed at transparency and fair treatment of customers. This can include mandatory deposit insurance.
- Rules for systemically important institutions (SIFI) - increased capital and risk management requirements for the largest banks to reduce their potential threat to the stability of the financial system.
- Shadow banking regulation - supervision of non-bank financial services entities that may pose a systemic risk.
- Green regulation and sustainable finance - introducing rules to integrate environmental, social and governance risks into banking strategies and processes and into reporting and disclosure.
- Rules for markets in crypto assets.

The EU's broader approach to bank regulation encompasses a range of critical areas beyond traditional prudential oversight. These regulations aim to address various risks that could

threaten the stability of the financial system, from money laundering and consumer protection to digital resilience and sustainability. By covering both banks and non-bank financial entities, these measures should ensure that the financial sector remains robust in the face of emerging challenges, such as technological disruptions, climate change, and the growing importance of digital assets.

8.4 Current trends in banking regulation

Over the recent approximately 15 – 20 years, a number of fundamental trends in prudential regulation have emerged, talking primarily about the EU.

1) A significant increase in scope and scale of regulation

Banking regulation has grown significantly since Basel I and continues to increase in complexity. In particular, European regulators continue to enforce stricter rules and banks face increasing pressure to comply, leading to rising compliance costs and potentially less flexibility in bank operations. In the US, currently (spring 2025) there is an intensifying trend (that started already in sooner) towards relaxing some requirements – see e.g. Tokar (2025), or even deregulation to stimulate economic growth, accompanied by efforts to tailor regulations to the needs of smaller banks – see Lawder & Schroeder (2025). This brings a new global dimension to the debate, underpinned by the aspect of competitiveness and regulatory arbitrage. The debate on the sustainability of the current scope of regulation thus continues and it can be expected that in the future a balance between stability and efficiency of the banking sector will be sought.

It should be noted that the very increase in the scope and scale of regulation and its frequent changes increases, at the very least, the regulatory risk for banks, has an impact on the opportunities for competition in the market, to the detriment of smaller firms, and may increase the concentration of systemically important banks and thus systemic risk. In other words, regulation both reduces and creates risk. This may be one of the contributing reasons why the number of credit institutions is falling sharply. According to the European Banking Federation (2024), this trend has been particularly pronounced since 2009, with the number of credit institutions in the EU falling by almost 40 % (from 7 971 to 4 927) in the 15 years to the end of 2023.

2) Expansion of horizontal prudential regulation across financial sectors

There is a growing emphasis on a horizontal, cross-sectoral approach to prudential regulation. Rather than focusing narrowly on individual financial sectors—such as banking, insurance, or capital markets—regulators increasingly design and apply rules that cut across the entire financial system. This shift reflects the recognition that systemic risks and business models are no longer confined to traditional sectoral boundaries.

One of the key drivers of this trend is the prevalence of financial groups and conglomerates that operate simultaneously in multiple segments of the financial market. Such entities may combine banking, insurance, and asset management activities under a single holding structure, creating complex interdependencies and risk transmission channels. As of December 2024, 63 financial conglomerates with a head of group in the EU/EEA were officially identified and listed by the Joint Committee of the European Supervisory Authorities. These groups are subject to supplementary supervision under the Financial Conglomerates Directive

(i.e. Directive 2002/87/EC, 2002) and include some of the largest cross-sector financial institutions in Europe (Joint Committee of the European Supervisory Authorities, 2024). As a result, effective supervision and risk control require a regulatory framework capable of addressing these interconnections in a coherent and consistent manner.

A good example of this cross-sectoral approach is the Digital Operational Resilience Act (DORA), i.e. Regulation (EU) 2022/2554 (2022), which introduces a unified set of rules on ICT risk management for a broad range of financial entities across the EU. DORA acknowledges that digital operational resilience is a systemic concern that cannot be tackled in silos. By harmonising requirements for banks, insurers, investment firms, and other financial entities, it reflects the broader trend of aligning prudential rules with the realities of integrated financial service provision in a digital age.

Generally, this approach enhances regulatory consistency, reduces regulatory arbitrage, and enables the more effective management of systemic risks across the financial market. However, horizontal regulation can be more complex to implement, requiring coordination between different regulators, which can slow down the decision-making process. Furthermore, it can sometimes result in overly general rules that do not adequately reflect the specifics of individual sectors, thereby limiting the flexibility and effectiveness of regulation in specific segments.

3) Harmonisation

In the first (roughly 10) years after the global financial crisis, there was a strong focus on the harmonisation of prudential regulation. This is evidenced, for example, by the fact that the original Capital Requirements Directive (CRD) of 2006, comprising Directive 2006/48/EC and Directive 2006/49/EC, was largely replaced by Regulation (EU) No 575/2013 and the more concise Directive 2013/36/EU. It's important to note that EU regulations (unlike directives) are directly enforceable in all member states, leaving no room for divergent interpretations. A similar trend has been observed in other areas of financial market regulation.

The reasons for this trend are succinctly summarized and defended e.g. in the conclusion of her thesis by Didyk (2022), p. 67, when she writes: “National banking structures left little room for deeper integration. The Global Financial Crisis uncovered all those inadequacies of the European banking regulation, highlighting how harmful the fragmentation of regulation and supervision is.” This idea and tendency is still valid and promoted, as evidenced, for example, by the statement made by Claudia Buch, a supervisor at the European Central Bank, at a university lecture in Warsaw in April 2025: "Europe must remove barriers to bank mergers because the fragmented financial environment with different national rules and practices makes the bloc vulnerable to shocks and instability. This fragmentation not only restricts efficiency gains but also leaves financial systems more vulnerable to asymmetric shocks and instability", quoted by Reuters (2025).

These rationales suggest that harmonisation would be particularly beneficial for entities operating across borders. However, a disadvantage is that it may not be tailored to domestic institutions or practices. In practice, this can result in sub-optimal or even disadvantageous solutions for certain entities or countries.

4) Stress on the proportionality principle

The proportionality principle began to be emphasized with the implementation of the later stage of Basel III. Stakeholders realized the growing complexity of regulation, which is becoming a challenge mainly for smaller and medium-sized entities. As a result, regulatory frameworks have increasingly incorporated provisions allowing to take into account the size, nature, and complexity of a given entity's operations. The principle of proportionality, however, is not new in the EU and is laid down in Article 5(4) of the Treaty on European Union.

In the EU banking prudential regulation the principle of proportionality started to be implemented after global financial crisis and in the EU in larger scale since approximately in 2019 together with the issuance of Regulation (EU) 2019/876, 2019 (CRR II) and Directive (EU) 2019/878, 2019 (CRD V).

As an example in Regulation (EU) No 575/2013, Article 325c(6) stipulates::

“An institution shall conduct the review referred to in the first subparagraph at least once a year, or on a less frequent basis of up to every two years where the institution can demonstrate to the satisfaction of the competent authority that the size, systemic importance, nature, scale and complexity of its trading book business justifies a less frequent review.“

However, from a supervisory point of view, the problem is how to apply proportionality in practice. In other words, how can institutions be clearly categorised according to their size and the complexity of their activities, while avoiding the application of too much subjectivity. This can even lead to legal disputes.

5) Simplification

This is a trend that appeared in the EU at the beginning of 2025 taking into account global tendencies and the necessity to boost EU competitiveness. The EU came up with the objective to cut red tape and simplify business environment. As a good example the recent proposal of the so-called Omnibus packages can be mentioned – see European Commission, 2025. The measures focus on the sustainability (or in other words environmental, social and governance) reporting and disclosure obligations of the largest companies which are more likely to have the biggest impacts on people and the environment, and make sure they do not burden smaller companies.

The problem with the EU simplification suggested so far is that it is too cautious and only partial and has a number of snags. The European Banking Federation (2025) is expressing concerns about the European Commission's Omnibus Legislative Proposal. The proposal's potential removal of core data from the Corporate Sustainability Reporting Directive (CSRD) or exclusion of companies from its scope could lead to increased bilateral engagement with clients, which banks see as inefficient and counterproductive to simplification. In the European Banking Federation view the simplification should ensure symmetry between corporate reporting and the requirements placed on the financial sector and there should be clear alignment between corporate and financial sector obligations

As a result, such a cautious and incomplete approach to the simplification could impose more burdens on financial institutions. In other words, simplification (or better said and more precisely described “deregulation”) must be consistently carried out through all parts of the regulation in order to be efficient. However, this is not a simple task and would take a longer

time and thoughtful steps. Primarily, a rigorous analysis should be performed and ideally include more interested parties.

6) Including elements that are not prudential

Incorporating elements into prudential regulation that are not prudential in nature but rather have the characteristics of economic or other policies has become typical in recent years. As a typical example the SME Supporting Factor can be mentioned which is an element of prudential regulation introduced to support lending to small and medium-sized enterprises (SMEs). It reduces the capital requirements for banks when granting loans to small and medium enterprises (see Regulation (EU) 2013/575, 2013, Art. 501). Similarly, infrastructure supporting factor was introduced too.

7) The emergence of a number of complementary regulatory documents

These documents are mostly produced by the European supervisory authorities and are of considerable scope and detail (technical standards, guidelines). While they can help harmonisation in greater detail, they can make it difficult to react flexibly to the development of new practices or market situations.

8) Large increase in the number of stakeholders

Although the main parties involved in regulation and supervision are the state and its authorities (particularly the central bank and the supervisory authority, if applicable), as well as the regulated parties (particularly banks), there are other important parties as well. These include consulting, advisory and law firms, which often play a strong global role and grow in importance alongside increasing regulation. Chambers of commerce and official lobbyists may also be involved.

The interests of the stakeholders are far from aligned. This is largely to be expected in the case of the fundamental parties, i.e. the regulated entities and the state, who are standing on opposite sides. However, differences in interests can also be seen between different groups of regulated entities. Large banks, for example, have more capacity to develop sophisticated methods and comply with regulation than small banks. Similarly, there may be differences between countries whose banking is based more on traditional models of lending and deposit-taking, and those whose banking is more speculative. There may also be differences between countries in terms of whether they are in the position of host supervisors or home supervisors.

It is therefore very difficult to identify a single trend for the future. Regulation, especially in the EU, is always the result of a compromise, often negotiated over a long period of time, where the interests of many parties intersect. This may be one reason for its complexity. In an attempt to satisfy these parties, conflicting elements may be introduced into regulation almost in parallel, for example, simplification on the one hand and complexity on the other. The interest of the consulting industry is also clear. Therefore, although many experts in this field formally or informally acknowledge the need to simplify or deregulate, they will probably have different ideas about how to implement this idea.

8.5 Potential future directions in prudential banking regulation

If we accept the premise that regulation should meet the basic requirements of effectiveness, clarity, and unambiguity, and should not undesirably interfere with business, we can set out the following appropriate theoretical directions for its further development.

1) Clarification of the objectives of prudential regulation

Clarifying the key objectives of regulation is an essential strategic prerequisite for ensuring that regulation achieves these objectives. This is essentially a political task that must come from the top. How it is achieved - i.e. how individual rules are structured and what binding requirements exactly are imposed – is then a task to be elaborated by expert banking supervisors.

2) Avoiding 'regulatory overload' in areas with different primary logic

In recent years, there has been a trend of incorporating other goals, such as promoting sustainability, addressing social issues, or geopolitical interests, into prudential regulation. While these goals can be legitimate, they may not always be appropriate to implement within a framework primarily designed to protect the stability of the financial system. Overloading regulations with these elements could lead to confusion and, in the worst-case scenario, undermine confidence in the core purpose of regulation. Elements that are not of a prudential nature unduly complicate this regulation and should thus be removed from prudential regulation. Nevertheless, the links with other parts of banking regulation, such as those focused on customer protection, need to be thought through carefully.

3) Formal simplification and streamlining of regulation

Such simplification could take the form of, for example, more linguistically efficient and clearer drafting, the simplification and merging of some regulatory documents, the elimination of an unnecessary number of cross-references, often at several levels. Where appropriate, the scheme could be presented in graphic or schematic form (e.g. as an annex) in addition to the textual form of the regulation.

Moreover, the regulation emphasises quantitative requirements (capital, liquidity, leverage ratio), leading to a system of a large number of restrictive requirements. An alternative approach could make more use of risk management principles, where regulators would assess the overall behaviour of the bank, not just compliance with individual limits. In other words, an approach referred to as "principles-based regulation" rather than rule-based could be used, at least in some parts. This could lead to less rules. However, this approach would be more demanding in terms of individual risk assessment by supervisors and their qualifications.

4) Improved legal quality and legal certainty

One often overlooked aspect of regulation is its legal form and coherence. Given the multitude of regulations, directives, technical standards, and their implementing acts, it can become difficult to interpret certain provisions in a clear and consistent way. Therefore, more emphasis should be placed not only on content but also on legal technical aspects, including the consistent interconnection and clarity of terminology used.

5) Two level regulation

This idea represents a development and elaboration of the recognised principle of proportionality and should be analysed. The deepening of proportionality can lead either to a two-tier (or even multiple-tier) system of regulation or in a minimalistic way to a clear mapping of rules that do not apply to small and less complex banks or banks that do not use sophisticated approaches. By distinguishing between large, complex banks and smaller, less systemic and less complex ones, regulators can provide a more proportional and efficient approach to supervision.

There are at least the following challenges to consider:

a) Properly defining and assessing the risk profile of different institutions to ensure they are classified correctly could be difficult. Misclassifying institutions may lead to either excessive regulation or under-regulation, both of which could undermine financial stability.
b) Smaller institutions might attempt to manipulate their size or business activities to fall into the lower tier, even if they pose greater risks than their size suggests. Regulators will need strong oversight mechanisms to prevent such arbitrage and ensure proper categorization.
c) Consistency across jurisdictions: If implemented, a two-tier system would need to be harmonized across jurisdictions, especially within the EU, to avoid regulatory arbitrage between countries. It would be crucial for the EU to align its rules with international standards, ensuring consistency in classification and regulation.
d) The challenge of how to reconcile this with the single EU license becomes significant. The two-tier system aims to apply different regulatory standards to banks of varying sizes and complexities, but the single EU banking license presupposes that one regulatory framework applies uniformly across all EU Member States. To address these challenges, a few solutions could be explored – e.g. to incorporate the two-tier regulatory framework directly into the structure of the single EU banking license, or to limit the scope of the single EU license.

If there is a clear goal, even these challenges can be overcome. While the implementation of such a system would require careful thought and coordination, its potential benefits in terms of reduced regulatory burden, enhanced competition, and improved financial stability could potentially prevail in the long-term.

6) A more in-depth review of the regulation

As already mentioned above, the complexity of modern banking regulation has grown significantly over the years, often leading to redundancy and overlaps between regulatory frameworks. In many instances, different parts of the regulation may address similar issues from slightly different angles, which can create confusion and inefficiencies for both regulatory authorities and financial institutions. Therefore, a more systematic and in-depth review of existing regulations is essential to identify and address these interrelationships and overlaps. This should also include reporting.

Examining the interrelationships between different parts of the regulation and overlaps, focusing on whether the regulatory objectives could be achieved more simply. Potentially, some regulatory elements could be omitted altogether or transferred from mandatory requirements to monitored indicators or moved to the area of Pillar 2, i.e. the supervisory

review. Under Pillar 2, supervisors always have the ability to adequately intervene if they detect an increased risk. This in-depth review could halt the current trend of increasing regulation..

7) Greater use of technology in regulation

The increasing number of regulatory requirements puts pressure on the automation and digitisation of compliance processes. Regulators may gradually require real-time access to bank data instead of periodic reports. SupTech (Supervisory Technology) – tools that enable real-time monitoring and better detection of systemic risks – may develop. Regulation would not diminish, but its application may become more efficient and less costly. Artificial intelligence tools can also help in the above cases such as simplification, streamlining, improving legal quality and legal certainty, regulatory review and better risk detection, enabling supervisors and regulated entities to focus resources more effectively while ensuring compliance with evolving regulatory frameworks.

8.6 Future research avenues

Regulatory theory and practice often relies on the following four basic hypotheses:

H1: The introduction of stricter regulation leads to a reduction in the probability of banking crises.

H2: Higher regulatory costs negatively affect the profitability of smaller banks.

H3: Proportionality in regulation increases the competitiveness of smaller banks.

H4: Regulatory harmonisation in the EU reduces regulatory arbitrage and contributes to financial system stability.

However, testing these hypotheses empirically faces a number of methodological, data-related and interpretive challenges. The most important of these are:

- Cost decoupling: Banks find it difficult to distinguish between costs incurred solely for regulatory reasons and those incurred for other reasons. These costs are often integrated with expenditure on IT infrastructure and internal governance mechanisms that would be necessary even in the absence of regulatory requirements.'
- Structural disadvantages of small banks: The lower profitability of smaller banks may not be the result of regulation, but rather the consequence of a high proportion of fixed costs that disproportionately burden smaller institutions.
- There is a lack of comparable indicators of regulatory stringency. There is no single, up-to-date and widely accepted index of regulatory stringency across countries. While the Basel Committee assesses countries' compliance with international standards, this may only cover large, internationally active banks and may not reflect the full scope of national regulatory frameworks.
- The benefits of regulation are difficult to quantify. The benefits of regulation, such as crisis prevention or increased confidence, cannot easily be separated from other factors, such as the quality, audacity, and position of the supervisory authority; the macroeconomic environment; or the behaviour of the banks themselves.

For these reasons, the author of the research decided not to engage in a deeper quantitative testing of the above hypotheses and relies primarily on analytical synthesis and professional

experience. Some illustration of the quantitative implications was provided, for example, by a study by PricewaterhouseCoopers Risk Management (2004), which estimated that the implementation of the Basel II rules would lead to a reduction in EU GDP of 0.05-0.1% in the long run. In retrospect, however, it is not possible to assess objectively to what extent these estimates have been met. The study also noted that the introduction of Basel II would bring greater stability to the financial system in the long run, which may increase the resilience of economies to crises - this positive impact was not quantified but was mentioned as an important counter-argument to the purely quantitative impact on GDP.

The author welcomes any suggestions for methodological approaches and demonstrable data that would enable a more systematic examination of the above hypotheses in future research.

8.7 Conclusions

Considering the above, the future of prudential regulation should not be viewed solely through the lens of more or less regulation. Rather, it is about improving the quality, coherence, and proportionality of the regulatory framework in a way that better reflects the diversity of financial institutions, the evolving nature of risks, and the opportunities brought by technology.

Yet, the direction of regulatory evolution will inevitably depend on which path banking and its business models take. If the sector moves further towards securitisation, increased risk-taking and disintermediation, the regulation will have to focus more on systemic stability, transparency, and cross-sectoral coordination. Conversely, if banking strengthens its traditional role of accepting deposits and providing loans for the real economy, a more focused and less complex regulatory approach might be feasible. It is also conceivable that the banking sector's role may diminish relative to the capital markets or to non-bank financial institutions. In such a case, prudential regulation may need to adjust its scope and institutional coverage to ensure that risks are appropriately captured wherever they arise.

A more thoughtful and streamlined approach to prudential regulation may ultimately increase both its effectiveness and credibility. However, such evolution must be based on a clear political mandate, strong supervisory expertise, and continuous dialogue between regulators, supervised institutions, and the academic and professional community.

The challenge lies not in finding a single best regulatory model, but in designing a system that remains open to critical self-reflection and responsive to change.

In the regulatory debate, the question of how to address the underlying drivers of market failures is often overlooked. These drivers frequently lie not in a lack of rules, but in their enforcement and the distorted incentives of key financial actors. Short-termism, excessive risk-taking tied to misaligned remuneration structures and the tendency to externalise costs are among the core issues that regulation may fail to address. These issues may be a manifestation of positional investing, whereby investment opportunities are not exploited according to their rate of return, as explained by Valenčík et al. (2025). In other words, it occurs when one entity uses its superiority in terms of property or income to discriminate against another entity. This concerns by no means only a narrow area of investment in the financial markets. Rather than confronting these root causes directly, the regulatory response often results in a proliferation of complex rules that can obscure responsibility, reduce

flexibility, and create more opportunities for positional investing. A more balanced approach could realign market incentives with long-term stability and resilience rather than merely adding new compliance obligations to existing frameworks.

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Note: ChatGPT (OpenAI, GPT-4, May 2025 version) was used as a supporting tool for refining the text's structure and language.

9. EU general sales taxation and US tariff plan

Jaroslav Vostatek

Donald Trump April 2025 tariff plan promises to introduce a 20 percent tariff for the European Union. There are analyses of the impact of similar tariffs on the prices and living standard in the US; Trump might neutralize this effect by the abolition of the federal income tax. The February Trump executive order includes value-added taxes in the list of discriminatory taxes.

This chapter presents the VAT schemes of sale within the EU and to the US, using 20% rate, and the VAT reform options. The aim is an analysis of the destination-based VAT in relation to the Trump general tariff plan. We confirm that the EU VAT is a trade barrier, and the Trump general (20%) tariff plan is adequate. The United States should also subsidize the exports of goods to the EU, to balance the European VAT import taxation, too. The European Union should actively cooperate with the US because the basic problem was generated by the application of the destination principle to the EU VAT.

EU might offer a quick, small VAT reform to avoid the Trump general tariff plan: the transition to the origin-based VAT. The best, middle-term solution is a replacement of the EU VAT with a real taxation of the value added, e.g. according to the Hall & Rabushka´s proposal (wage tax + business tax). These two taxes might be integrated with the payroll taxes (social security contributions) and the corporation income taxes. The proposed reforms shall have substantial positive impact on public finance and welfare.

9.1 Introduction

US president Trump promised "reciprocal tariffs" to VAT: in February 2025, he signed a memorandum (executive order, EO) "Reciprocal Trade and Tariffs" which directs a review of non-reciprocal trade arrangements and allows the USTR and Secretary of Commerce to propose new levies on a country-by-country basis to counter what the Administration considers unfair trade practices. The EO includes value-added taxes in the list of discriminatory or extraterritorial taxes imposed by US trading partners (PwC, 2025). There is an opposition to this expert approach. E.g. the International Chamber of Commerce thinks: "VAT and tariffs are substantially different not only in scope but also in terms of the impact they have on trade and the overall economy. VAT is neutral by design. Viewing it as a reciprocal tariff could lead VAT imposing countries to adopt retaliatory measures, potentially escalating trade conflicts unnecessarily" (ICC, 2025). "VAT is neutral with respect to trade," said Erica York, vice president at the Tax Foundation, a policy group. "If you are a person who operates under this ideology where exports are good and imports are bad, a foreign VAT seems like it is discriminatory. But that ignores all the economic effects that VAT has" (Palmer, 2025).

Is the EU VAT neutral by design and in the EU practice? We start our analyses with a comparison of the different methods of general sales taxation in the world. The US retail sales taxes are one of these methods, the simplest one. Our next general question is if the VAT is or might be a trade barrier. What is the role of the origin and destination principles here?

It is useful to consider the quality and (in)efficiency of the "first-generation" EU VAT and its potential reforms. Why has US not introduced a similar tax? Is a turnover tax (general sales tax) a constituent part of a normal tax system?

9.2 Sales taxation: methods

The US tax structure differs significantly from other OECD countries. „Compared to the OECD average, the United States relies significantly more on individual income taxes and property taxes. While OECD countries on average raised 23.6% of total tax revenue from individual income taxes, the share in the United States was 45.3%, a difference of 21.7 percentage points… The United States relies much less on consumption taxes than other OECD countries. Taxes on goods and services accounted for only 15.7% of total U.S. tax revenue, compared to 31.6% in the OECD. This is because all OECD countries, except the United States, levy value-added taxes (VAT), usually at relatively high rates. State and local retail sales tax rates in the United States are relatively low by comparison, but they are on a different tax base“ (Bunn and Weigel, 2024).

In theory there are “four basic forms of the VAT that can produce an identical result:

(1) *t* (wages + profits): the additive-direct or accounts method;

(2) *t* (wages) + *t* (profits): the additive-indirect method, so called because value added itself is not calculated but only the tax liability on the components of value added;

(3) *t* (output – input): the subtractive-direct (also an accounts) method, sometimes called the business transfer tax; and

(4) *t* (output) – *t* (input): the subtractive-indirect (the invoice or credit) method and the original EC model” (Tait, 1988).

In practice, only the indirect method No. 4 is used, “it never actually calculates the value added; instead, the tax rate is applied to a component of value added (output and inputs) and the resultant tax liabilities are subtracted to get the final net tax payable. This is sometimes called the “indirect” way to assess the tax on value added” (Tait, 1988). We might simplify the verdict: The EU VAT is not a tax on value added but a turnover tax with deduction of the same input tax: a company burdens its sales with VAT and reduces the payment of VAT to the state budget by the VAT paid in the price of the purchased goods and services.

“Value added tax” is successor to the turnover tax introduced after the WW1 as a provisional source of the state budgets, to help with the reconstruction of the economics. The turnover taxes are not neutral in relation to big/composite and small competitors. Thus, they do not fit in a “normal” tax system (Engliš, 1946). The turnover taxes survived the WW2 and in Europe (and other countries) they were transformed to “credit-invoice” value added tax (method No. 4). The “credit invoice method” of the VAT is used in more than 170 countries, including the EU Member States.

A consistently conceived VAT (“income type”) taxes 2 components of value added (labour costs + profit without interest deduction); in the literature, this construction is mostly referred to as the subtraction method: businesses pay tax on the difference between the value of their sales and the value of their purchases from other businesses. Table 3 compares these 2 methods of calculating VAT with the US retail sales tax and the sales tax-free system. In practice, the subtraction method was used only in Japan until recently; however, from October 2023 they switched to a "qualified invoice system", which is like VAT in the EU. Model-wise, the resulting tax burden of all these 3 tax types is the same.

Table 3: Prices with different types of 10 percent sales taxes ($, taxes paid in parentheses)

Production stage	No tax	Retail sales tax	Credit-invoice VAT	Subtraction method VAT
Farmer	300	300 (0)	330 (30)	330 (30)
Miller	700	700 (0)	770 (70 – 30)	770 (40)
Baker	1,000	1,100 (100)	1,100 (100 – 70)	1,100 (30)
Total tax	**0**	**100**	**100**	**100**

Source: Toder and Rosenberg (2010)

Retail sales tax is a "tax on general consumption charged only once on products at the last point of sale to the end user. In principle, only consumers are charged the tax; resellers are exempt if they are not end users of the products. To implement this principle, business purchasers are normally required to provide the seller with a "resale certificate", which states that they are purchasing an item to resell it, or with equivalent evidence that the business will fulfil whatever tax obligations it may have (e.g. a so-called "direct pay" permit, which is analogous to the "reverse charge" concept). The tax is charged on each item sold to purchasers who do not provide such a certificate or equivalent evidence. The retail sales tax covers not only retailers, but all businesses dealing with purchasers who do not provide a resale or other evidence signifying that no tax is due (e.g. a public body or a charity, unless specific exemption applies). The basis for taxation is the sales price. Like the VAT and unlike multi-stage cumulative taxes, this system allows the tax burden to be calculated precisely, and it does not in principle discriminate between different forms of production or distribution channels. In practice, however, at least in the United States, the failure of the retail sales tax to reach many services and the limitation of the resale exemption to products that are resold in the same form that they are purchased, or are physically incorporated into products that are resold, leads to substantial taxation of business inputs.

In theory, the outcomes of VAT and retail sales tax should be identical: they both ultimately aim to tax final consumption of a wide range of products where such consumption takes place. They also both tax the consumption expenditure i.e. the transaction between the seller and the buyer rather than the actual consumption. In practice, however, the end result may be somewhat different given the fundamental difference in the way the tax is collected. Unlike VAT where the tax is collected at each stage of the value chain under a staged payment system …, sales taxes are collected only at the very last stage i.e. on the sale by the retailer to the final consumer. The latter method has significant disadvantages: the higher the rate the more pressure is placed on the weakest link in the chain i.e. on the retailer and in particular on numerous small retailers. All the revenue is at risk if the retailer fails to remit the tax to the authorities and the audit and invoice trail is poorer than under a VAT, especially for services. In addition, revenue is not secured at the time of importation, and this can be crucial for many developing countries. As a result, a single point resale sales tax is efficient at relatively low rates, but is increasingly difficult to administer as rates rise…

The United States is the only OECD country that employs a retail sales tax as the principal consumption tax. However, the retail sales tax in the United States is not a national tax. Rather, it is a subnational tax imposed at the state and local government levels. Currently, 45

of the 50 States as well as thousands of local tax jurisdictions impose broad-based retail sales taxes. In general, the local taxes are identical in coverage to the state-level tax, are administered at the state level and amount in substance simply to an increase in the state rate, with the additional revenues distributed to the localities. Retail sales taxes are complemented in every state by functionally identical "use" taxes imposed on goods purchased from out of-state vendors, because the state has no power to tax out-of-state "sales" and therefore imposes a complementary tax on the in-state "use"…

Combined state and local sales tax rates vary widely in the United States, from 1.82% (Alaska), 4.50% (Hawaii) and 5.44% (Wyoming) to 9.54% (Louisiana and Tennessee), 9.47% (Arkansas) and 9.45% (Washington). Five states do not have a state-wide sales tax (Alaska, Delaware, Montana, New Hampshire, and Oregon and, of these, only Alaska generally allows localities to charge local sales taxes, and Montana permits special taxes in local resort areas … These rates are (much) lower than the applicable VAT rates in OECD countries. This is due to two main factors: the compliance risks associated with the sales tax collection method … and the competition between jurisdictions… Retail sales and use taxes in force in the United States are subject to significant competitive pressure, especially in the context of interstate and international trade" (OECD, 2024).

Retail sales tax, credit-invoice VAT and subtraction VAT are 3 comparable theoretical constructs of the general consumption taxation. The "subtraction method" of the VAT is a general value-added taxation, its basic scientific evaluation is possible, but here the basic "problem" is its non-existence in practice. The "credit-invoice VAT" is no tax on value added but a turnover tax with deduction of the same input (turnover) tax. "The drawbacks of the VAT begin with its complexity, which imposes substantial administrative and compliance costs on taxpayers and the government. The analysis … presented a simple comparison between the relative simplicity of a retail sales tax— that taxes the same tax base—with a VAT… the VAT is far more complex to compute, to comply with, and to enforce" (Holcombe, 2010). These facts might be enough to prefer a retail sales tax to the "credit-invoice VAT". „It is really nonsense for a country with an already functioning retail sales tax structure to add a value-added structure that collects in more complex and burdensome fashion the amounts that could be collected under the retail sales tax procedure" (Surrey, 1969). That is why we may recommend a transition from the value added taxes to a retail sales tax in Europe etc. (or an even better tax reform).

9.3 International VAT/GST guidelines

"The overarching purpose of VAT as a levy on final consumption, coupled with its central design feature of a staged collection process, lays the foundation for the core VAT principles bearing on international trade. The fundamental issue of economic policy in relation to the international application of the VAT is whether the levy should be imposed by the jurisdiction of origin or destination. Under the destination principle, tax is ultimately levied only on the final consumption that occurs within the taxing jurisdiction. Under the origin principle, the tax is levied in the various jurisdictions where the value was added. The key economic difference between the two principles is that the destination principle places all firms competing in a given jurisdiction on an even footing whereas the origin principle places consumers in different jurisdictions on an even footing" (OECD, 2017). "The cornerstone of VAT neutrality

is the destination principle, which stipulates that goods are taxed in the country where they are consumed, not where they are produced" (ICC, 2025). I register here again an inconsistence of the name of the tax (on value added) with the ambition to tax (final) consumption. And vice versa: VAT as a tax on the "value added" should burden the production (its value added), using the origin principle!

The credit-invoice VAT is a very complex tax, and it depends on several „details" if it is a trade barrier or not. "The overarching purpose of VAT as a levy on final consumption, coupled with its central design feature of a staged collection process, lays the foundation for the core VAT principles bearing on international trade. The fundamental issue of economic policy in relation to the international application of the VAT is whether the levy should be imposed by the jurisdiction of origin or destination. Under the destination principle, tax is ultimately levied only on the final consumption that occurs within the taxing jurisdiction. Under the origin principle, the tax is levied in the various jurisdictions where the value was added. The key economic difference between the two principles is that the destination principle places all firms competing in a given jurisdiction on an even footing whereas the origin principle places consumers in different jurisdictions on an even footing… The application of the destination principle in VAT achieves neutrality in international trade. Under the destination principle, exports are not subject to tax with refund of input taxes (that is, "free of VAT" or "zero-rated") and imports are taxed on the same basis and at the same rates as domestic supplies. Accordingly, the total tax paid in relation to a supply is determined by the rules applicable in the jurisdiction of its consumption and all revenue accrues to the jurisdiction where the supply to the final consumer occurs… By contrast, under the origin principle each jurisdiction would levy VAT on the value created within its own borders. Under an origin-based regime, exporting jurisdictions would tax exports on the same basis and at the same rate as domestic supplies, while importing jurisdictions would give a credit against their own VAT for the hypothetical tax that would have been paid at the importing jurisdiction's own rate. Tax paid on a supply would then reflect the pattern of its origins and the aggregate revenue would be distributed in that pattern. This would run counter to the core features of a VAT: as a tax on consumption, the revenue should accrue to the jurisdiction where the final consumption takes place. Under the origin principle, these revenues are shared amongst jurisdictions where value is added. By imposing tax at the various rates applicable in the jurisdictions where value is added, the origin principle could influence the economic or geographical structure of the value chain and undermine neutrality in international trade… For these reasons, there is widespread consensus that the destination principle, with revenue accruing to the country of import where final consumption occurs, is preferable to the origin principle from both a theoretical and practical standpoint. In fact, the destination principle is the international norm and is sanctioned by World Trade Organization ("WTO") rules" (OECD Legal, 2016).

Council Directive 2006/112/EC lays down the rules of the common VAT system. "Among other issues, the Council Directive establishes a temporary VAT system based on 'the origin principle', which requires that a VAT rate applicable to transactions is determined by the Member State of the seller's location. The temporary VAT system, established by the directive was supposed to be replaced by a definitive system. This however has not happened yet despite the latest VAT system having been set up approximately two decades ago. The temporary nature of the current VAT system brings several challenges, including the fact that

it is more susceptible to VAT fraud" (Remáč, 2017). "The transitional VAT system" was set up until a definitive destination-based system could be established" (Remeur, 2019).

Who pays the VAT to public budgets? "For EU-based companies, VAT is chargeable on most sales and purchases of goods within the EU. In such cases, VAT is charged and due in the EU country where the goods are consumed by the final consumer. Likewise, VAT is charged on services at the time they are carried out in each EU country. VAT is not charged on exports of goods to countries outside the EU. In these cases, VAT is charged and due in the country of import and you do not need to declare any VAT as an exporter. However, when exporting goods, you will need to provide documentation as proof that the goods were transported outside the EU" (Your Europe, 2024).

We show the differences in turnover taxation within the EU and exports to the US on a simple example in the Table 4: we have here a primary producer (company 1) and company 2, which sells alternatively within the EU and to the US. The VAT rate is 20%. For sales within the EU, the 2nd company invoices the customer €2,000 plus VAT €400 = €2,400. For the alternative sale to the US, the exporter is entitled to credit the VAT paid (€200) and does not invoice the customer any VAT; the total tax revenue from the exported goods is therefore zero (200 – 200 = 0). The comparable selling price of goods to the US is €2,000, so exports are effectively subsidized by not collecting €400 in VAT.

Table 4: VAT schemes of sale of goods within the EU and to the US (20% rate)

Company	Purchase (net)	Sale (net)	VAT credit	VAT invoice	Effective taxation	Sale (gross)
1	0	1,000	200	0	200	1,200
2: sale to EU	1,000	2,000	400	200	200	2,400
2: sale to US	1,000	2,000	0	200	0	2,000

Source: author

The conclusion from these schemes is very simple: the EU exports to the US (outside the EU) are not taxed, they are de facto subsidized by the EU countries. Exports are exempt and imports are taxable – the VAT is here a primitive trade barrier, without any reason! We must display it, explain it (who did it?) … and change it! That is no new scientific achievement, e.g. the UK Mirrlees´ tax commission concluded: "retain a destination basis for VAT while ending the zero-rating of exports" (Mirrlees et al., 2011). The international VAT/GST guidelines and the EU legislation ignore this fact and thus the EU "value-added" tax is a substantial barrier in the trade between US and EU countries. It holds not only for the export of goods to US but also for the imports from the US which are burdened with a "hidden" import tariff in the same extent (e.g. 20%). Surprisingly, this is opposed by more authors.

9.4 „Value added“ tax: a trade barrier

According to Toder (2016) „Donald Trump peddled an economic fallacy in … Presidential debate by suggesting that Mexico's value added tax, or VAT, gives its producers an advantage over American companies. He said, "When we sell into Mexico, there's a tax – automatic, 16 percent, approximately. When they sell to us, there is no tax." "Yes, Mexico has a VAT, and the United States does not. And VATs around the world are border adjustable – exports are exempt, and imports are taxable. But that does not give Mexican producers a leg up over their US competitors. There is a simple reason for border adjustability. A VAT is meant to be a tax on consumption. Mexicans pay the same Mexican VAT on taxable goods and services they buy in Mexico no matter where they are produced. At the same time, no Mexican VAT is imposed on goods or services consumed outside of Mexico, regardless of where they are produced" (Toder, 2016).

"Of course, the United States has no national sales tax. We do, however, impose federal excise taxes on goods such as tobacco products, alcoholic beverages, and motor fuels. And those taxes treat traded goods the same way as other countries' VATs. The cigarette excise tax, for example, applies to imported cigarettes, but not those exported by U.S. tobacco companies. State retail sales taxes in the United States work the same way: They apply to domestic consumption of taxed products from all sources, but not to exports. The World Trade Organization rightly does not view these rules as trade barriers. They are simply ways for a country to tax its own residents, without discriminating based on where goods are produced. In contrast, the WTO would appropriately view a tariff that is imposed only on imported goods and services but exempts domestically produced products as a trade barrier… A VAT does not favour one country's producers over another's. Trump's claim that Mexico's VAT gives its producers an advantage over American competitors is simply wrong" (Toder, 2016).

Many/some experts think also that the credit-invoice VAT is no trade barrier and that the European Union should respond to Trump´s tariffs. "President-elect Trump has threatened to increase United States tariffs to 60 percent on imports from China and 10 percent to 20 percent on imports from other trading partners, including the European Union. In doing so the US would be ignoring its World Trade Organisation commitments and would also rollback the substantial liberalisation that has taken place during the past 80 years, with a potentially major negative impact on the world economy. In response to this threat, the EU should pursue a three-pronged strategy. First, the EU should engage bilaterally with the US to seek to avoid the imposition of tariffs. This could include an offer to consider measures on facilitation of bilateral trade and on economic security cooperation, while making clear that any trade measures adopted by the EU will be consistent with WTO rules. This offer should be backed up with a credible threat of retaliation that could be implemented if the US decides to impose tariffs on EU exports. Retaliation could take the form of a negative list – the EU would increase its tariffs on all US exports to the same level as the US tariffs, except for products imported from the US identified as crucial for the EU. Second, the EU should act to preserve a functioning rules-based multilateral trading system, including on dispute settlement, and should continue to pursue WTO reform. To this end, the EU should build a coalition of countries including key players from the Global North and the Global South ready to lead in this endeavour. Third, the EU should expand its network of bilateral and regional preferential

trade agreements. The priority should be ratification of the agreement with Mercosur, but the EU should also aim to improve trade relations with the United Kingdom and Switzerland and to further strengthen partnerships in the Indo-Pacific region, and with Africa" (García Bercero et al., 2024).

I think that the European Union should respond to the potential general US tariff (at some 20% rate) with an immediate reform of its VAT rules: to stop the zero-rating of exports and the full rating of imports! The Trump approach is basically OK … and his tariff (20%) should be even supplemented with (20%) export subsidy.

Some authors think that the economic effects of the existing EU VAT are different. "VAT are border-adjusted, meaning they rebate tax on exports and impose tax on imports. Despite the appearance of subsidizing exports and punishing imports, however, a border-adjusted VAT is trade neutral. A border adjusted tax leads to currency appreciation for the imposing country, which would make it cheaper to import goods, more expensive to export goods, and thus would cancel out the apparent benefits of the tax on imports and the rebate on exports" (Bray, Walczak & York, 2025). If it is true then we must "Stop saying a value-added tax is an export subsidy" (Albrecht, 2025). "The cornerstone of VAT neutrality is the destination principle, which stipulates that goods are taxed in the country where they are consumed, not where they are produced… While VAT is neutral from a tax perspective, its practical implementation creates significant burdens for businesses, particularly micro-, small- and medium-sized enterprises (MSMEs). Simplifying VAT compliance and refund processes would benefit both businesses and tax authorities – reducing compliance costs and improving compliance for companies while lowering administrative costs and improving tax collection efficiency for governments" (ICC, 2025).

There is no evidence that the mentioned subsidizing exports to US and punishing imports from US via VAT is trade neutral. We may agree with Bray et al. that "a border adjusted tax leads to currency appreciation for the imposing country, which would make it cheaper to import goods, more expensive to export goods" but it need not simply "cancel out the apparent benefits of the tax on imports and the rebate on exports". Even if it were so, it need not be favourable for the country. The US and EU should prefer zero tariffs and zero export subsidies in the 21st century. Thus, the VAT should be reformed, it must be trade neutral!

We may ask why it is possible that even experienced analysts think that the EU VAT is neutral. It seems that it is the result of using a wrong terminology: VAT is no tax on value added but a very complicated turnover tax and the destination principle generates no consumption-like tax but an additional deformity: discrimination of trade with US and other countries without "VAT".

Klaus (2025) concludes that Trump is not a destroyer but a rescuer of the world trade in the long term; Trump tariff plan aims at lowering the US foreign trade deficit and at the devaluation of the USD. We may agree with Klaus; his analysis is not inconsistent with our recommendations.

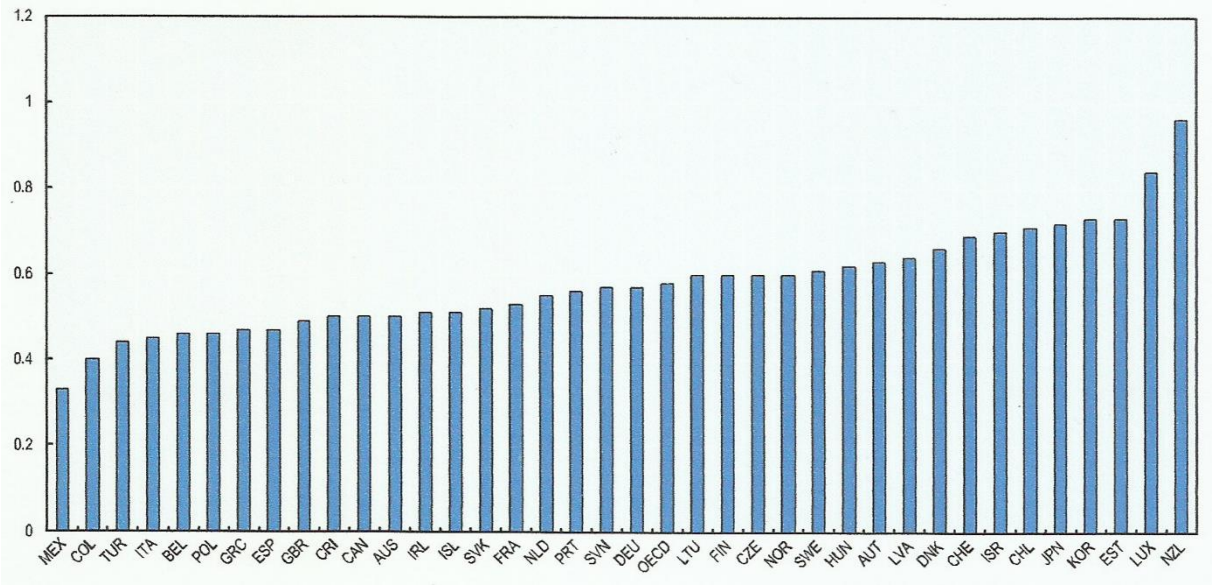
9.5 Value added tax reform options

The “never ending” transitional VAT system is not the main problem of the “first-generation” EU concept. “The ideal VAT system has a broad base comprising all final consumption and a single rate of tax, usually between 15 and 20 percent. This means consumers have no incentive to shift consumption to more lightly taxed goods and services that would be less enjoyable to them. The only distortion is between goods and services purchased on the formal market and informal home-produced goods and services. Yet there is little that redesign of VAT can do to mitigate this. Objectives other than raising revenue are ill-served by VAT concessions. For example, seeking to support poor households by exempting food from VAT can cost significant revenue. After all, the rich also purchase food—and often much more of it. The poor could be supported more efficiently by a combination of progressive income taxes and cash transfers… Most VATs are far from the textbook design. Countries often employ a variety of reduced rates, exemptions, and special programs. Some are intended to make it simpler to administer the tax. For example, many countries use a minimum registration threshold based on turnover to exempt micro businesses from VAT and its associated cost of compliance and administration. Most exemptions and reduced rates are adopted to improve the distributional impact of VAT, but they undermine the core objective of raising revenue, both directly and indirectly, by increasing the cost of collection and often facilitating fraud. Reforms to eliminate these VAT concessions have often met with fierce resistance from powerful lobby groups with vested interests” (Mooij & Swistak, 2022).

„Value-added taxes … are ripe for reform to avoid distorting consumption patterns and raise revenue in a stable manner“ (Bunn et al., 2021). „The second key structural issue is the VAT treatment of trade between EU member states. We argue that while the goal of a systematic destination principle VAT treatment of internationally traded goods and services remains desirable, the current mechanisms by which this is achieved need reconsideration. In particular, zero-rating of exported goods exposes the VAT system to significant risks of fraud and evasion – exploited by recent highprofile instances of ‘carousel fraud’, as well as by more mundane evasion. We argue that while the extent of these problems should not be over-stated, a reform of the VAT treatment of intra-EU trade, in which goods would be exported bearing VAT, would reduce the vulnerability of the VAT system to frauds and evasion surrounding international transactions“ (Mirrlees et al., 2010).

The VAT efficiency is a big problem. „The OECD measures the efficiency of VAT using the VAT Revenue Ratio (VRR). VRR assesses the loss in VAT revenue as a consequence of exemptions and reduced rates, fraud, evasion, and tax planning. To do this, the VRR measures the difference between the VAT revenue actually collected and what would be raised if the standard VAT rate were applied to the entire tax base. Therefore, VRR is the ratio of the actual tax revenue to the maximum possible tax revenue. VRR = VAT Revenue/[(Final Consumption Expenditure – VAT Revenue) * standard VAT rate]” (Bunn et al., 2021). Across the OECD, the unweighted average VRR in 2022 was 0.58 – see Figure 17. New Zealand has the highest VRR (0.96), due to its “second-generation” VAT.

Figure 17: VAT revenue ratio (2022)



Source: OECD (2024)

The New Zealand "general sales tax" has given a lead for recommendations for modernizing the EU VAT „by broadening the base and levying a uniform rate. Base broadening would eliminate the distortions and complexities associated with skewed input choices, self-supply bias, export taxation, contentious input tax allocation, and exemption creep. Following New Zealand's example:

1. governments, particularly provinces and municipalities, should be made liable to VAT;
2. education (except elementary schools), health care, and social and cultural establishments can be brought into the VAT base without increasing the cost for students, patients or other users;
3. property and casualty insurance should be subject to VAT, and the distortionary stamp duty on insurance abolished;
4. fee-based financial services should be made taxable and a scheme should be developed that would permit the recovery of the input VAT by financial institutions in supplying B2B services;
5. lotteries and gambling should be brought into the VAT base;
6. all non-residential property should be subject to VAT and it is suggested to impose VAT on the gain realized on the transfer of residential property, while distortionary transfer and registration duties should be abolished;
7. the thresholds should be reviewed and the flat-rate compensation scheme for farmers abolished; and
8. lower rates should be increased (and the standard rate reduced) in a move towards one single rate.

But for the EU's Common Directive (2006), most of these reforms can be implemented without much further ado. The taxation of governments, education and health care may be somewhat problematic as it would involve important changes on the expenditure side of the budget. The greater neutrality that would be achieved by taxing these sectors fully can also be achieved by

zero rating the bodies involved in providing government, education and health care services. While this would not remove the competitive distortion with respect to the private sector, it would eliminate the input choice distortion, the self-supply bias, and various administrative complications. Also, it would permit an optical reduction in the overall tax ratio.

The Common VAT Directive is the most important obstacle to these reforms. However, if the EU cannot reach a consensus on the adoption of improvements to the Common VAT Directive, perhaps Member States themselves should be allowed to do so, subject to approval by the EU VAT Committee. Arguably, a modern VAT, which does not affect the workings of the single market, unlike the current EU-VAT, cannot be considered to infringe on the principles of free trade and free competition, that is, violate the EU Treaty“ (Cnossen, 2020).

New Zealand thus operates a very broad VAT/GST tax base with limited exemptions, at a single 15% rate with very limited application of a zero rate. New Zealand treats public services as VAT/GST taxable, too (OECD, 2024). A transition of the European Union to the second-generation VAT would be very efficient. “The harmonized European value-added tax (VAT) is anything but a modern consumption tax that taxes all goods and services at a uniform rate. As exemplified by an analysis of the Dutch version, some 60% of the base is exempted, that is, not taxed on output but on inputs. This has serious consequences. The VAT exemptions distort input choices, stimulate uneconomical self-supply, and complicate administration and compliance. The welfare costs of the exemptions can be estimated at one half of one percent of gross domestic product (GDP). Research shows that under an equal yield assumption, the elimination of the exemptions and the introduction of a single rate in conjunction with a reduction in the standard rate should foster economic growth. The Member States of the European Union (EU) should be allowed to replace their defective VATs with a modern version. This would strengthen competitive conditions” (Cnossen, 2020).

Transition to the (US) retail sales tax would be very efficient for EU as well. Every country might choose its rate, including the “zero” rate. A general consumption tax need not exist; VAT may be “exchanged” for another value-added taxation. For example: the Czech VAT is equivalent to a direct taxation of the value added with a rate of some 9 percent. This direct value-added taxation may be realized with the “subtraction method” or with two taxes: a wage tax and a business tax.

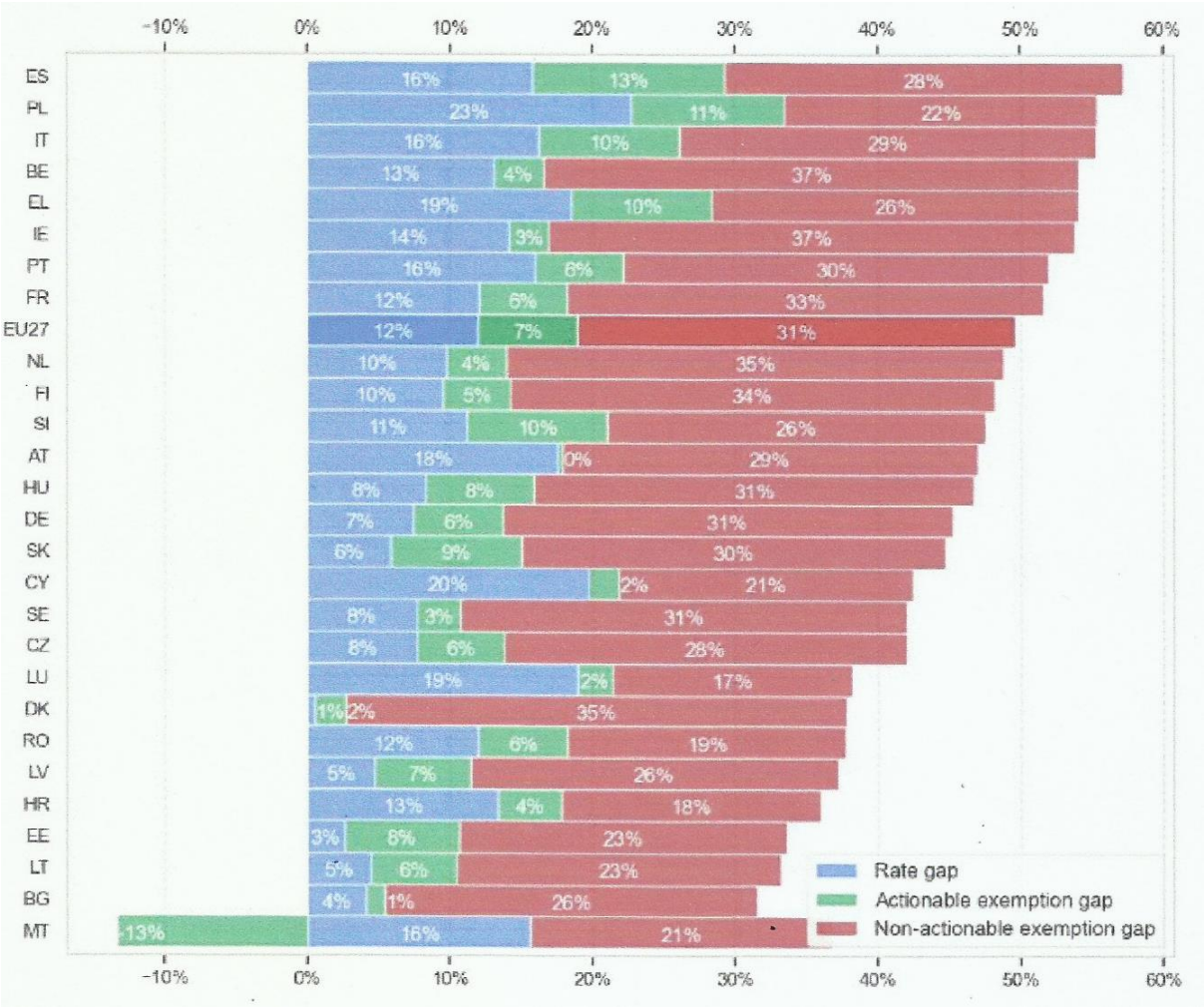
Next reform scheme is the Hall-Rabushka flat tax. Their system, conceived for the US, is a two-part value-added tax. All value added would be taxed at the business level except wages (“business tax”); wages would be taxed at the personal level with an exemption based on family size (“individual wage tax”). All wages and all business non-wage value added would face the same flat rate: 19 percent (Hall & Rabushka, 1985).

Hall and Rabushka argue that replacing the existing individual income tax with their flat tax would be a major improvement for three reasons: the flat tax would be much simpler than the current income tax, the flat tax would be much more efficient than the current income tax system, and consumption is a better tax base than income. Hall and Rabushka argue that a consumption tax is superior to an income tax because “individuals would be taxed on what they take out of the economy (when they spend money to consume), not on what they produce (reflected in working and saving).” They claim that by exempting investment from taxation, consumption taxes encourage investment and discourage spending; over time, each

act of investment traces back to an act of saving, thus exempting investment from the tax base amounts to exempting saving (Hall & Rabushka, 1985). It suggests completion/addition of the "value-added" Hall-Rabushka flat taxes with existing social security contributions (payroll taxes). The "next improvement" of the core of the tax systems is to eliminate the VAT at all. A turnover tax is not a constituent part of a normal tax system (Engliš, 1946).

The potential effects of the best (ideal) option are illustrated by the "VAT policy gap". It is an indicator of the additional VAT revenue that a Member State could theoretically collect if it applied a uniform VAT rate on all consumption of goods and services supplied for consideration, which would lead to so-called notional ideal VAT revenues. The Policy Gap compares these notional ideal VAT revenues with the expected revenues in the actual current system which allows for reduced rates and exemptions. The Policy Gap can be broken down into the Rate Gap and the Exemption Gap… the Rate Gap represents the potential revenue loss due to the existence of reduced rates, whereas the Exemption Gap represents the potential revenue loss due to the existence of exempted supplies of goods and services. The EU Exemption Gap, or the average share of 'ideal revenue' lost due to various exemptions is normally the larger of the two – see Figure 18. In 2022 this average EU gap was 38%. The largest part of the Exemption Gap is composed of exemptions on services that cannot be taxed by VAT in principle, such as imputed rents, the provision of public goods by the government, or financial services. The remaining level of so-called "Actionable" Exemption Gap is about 7% on average.

Figure 18: VAT policy gap (% of notional ideal revenue, 2022)



Source: Poniatowski et al. (2024)

In particular, zero-rating of exported goods exposes the VAT system to significant risks of fraud and evasion — exploited by recent highprofile instances of 'carousel fraud', as well as by more mundane evasion. We argue that while the extent of these problems should not be over-stated, a reform of the VAT treatment of intra-EU trade, in which goods would be exported bearing VAT, would reduce the vulnerability of the VAT system to frauds and evasion surrounding international transactions" (Mirrlees et al., 2010). Of course, the vulnerability to carousel frauds is much higher in the EU trade with non-EU countries.

9.6 Conclusions

Donald Trump plan to introduce a special tariff of 20% is fully justified by the subsidization of the exports within the EU value-added tax legislation. This fact has been fully neglected by the international community, and it ought to be eliminated as soon as possible. Next to this systematic export subsidization there exists also an "equivalent" (hidden) tariff on US exports to the EU countries, hidden in the "destination principle" applied to the so-called value added tax. Both these constructs have been fully neglected by the international community, and they ought to be eliminated as soon as possible.

“Value added tax” is a successor to the turnover tax introduced after the WW1 as a provisional source of the state budgets, to help with the reconstruction of the economics. The turnover taxes are not neutral in relation to big/composite and small competitors. Thus, they do not fit into a “normal” tax system. The turnover taxes survived the WW2 and in Europe (and other countries) they were transformed to “credit-invoice value added tax” which is a turnover tax with deduction of the same input tax paid; it is treated as an indirect tax on goods and services: a company burdens its sales with VAT and reduces the payment of VAT to the state budget by the VAT paid in the price of the purchased goods and services. The construct of the credit-invoice “value added tax” is very complex and it generates basic efficiency problems.

The EU has a “first-generation” VAT, with many exceptions (from taxation) and several tax rates; fraud, evasion and tax planning are thus much more important than e.g. in New Zealand which has a “second-generation” VAT (General sales tax – GST): very broad tax base with limited exemptions, at a single 15% rate with very limited application of a zero rate. New Zealand treats public services as VAT/GST taxable, too. A transition of the European Union to the second-generation VAT/GST would be very efficient.

Transition to the (US) retail sales tax would be efficient for EU as well. Every country might choose its rate, including the “zero” rate. A general consumption tax need/should not exist; the so-called VAT may be “exchanged” for another value-added taxation. For example: the Czech VAT is equivalent to a direct taxation of the value added with a rate of some 9 percent. Such a (direct) value-added taxation may be realized with the “subtraction method” or with two taxes with the same/similar concept: a wage tax and a business tax.

Next (well known) reform option is the Hall-Rabushka flat tax plan. Their system, conceived for the USA, is a two-part direct value-added tax. All value added would be taxed at the business level, except wages (“business tax”); wages would be taxed at the personal level (“individual wage tax”). All wages and all business non-wage value added would face the same flat rate: 19 percent. Nevertheless, their individual wage tax is a progressive tax, with an average tax rate lower than the business tax rate. Social security contributions should/could be added to these two taxes.

If we “would” like to tax the genuine value added, we should do it directly in the units where this value is being generated, using the origin principle. This scientific approach rejects any turnover or consumption taxation and the application of the destination principle, too.

The EU “value added tax” is an extremely inefficient source of public finance and it is to be reformed or abolished right away. The best solution is its integration into the taxation of wages and business incomes.

Acknowledgements

This research was supported by GA AA project “Possibilities for improving the sustainability of the Czech social security system” (GAAA/2024/1).

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10. Fiscal space for Czech healthcare and its sustainability

Jan Mertl

This chapter examines the concept of fiscal space in the context of Czech healthcare financing, analysing its determinants, recent trends, and strategies for long-term sustainability. Fiscal space — the capacity to increase sectoral funding without jeopardising fiscal stability — is explored through its theoretical foundations, revenue channels, and relevance to the Czech Republic's hybrid Bismarck–Beveridge model. The analysis highlights the growing role of state payments for non-working insured groups, which, while stabilising revenues during downturns, increase dependence on the state budget amid persistent deficits. International comparisons show Czech healthcare expenditure rising steadily as a share of GDP, positioning the country above regional peers but below Western European levels. The chapter outlines a two-track strategy for sustainability: short-term measures such as broadening the contribution base of public health insurance payments, improving procurement efficiency, optimizing both universal and optional care content, and maintaining reasonable balance of public budgets; and long-term reforms including strengthened prevention, pharmaceutical policy reform, and clearer integration of private providers. The findings underscore that preserving universal coverage in the face of demographic ageing, cost pressures, and fiscal constraints will require both immediate revenue-enhancing actions and structural efficiency gains to safeguard the fiscal space for a high-performing healthcare system.

10.1 Introduction: why fiscal space matters

The financing of healthcare is a perennial challenge for governments worldwide. In the Czech Republic, the issue is particularly salient because the country operates a universal healthcare system within the constraints of a relatively small, open economy. The concept of fiscal space — the capacity of a government to allocate additional resources to a sector without endangering fiscal sustainability — provides a valuable framework for understanding the pressures and opportunities in healthcare financing.

The origins of the fiscal space concept in health policy can be traced to the early 2000s, when scholars such as Heller (2006) and Tandon and Cashin (2010) began to formalize the idea in the context of development economics. Their work emphasized that fiscal space is not simply about increasing spending; it is about doing so in a way that is consistent with macroeconomic stability, debt sustainability, and intergenerational fairness. In healthcare, this means balancing the need for adequate funding with the imperative of maintaining a stable fiscal environment.

In the Czech context, fiscal space is shaped by several interrelated factors: the structure of the healthcare financing system, the country's economic performance, demographic trends, and political priorities. This chapter examines these factors in detail, drawing on recent data and policy developments to assess the sustainability of Czech healthcare financing and to explore strategies for its preservation.

10.2 Theoretical foundations of fiscal space in healthcare

Fiscal space is a concept rooted in public finance theory, where it is defined as the budgetary room that allows a government to provide resources for a desired purpose without prejudicing the sustainability of its financial position (Heller, 2006). In healthcare, this concept intersects with the principles of equity, efficiency, and solidarity — values that underpin most European health systems.

The creation of fiscal space can occur through several channels. Economic growth expands the tax base and increases contribution revenues. Reprioritization of expenditure shifts resources from lower-priority areas to healthcare. Increased revenue mobilization can be achieved through higher taxes or contributions. External grants or borrowing can also create fiscal space, though these are less relevant in the Czech case. Finally, efficiency gains allow more output from the same input, effectively expanding fiscal space without increasing spending.

In the Czech Republic, the healthcare system is financed primarily through two channels: proportional health taxes on earnings (public health insurance contributions) and state payments for "state-insured" individuals. The Czech healthcare financing system is a hybrid model that combines elements of the Bismarckian and Beveridge traditions. The primary source of revenue is the proportional health tax on earnings, paid by employees, employers, and the self-employed. This is supplemented by state payments for individuals who are not active in the labour market, such as children, pensioners, and the unemployed. This dual structure reflects both the contributory principle — linking benefits to labour market participation — and the solidarity principle — ensuring coverage for vulnerable groups. It is important to note however, the benefits are not related to the amount paid even in case of the first group, unlike the equivalency-based social insurance payments, making their contribution earmarked tax-like character.

Thus, to classify it precisely, fiscal space for healthcare in Czechia derives from several interrelated sources:

- Contributions from economically active insured persons: These are the primary revenues of the public health insurance system, dependent on wage levels, employment rates, and compliance with contribution obligations.
- State contributions for "state-insured persons": A distinctive feature of the Czech system, these payments cover individuals who do not participate directly in the labour market, such as children, pensioners, the unemployed, and other socially protected groups.
- Reserves of health insurance funds: Accumulated balances act (or can act) as a buffer against cyclical downturns and unexpected expenditure shocks.
- Tax and policy instruments: Broader fiscal policy can influence healthcare financing through earmarked taxes, shifts in contribution rates, or structural reforms.

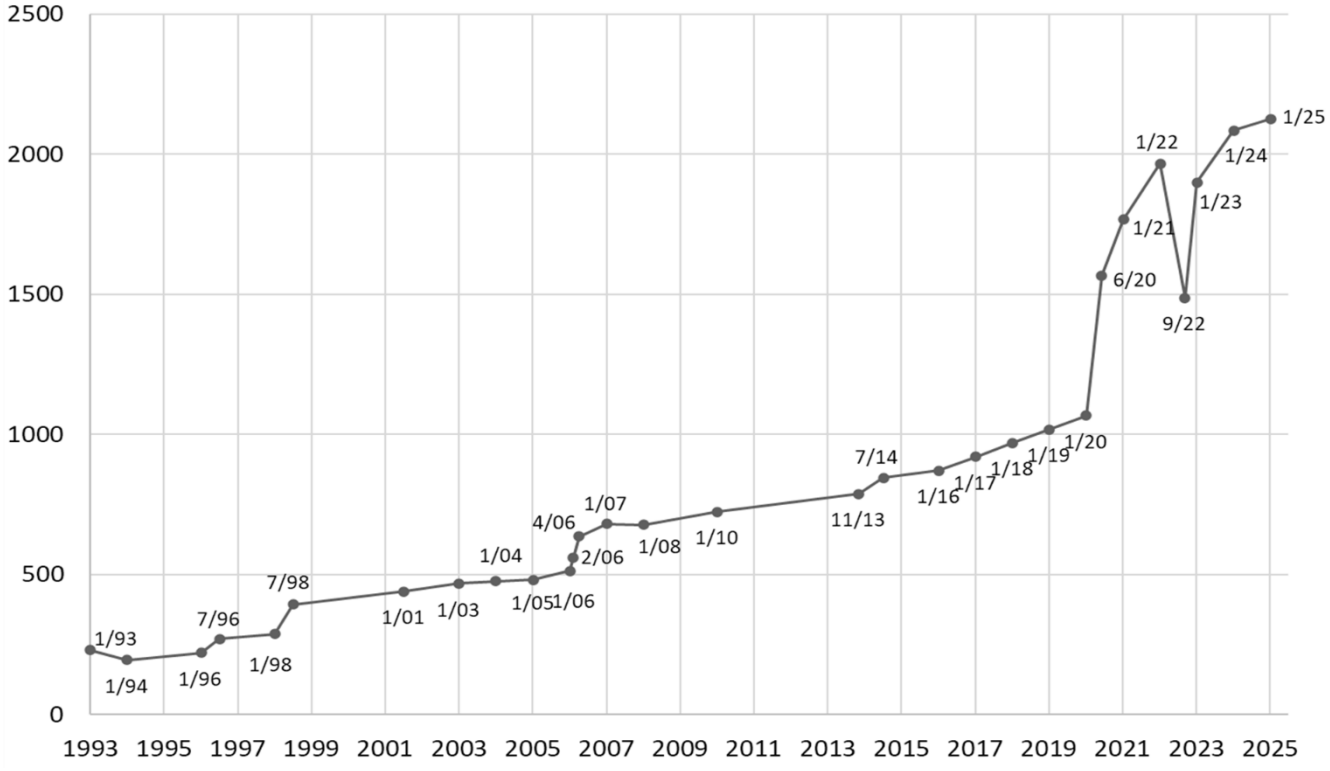
This structure has several advantages. It ensures a stable flow of revenue from contributions during periods of economic growth, while state payments provide a countercyclical buffer during downturns. However, it also creates vulnerabilities. The system is sensitive to labour market fluctuations, and the growing share of state payments raises questions about the long-term sustainability of the government budget.

10.3 Trends in state payments and health insurance revenue composition

Between 2019 and 2023 in Czechia, state payments per insured person increased significantly. This was driven by policy decisions to raise the per-capita payment, as well as by inflationary adjustments. The result has been a growing reliance on state transfers to maintain the solvency of the health insurance funds.

The share of state payments in total public health insurance revenues has also risen. While this can be seen as a form of countercyclical stabilization — increasing funding during economic downturns — it also increases the system's dependence on general taxation. This dependence could become problematic if fiscal pressures in other areas of the budget limit the government's ability to maintain or increase these payments.

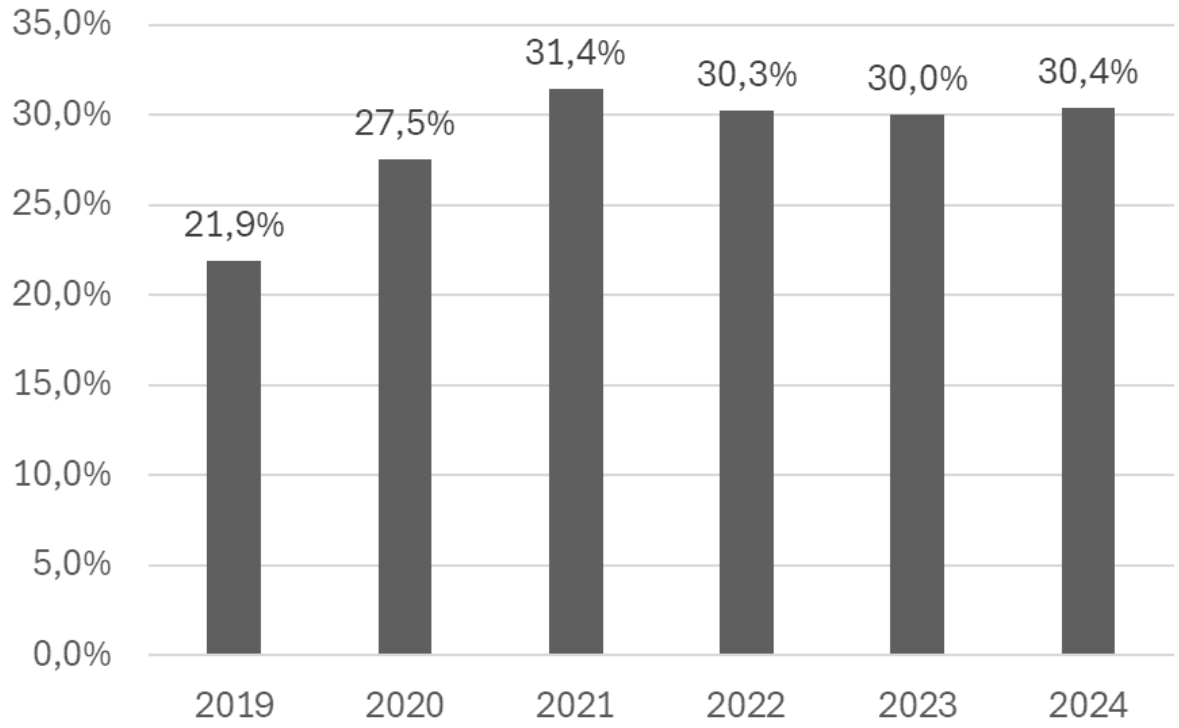
Figure 19: Payment for 1 state insured person in Czechia (1993-2025)



Source: author

The share of those payments on total healthcare budget also arose, as documented in the next graph.

Figure 20: Share of payments for state-insured persons in total revenues of the public health insurance (2019-2024)

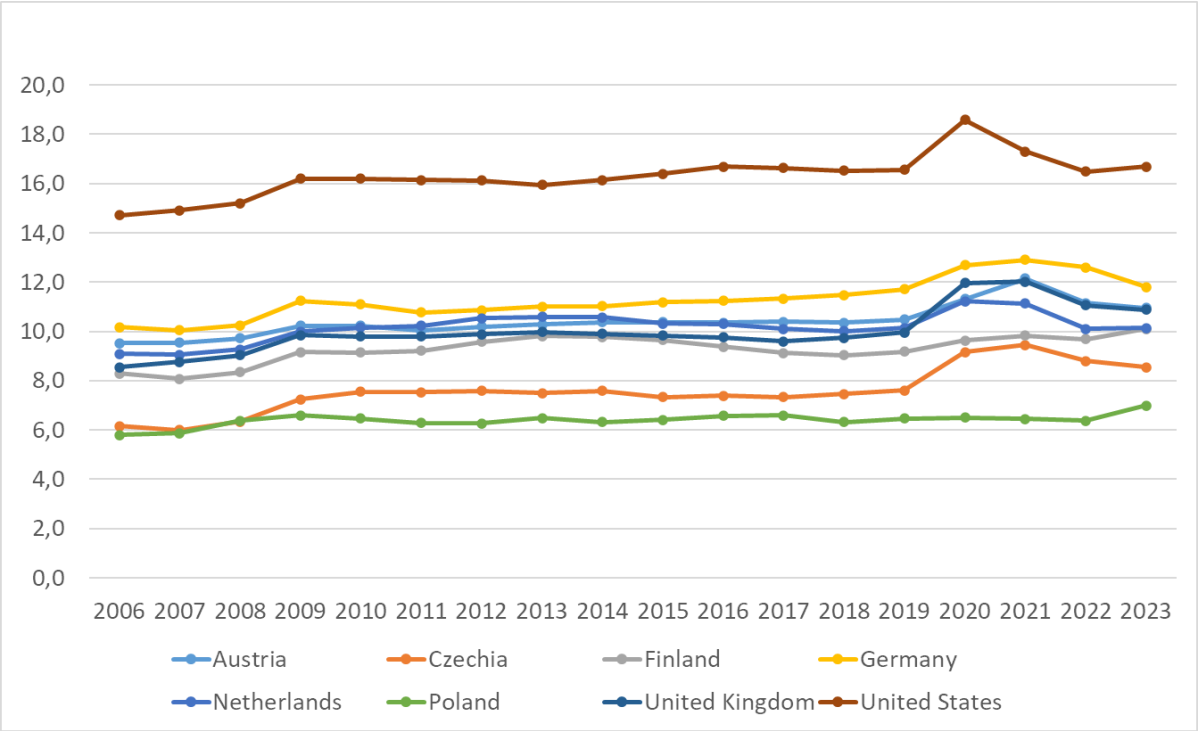


Source: author, data MF Czech Republic

10.4 The international comparison of healthcare expenditure

The international comparison of healthcare expenditure as a share of GDP from 2006 to 2023 reveals several important patterns that place Czechia's development in a broader context. Across the entire period, the United States stands apart from all other countries, beginning at roughly fifteen percent of GDP in 2006 and climbing gradually to around sixteen and a half percent by the mid-2010s. In 2020, the onset of the COVID-19 pandemic triggered a dramatic surge to nearly nineteen percent, before easing back to about seventeen percent in 2022. This level remains five to seven percentage points higher than the next-highest spenders, underscoring the structural cost intensity of the U.S. healthcare system.

Figure 21: Health expenditure as % GDP, 2006–2023



Source: OECD (2025)

Among European countries, Germany and the Netherlands occupy the upper tier of spending. Germany's share rises steadily from about ten and a half percent in 2006 to twelve and a half percent in 2020, followed by a slight decline to just above twelve percent in 2022. The Netherlands follows a similar trajectory, starting near nine and a half percent, peaking at eleven and a half percent in 2020, and settling at eleven percent in 2022. These countries combine high per-capita incomes with comprehensive coverage, which helps explain their consistently high GDP shares. A middle cluster of Austria, Finland, Sweden, and the United Kingdom maintains spending between roughly nine and eleven percent of GDP. Austria and Finland show gradual, steady increases over the period, while Sweden and the UK display a sharper pandemic-era spike in 2020, stabilising thereafter at around ten and a half and ten percent respectively. This group reflects mature welfare states with relatively stable financing models.

Czechia's trajectory is notable for its steady upward shift. Starting at about seven percent of GDP in 2006 and holding that level until around 2010, it then embarks on a gradual but persistent climb, reaching approximately nine percent by 2022. The increase is structural rather than a temporary pandemic-related blip, with a positive slope across the entire period. The pandemic did accelerate the rise, but the trend was already in motion, reflecting deliberate policy choices such as higher state payments for state-insured individuals and underlying cost growth in the system. In contrast, the Slovak Republic and Poland remain at the lower end of the spectrum. The Slovak Republic begins slightly above Czechia in 2006 but grows more slowly, converging with Czechia around 2020 at roughly nine percent. Poland lags further behind, starting near six and a half percent and only reaching about seven percent by 2022, indicating a more constrained fiscal commitment to healthcare.

A pronounced spike in 2020 is visible across almost all countries, corresponding to emergency spending during COVID-19. The magnitude varies, being largest in the United States, the

United Kingdom, Sweden, and Germany, and more modest in Czechia, Austria, and Poland. Post-2020, most countries show a slight decline, suggesting that some pandemic-related spending was temporary. For Czechia, the graph confirms its position in the upper half of Central and Eastern Europe but still below the Western European average. The steady upward trajectory suggests a long-term policy commitment to increasing healthcare's share of GDP, yet the gap with high-spending systems like Germany remains significant. This raises strategic questions about whether Czechia should aim to converge further with Western European spending levels, and if so, how it will finance such an increase. It also prompts consideration of whether efficiency gains could offset the need for large revenue hikes, or whether higher contributions and state transfers will be necessary, and how to ensure that any increase in spending translates into measurable improvements in access and outcomes.

10.5 Ways to improve sustainability

Improving the long-term sustainability of Czech healthcare requires a combination of measures that can be implemented in the short term to stabilise financing and more complex, structural reforms that address underlying cost drivers. The presentation distinguishes between "simpler" and "more complex" options, but both categories are essential parts of a coherent fiscal space strategy.

On the simpler side, one avenue is to increase general taxation to maintain the state budget's capacity to transfer funds to public health insurance. This is particularly relevant given the current structural government budget deficit of around CZK 250 billion annually. Without additional revenue, the state's ability to make adequate per-capita payments for "state-insured" groups — children, pensioners, the unemployed — will be constrained, especially during economic downturns when wage-linked contributions stagnate. While politically sensitive, modest adjustments to broad-based taxes such as property or income tax could preserve the fiscal room needed to sustain these transfers without cutting other essential services.

A second measure is to broaden the contribution base, so that under-represented groups participate more equitably in financing. At present, certain categories of self-employed individuals (OSVČ) contribute on a reduced assessment base, and individuals with passive income streams — from rents, dividends, or capital gains — may not contribute at all. Adjusting the rules to capture a fairer share from these groups could yield additional revenue without increasing rates for current contributors. This would also strengthen the perceived fairness of the system, which is important for public legitimacy.

Improving efficiency within the existing system is another relatively quick win. Efficiency gains can be realised through better procurement practices, particularly in pharmaceuticals and medical devices, where centralised purchasing and transparent tendering can reduce costs. Streamlining administrative processes, optimising hospital networks to avoid duplication of services, and expanding the use of digital health tools can all help deliver more care for the same expenditure. These measures do not require a fundamental change in the financing model but can significantly stretch the available fiscal space.

A further option is to shift certain services to the voluntary, privately financed sector. This does not mean privatising core healthcare, but rather identifying elective, non-urgent, or luxury services that could be offered on a self-pay basis. By narrowing the publicly financed

package to essential and cost-effective interventions, public funds can be concentrated where they have the greatest impact. The challenge lies in defining the boundary in a way that preserves equity and avoids creating barriers to necessary care.

The more complex measures focus on structural reforms with longer-term payoffs. Strengthening health promotion and prevention is a prime example. By reducing the incidence and severity of disease, prevention lowers the demand for costly curative services. This includes sustained public health campaigns, vaccination programmes, early screening for chronic conditions, and policies targeting major risk factors such as smoking, alcohol consumption, poor diet, and physical inactivity. While the fiscal benefits may take years to materialise, the long-term impact on both population health and expenditure is substantial.

Reforming pharmaceutical policy and embedding pharmacoeconomic evaluation into reimbursement decisions is another strategic priority. Pharmaceutical spending is a major cost driver, and without rigorous assessment, there is a risk of funding high-cost drugs with marginal benefit. Health technology assessment (HTA), reference pricing, and outcome-based reimbursement models can ensure that public funds are directed towards treatments that deliver the greatest health gain per koruna spent. This approach aligns with international best practice and can help contain costs without compromising quality.

Finally, clarifying the role of private outpatient providers within the public insurance framework can improve efficiency and service integration. Private clinics are a significant part of Czech service delivery, but contracting arrangements, reimbursement rates, and quality oversight can be inconsistent. Establishing clear, transparent rules for their participation in the public system would help ensure that public funds are used effectively, while maintaining patient choice and access.

Taken together, these measures form a two-track strategy: immediate steps to stabilise financing and longer-term reforms to address structural pressures. The simpler measures can provide quick fiscal relief and buy time, while the more complex reforms tackle the root causes of cost growth and inefficiency. In the Czech context, where demographic ageing and technological advances are set to increase expenditure pressures, a balanced approach that combines both is essential for preserving universal coverage and fiscal sustainability.

10.6 Conclusions

The analysis of Czech healthcare financing shows a system that has proven resilient in the face of economic cycles and extraordinary shocks such as the COVID-19 pandemic, but whose sustainability cannot be taken for granted. The dual-stream model — wage-linked contributions complemented by state payments for non-working insured groups — has provided stability, yet recent trends reveal a growing reliance on state transfers. This shift has helped maintain solvency during downturns but also increases exposure to broader fiscal constraints, especially given the state budget's persistent deficit. The gradual rise in healthcare's share of GDP, while still below Western European levels, reflects both deliberate policy choices and underlying cost pressures.

Financial reserves in the health insurance funds have played a critical role as a buffer, but their recent decline signals the limits of relying on accumulated surpluses to absorb shocks. Demographic ageing, technological advances, and evolving patterns of morbidity will continue

to drive expenditure growth, while the contributory base may be constrained by labour market changes. International comparisons underline that Czechia aspires to the access and quality of higher-spending systems but operates with a more modest fiscal envelope, making the efficient use of every koruna essential.

Ensuring long-term sustainability will require a balanced strategy that combines immediate revenue and efficiency measures with deeper structural reforms. Short-term steps such as broadening the contribution base, improving procurement, and maintaining the state's capacity to fund "state-insured" groups can stabilise financing. Longer-term priorities — strengthening prevention, reforming pharmaceutical policy, and clarifying the role of private providers — can address structural cost drivers and improve value for money. By pursuing both tracks in parallel, Czechia can preserve universal coverage, adapt to future health needs, and safeguard the fiscal space necessary for a high-performing healthcare system.

Acknowledgements

This research was supported by GA AA project "Possibilities for improving the sustainability of the Czech social security system" (GAAA/2024/1).

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11. The impact of public healthcare expenditure on people's health status – a comparison of the countries Germany, Austria, and Czechia for the years 2013 to 2021

Patrick Mini

Health, defined as complete physical, mental, and spiritual well-being, is a vital foundation for happiness, surpassing wealth and material factors in importance; it enhances life satisfaction, social relationships, and economic outcomes, with most people valuing healthy living over mere longevity. This chapter aims to gain insights to the impact of healthcare expenditure, health system staffing and healthy life habits on citizens' health status for Germany, Austria, and Czechia.

Using Eurostat data and correlation analysis, this study compares the effects of health expenditure and health system staffing (as measured by the number of physicians per inhabitants (physicians' density)) on healthy life years and the perceived health status of individuals in Germany, Austria, and Czechia from 2013 to 2021. This study also considers the moderate impacts of lifestyle factors and finds important differences among countries. However, these differences are inconclusive and cannot be explained by the dataset alone.

Healthcare expenditures and efforts to live healthily do not correlate with an increase in the number of healthy life years and improved perceived health. For Czechia, a positive impact of healthcare staffing on perceived health is observed. Germany and Austria have expensive healthcare systems with relatively low physician density. Increasing staffing could improve citizens' health more effectively than further technological expansion and administrative complexity. Czechia maintains a high physician density despite low healthcare spending but should promote healthier lifestyles to enhance perceived health and healthy life years through initiatives such as information campaigns and insurance premiums while lowering future cost increases from advancing medical technologies. Further research on health system structures and processes is required to gain a comprehensive understanding of these results.

11.1 Introduction

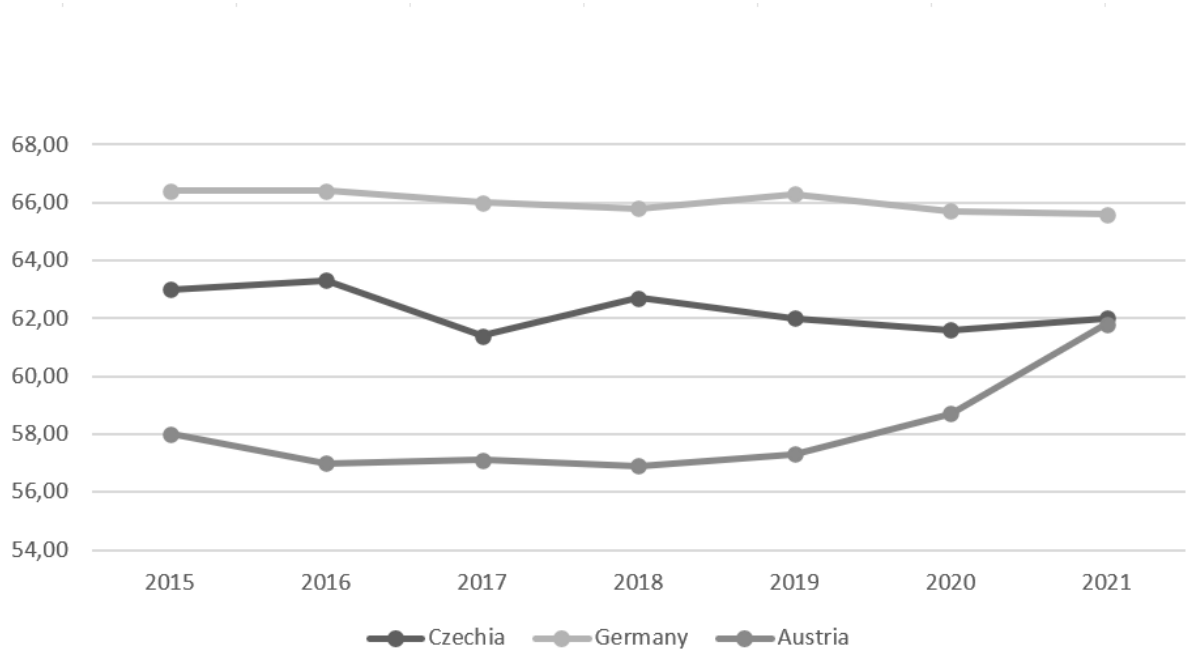
The aim of this chapter is to analyse how public healthcare expenditure, health system staffing (physician density) and healthy lifestyle habits influence both objective and perceived health status in Germany, Austria and Czechia between 2013 and 2021, and to derive implications for health policy in these countries.

Health is a growing and major concern of people in probably all societies and is defined as "a state of complete physical, mental and spiritual well-being" (WHO, 2006, p. 1). The components of health – mental, spiritual, and physical – reinforce each other, suggesting their inseparability in the long term (Ali & Venkat Narayan, 2009, p. 2035). Compared to those suffering from physical or psychological impairments, healthy people enjoy longer and happier lives (Slade, 2010, p. 1). Additionally, healthy individuals benefit from higher wealth (Graham et al., 2004, p. 319) and enjoy more fulfilling social relationships (Mushtaq et al., 2014, p. WE01; Myers, 2000, p. 56). In brief, health is a central key determiner of perceived happiness (Veenhoven, 2008, p. 449), significantly more important than money and other material

factors. Many individuals would prefer a healthy life over pure longevity impacted by physical or mental issues (Yasamy et al., 2023, p. 4).

The key metric for assessing health is “healthy life years” which measures the number of years an average citizen lives without long-term activity limitations caused by health issues (equivalent to disability-free life expectancy) (OECD, 2023). This indicator is widely used in the European Union (EU) to evaluate health. According to OECD data from 2018, average life expectancy in the EU is 83.7 years for women and 78.2 years for men. Individuals expect to spend 23% (women) and 19% (men) of their lifespan with permanent health impairments. Consequently, as longevity increases, so do the years lived with impairments (OECD, 2023/2). Thus, measuring healthy life years by countries is a more objective perspective:

Figure 22: Healthy life years in the European Union and selected member states in 2015 to 2021

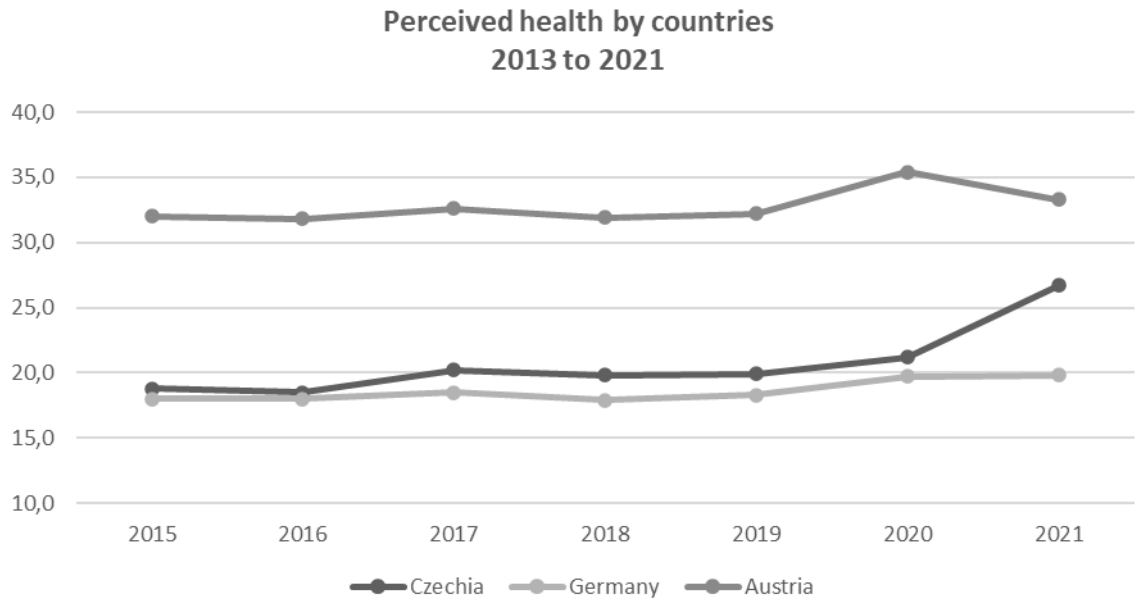


Source: based on own evaluations using Eurostat (2023/2)

Figure 22 compares health data for three European countries - Czechia, Germany, and Austria - from 2015 to 2021, revealing significant differences. German’s experience the highest number of healthy live years (66), followed by Czechia (64 years). Austria lagged until 2019 but caught up with Czechia in 2020 and 2021 (based on own evaluations using Eurostat, 2023/2).

A comparison of the data on perceived health by countries is of interest. Perceived health refers to what extent people of a country are satisfied with their general health status, indicating how healthy they feel. Figure 23 summarizes the share of individuals indicating that their health is “very good”. This share is highest for Austria, ranging from 30% to 35%, followed by Czechia (18% to 26%) and lastly Germany (10% to 20%).

Figure 23: Perceived health in ranking points in selected EU-member states in 2015 to 2021



Source: Eurostat (2023/3)

The results for the medical measure of "healthy life years" obviously does not correspond to health status as perceived by the citizens. While Austrian citizens live fewer years without impairments than Czechs and Germans, they exhibit a higher level of subjective health satisfaction than citizens of the other countries. Although Germans enjoy the healthiest life years in the sample, they are least satisfied with their perceived health.

These differences between countries could originate from the healthcare systems and could also be influenced by lifestyle practices within these nations.

11.2 Status of earlier research determiners of citizens' health

The interrelationship between healthcare status and healthy living patterns was repeatedly analysed for different industrialized countries. The analysis focuses on publications after 2014 and in peer reviewed journals to ensure academic quality and topicality, earlier seminal papers are also considered. Due to fundamental differences in the healthcare system and life expectancy, studies from emerging and developing countries are excluded from the analysis. The following review provides a brief overview of the results and derives hypothesis for further empirical research in Germany, Austria, and Czechia in sections 3 and 4.

11.2.1 Impact of healthcare expenditure on objective/ perceived health status

The impact of healthcare expenditure on people's health status has frequently been assessed in different countries.

A comparative analysis of total, private and public healthcare expenditure to GDP in 15 South-Asian countries from 1995 to 2014 finds that health expenditure generally reduces infant mortality rates and crude death rates. The availability of sanitation facilities and per capita income positively moderate this relationship (Rahman et a., 2019, p. 1). In a sample of 28 EU countries from 2000 to 2017, the level of public health expenditure is a positive determiner of

life expectancy at birth (Railaite & Ciutiene, 2020, p. 375). Based on a systematic review of publications before 2019, Sabina et al. (2020, p. 591) report a predominantly positive impact of healthcare expenditure on population health for developed countries, while for less developed countries the reported effects are ambiguous and depend on the local availability of health services.

Based on World Bank data, Rezapour et al. (2019) evaluate the impact of private and public health expenditure on different health indicators from 2000 to 2015 for middle- and high-income countries. Public health expenditure increases life expectancy significantly and decreases infant mortality in all countries, while the effect of private health expenditure is insignificant for this sample.

These results are confirmed by a more prolonged time series of World Bank data from 1990 to 2017. Accordingly, there is a positive correlation between public health expenditure and citizens' health for upper- and middle-income countries. The study assumes a bidirectional relationship: health spending improves health status by providing the population with advanced medical services. With improving health status, individuals become more concerned about personal health and their demand for healthcare services increase, leading to rising healthcare expenses (Shahraki & Ghaderi, 2019, p. 220).

A comparison of 15 Asian and 30 OECD countries details that health expenditure per person co-depends on market demand, market supply, and further exogenous factors. Generally, high GDP contributes to higher healthcare related spending and probably to more expensive healthcare. The study also documents the inverse relationship: accordingly, an improvement in the population's health status leads to an increase in health expenditure for the Asian countries in the sample but decreases health expenditure in OECD countries (Kraipornsak, 2017, p. 412).

Although the direction of the relationship between healthcare supply and health status is ambiguous, the positive correlation between both factors is confirmed by all retrieved prior studies. An initial hypothesis summarizes this observation:

H1: Healthcare expenditure is positively correlated to a) citizens' healthy live years b) citizens' perceived health.

11.2.2 Healthcare quality

Some studies indicate that the quality of the healthcare system could be an important moderator of the impact of healthcare expenses on citizens' health:

A comparative study of 25 countries utilizing different healthcare systems from 2000 to 2015 suggests an influence of healthcare system financing type on life expectancy and children's mortality rates: when healthcare systems contain a private financing component, the impact of private healthcare on health is stronger than for publicly financed systems (Raeesi et al., 2018, p. 1).

Additionally, the number of physicians per capita has a positive moderating effect on life expectancy for countries employing nationalized health service systems (Raeesi et al., 2018, p. 4). A survey among Norwegian hospital patients in old and new hospitals (n = 650) indicates that staff qualification is a reliable indicator of perceived healthcare quality: Patient satisfaction with hospital care depends on the commitment and understanding of health care

staff, while the technical standard of the hospital is less important for patient satisfaction (Grøndahl et al., 2018, p. 596-597).

Concluding from these earlier insights a second hypothesis results:

H2: Health system staffing is positively correlated a) citizens' healthy live years b) citizens' perceived health.

11.2.3 Lifestyle and healthy life

Diverse studies suggest that lifestyle and social factors have important implications on perceived and objective health. In 1998, Carlson (p. 1355) finds significant differences in perceived health between Eastern and Western European countries and attributes this to differences in opportunities to participate in civic activities. These were for a long time limited in the Communist Eastern European states. The feeling of keeping control of their lives motivates Western citizens to get engaged in physical activities and cherish social contacts, while people in a communist regime could do less for their personal well-being.

According to a representative survey (European Survey, 2002 and 2004) among more than 65,000 European citizens from 21 countries, most of the variation in citizen's health depends on individual factors, e.g., income, occupational class, social network and social support, while only 10% of the variation is explained by the availability of "national welfare state characteristics", which are summarized in a dummy variable classifying countries of different welfare culture into five groups (Eikemo, 2008, p. 2290).

The observations of section 2.2 that increasing health expenditure increases people's health considers European and Asian countries only. For the USA, Papanicolas et al. (2018, p. 1024) observe an inverse relationship: although the USA spent 17.8% of its GDP on healthcare from 2013 to 2016, much more than most other countries, life expectancy in the US is lower (78.8 years) than in most equally developed countries. The authors thus assume that health related behaviour takes a significant impact on individual health.

Typical health-related life habits seem to be important moderators: Alcohol consumption and low educational status reduce life expectancy in a model explaining the health component of human capital by public health expenditure for 28 EU countries from 2000 to 2017 (Railaite & Cioutiene, 2020, p. 375).

Based on these observations a third hypothesis is derived:

H3: Healthy life habits positively moderate the impact of health expenditure and health system quality on a) citizens' healthy live years b) citizens' perceived health.

11.2.4 Conclusion and research gaps

Concluding from the review, health expenditure and health system quality (staffing) have a positive impact on citizens' health status, and healthy life habits could moderate this relationship. It seems plausible that health status differs by country due to differences in the mentioned explaining factors.

However, research comparing the relevance of the factors by country and particularly research for Central Europe, namely Germany, Austria, and Czechia, is outstanding.

11.2.5 Empirical analysis on nation-specific impacts on healthcare expenditure

Study aim and method of statistical analysis

The empirical study part works on this research gap and analyses the impact of healthcare expenditure, health system staffing and healthy life habits on citizens' health status as measured by healthy life years and perceived health in Germany, Austria, and Czechia from 2014 to 2021. The study is based on publicly available data extracted from Eurostat (2023).

To test hypothesis 1 and 2, correlation analysis of time series data from 2012 to 2021 for the three countries Germany, Austria, and Czechia (three models, one for each country) are conducted. The Bravais-Pearson Correlation Coefficient is applied to explore the impact sizes of the metrically scaled factors. The propositions are accepted for reliabilities above 95% for the individual factors in the two-sided χ^2-Test.

To examine hypothesis 3, healthcare data is collected for 2019. Note, time series data on healthy life habits are unavailable from Eurostat. A descriptive analysis indicates differences between the countries and allows conclusions on further detailed research needs.

Operationalization of model parameters

The following data are used to operationalize the model parameters:

Healthy life years are available on an annual basis in absolute values measured at birth for 2012 to 2021 from the Eurostat Database (2023/2).

Perceived health is measured as the share of citizens above 16 by country who indicate to be in "very good" state of health. Values are available from 2013 to 2023 for all three countries (Eurostat, 2023/3).

Per capita health expenses in euros as current (annual) healthcare expenditure (CHE) by country and inhabitant are available for the years 2012 to 2020 (Germany, Czechia) and 2021 (Austria) (Eurostat, 2023/1).

To measure the quality of healthcare, the number of physicians per 1,000 inhabitants is counted (Eurostat, 2023/4). This key ratio takes up Grøndahl et al.'s (2018, p. 596-597) observation that healthcare staff, rather than technical standards, are responsible for service quality.

Healthy life indicators are available from Eurostat (2023) for 2019 and the following indicators are applied:

- Share of the population dispensing with alcohol for at least 1 year
- Share of the population disposing of a normal BMI
- Share of the population performing health activities regularly
- Share of the population consuming one or more portions of vegetable daily
- Non-smoking share of the population feeling strong social support.

11.2.6 Descriptive data analysis

Health status

Health status is measured as healthy life years and perceived health as indicated in the introduction.

Table 5: Healthy life years by country

Healthy life years			
TIME	Czechia	Germany	Austria
2012	63,20	57,60	61,40
2013	63,30	57,40	59,90
2014	64,10	56,50	57,70
2015	63,00	66,40	58,00
2016	63,30	66,40	57,00
2017	61,40	66,00	57,10
2018	62,70	65,80	56,90
2019	62,00	66,30	57,30
2020	61,60	65,70	58,70
2021	62,00	65,60	61,80

Source: Eurostat (2023/2)

Healthy life years are available from Table 5 and were addressed and visualized in section 1. There is an evident and unexplained increase of about 10 healthy life years for Germany from 2014 and earlier to 2015 and onwards, which can result from a change of the measurement method or data errors.

Perceived health, such as the share of citizens above 16 indicating to be in “very good” health, is available from Table 6 as discussed in section 1.

Table 6: Perceived healthy life by country

Perceived health			
TIME	Czechia	Germany	Austria
2013	18,1	17,2	31,3
2014	18,9	17,2	31,7
2015	18,8	18,0	32,0
2016	18,5	18,0	31,8
2017	20,2	18,5	32,6
2018	19,8	17,9	31,9
2019	19,9	18,3	32,2
2020	21,2	19,7	35,4
2021	26,7	19,8	33,3
2022	26,	20,9	30,7

Source: Eurostat (2023/3)

Health expenditure by country

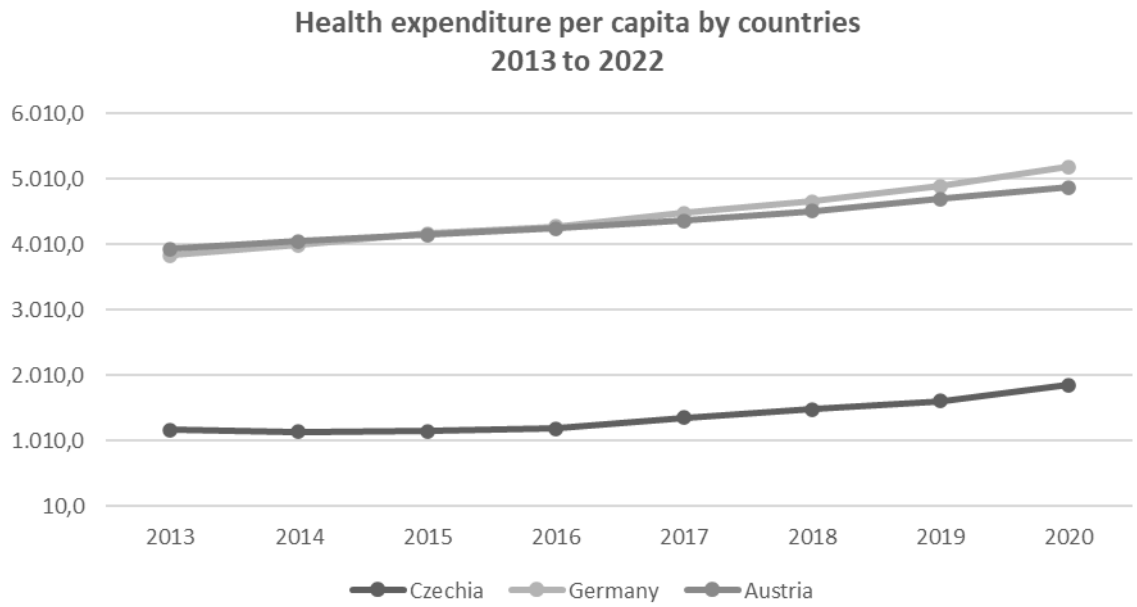
Per capita healthcare expenditures in all three countries are available from 2013 to 2020 and have increased continuously.

Table 7: Total health expenditures by country - Health Expenditure per capita (all providers in million Euros)

TIME	Czechia	Germany	Austria
2013	1.171,00 €	3.839,94 €	3.941,92 €
2014	1.140,49 €	3.995,01 €	4.059,92 €
2015	1.157,88 €	4.168,16 €	4.157,56 €
2016	1.194,80 €	4.284,89 €	4.255,00 €
2017	1.354,44 €	4.483,43 €	4.371,96 €
2018	1.485,43 €	4.660,64 €	4.519,41 €
2019	1.610,75 €	4.893,46 €	4.701,66 €
2020	1.859,85 €	5.192,04 €	4.873,92 €

Source: Eurostat (2023/1)

Figure 24: Total health expenditures by country



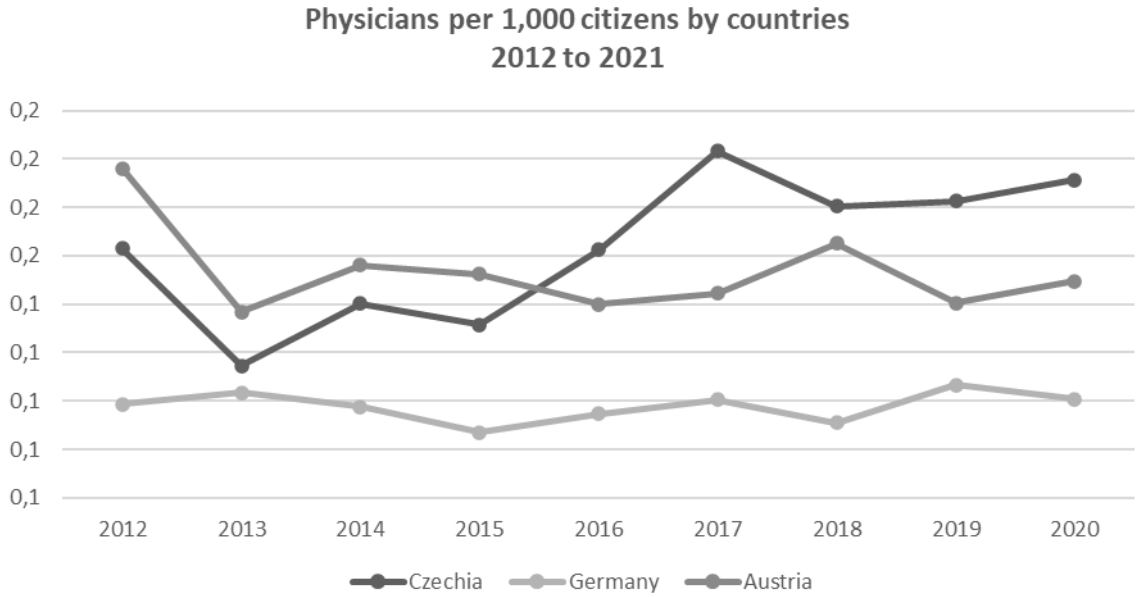
Source: Eurostat (2023/1)

Healthcare expenses in Germany (4,000- 5,192 €) and Austria (4,000 – 4,690 €) are high above the European average of 2,660 to 3,268 €. Meanwhile, per capita expenses in Czechia (1,140 to 1,859 €) are significantly below the EU-mean (Eurostat, 2023/1).

11.2.7 Health system staffing by country

Data on the number of physicians per 1,000 inhabitants are charted in Figure 25 based on data of Table 8 and available for 2012 to 2020:

Figure 25: Physicians per 1,000 citizens by country



Source: Eurostat (2023/4)

Table 8: Physicians per 1,000 citizens by country

Health staff per 1,000 citizens			
TIME	Czechia	Germany	Austria
2012	0,1514	0,1193	0,1681
2013	0,1272	0,1217	0,1384
2014	0,1401	0,1188	0,1480
2015	0,1357	0,1135	0,1462
2016	0,1512	0,1174	0,1400
2017	0,1716	0,1203	0,1423
2018	0,1602	0,1155	0,1526
2019	0,1613	0,1233	0,1402
2020	0,1656	0,1203	0,1447

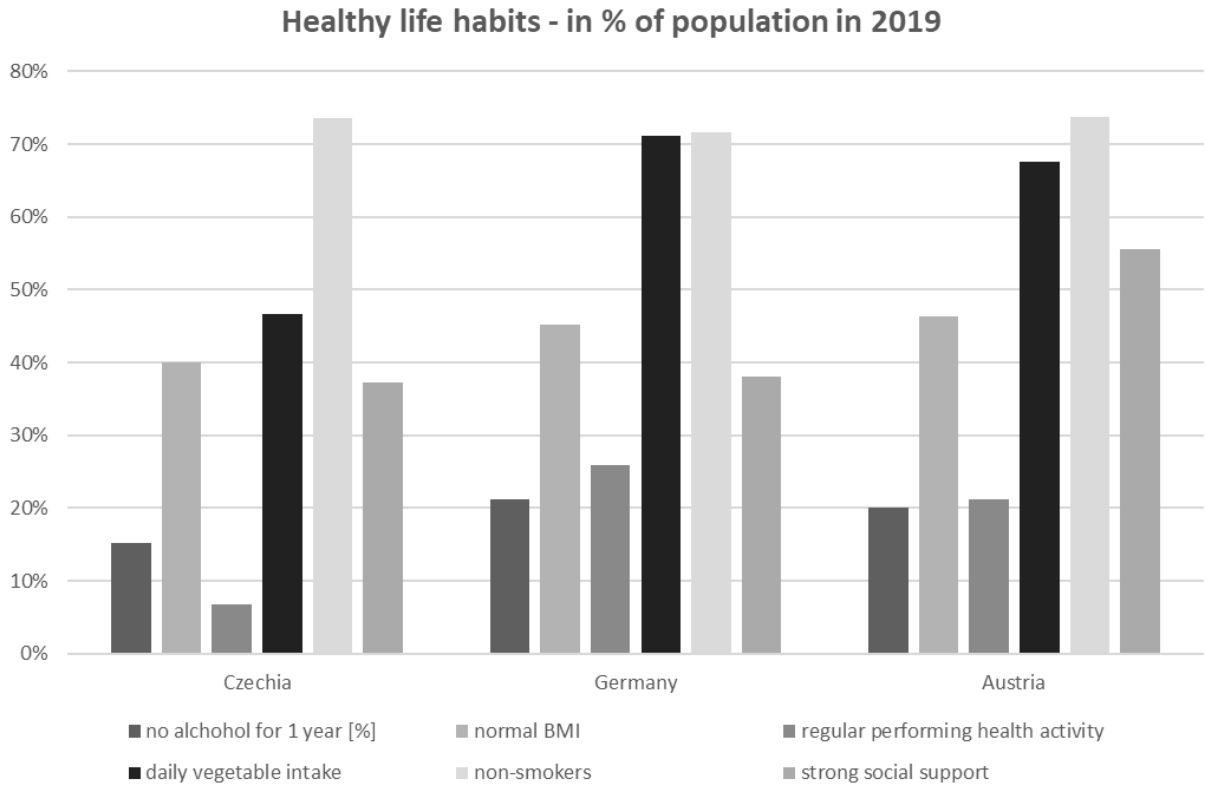
Source: Eurostat (2023/4)

Obviously, Germany has significantly fewer physicians per citizen (about 12 per 100,000 inhabitants) than Czechia (about 16/100,000 inhabitants) and Austria (about 14/100,000 inhabitants). From 2015 to 2018, physician density in the Czechia increased by 23%, while physician density in Germany and Austria has been roughly stable since 2013.

Healthy life habits by country

Healthy life habits are available for the year 2019 only from Eurostat. They indicate the percentage of the population, who practice the respective healthy life habit. The comparative statistics are summarized in the following Table 9 and Figure 26.

Figure 26: Healthy life habits by country



Source: Eurostat (2023, own compilation)

Table 9 also provides health status and health systems related data for 2019 to allow a qualitative comparison by country:

Table 9: Healthy life habits by country

Healthy life in 2019						
Data of 2019 [%] of population	no alcohol for 1 year	normal body mass index	regular performing health activity	daily vegetable intake	non-smokers	strong social support
Czechia	15,20%	40,00%	6,70%	46,70%	73,60%	37,30%
Germany	21,20%	45,20%	25,90%	71,10%	71,70%	38,10%
Austria	20,10%	46,30%	21,20%	67,50%	73,80%	55,50%

Health and health system in 2019				
Data of 2019	physicians per 1,000 citizens	health expenses per capita	healthy life years	„very good“ perceived health in [%] of population
Czechia	0,16	1.610,75 €	62,00	19,9
Germany	0,12	4.893,46 €	66,30	18,3
Austria	0,14	4.701,66 €	57,30	32,2

Source: Eurostat

According to Table 9, Czechs lived less healthily than Germans and Austrians in 2019, while Austria and Germany performed similarly concerning major physical health factors: in Czechia, only 15.2% of the population had no alcohol for one year or more, while that was the case for 20.1%, respectively 21.2% of Austrians and Germans. While in Austria and Germany around 46% of the population were of a healthy weight (normal body mass index), only about 40% of Czechs are not over- or under-weighted. While 25.9% of Germans and 21.2% of Austrians practiced sports regularly, only about 6.7% of Czechs did so. 71.1% of Germans and 67.5% of Austrians consumed vegetables every day, but only 46.7% of Czechs. These countries are about equal to (indicated, see Figure 26) non-smokers. Austrians feel social support in their personal environment most strongly (55.5% maintain high social support). Only 37.3% of Czechs and 38.1% of Germans experience the same social comfort.

Comparing health system data to this health status information for 2019, Czechia had significantly more doctors, but less health expenses per capita than Germany and Austria. Czechia is situated between Germany and Austria as to the number of healthy life years and the perceived health status of the population in 2019.

A qualitative comparison of the relationship between health status and health data for 2019 for the countries to test hypothesis H3, delivers inhomogeneous results: Czechia is in between Germany and Austria as to healthy life years, although Czechs have got significantly less healthy life habits than both neighboring countries. As to perceived health, Austria is clearly superior to Czechia and Germany, although the populations of Germany and Austria live similarly healthy. However, they differ in social support, with the Austrians superior to the other two nations. No definite statement on the impact of healthy living habits on objective or perceived health is thus possible based on the data for a single year. **Hypothesis H3 is not accepted.**

11.3 Quantitative impacts on citizen's health status by country

To test hypothesis 1 and 2, i.e., analyse the correlations between health expenditure (H1) and the number of physicians per 1,000 inhabitants (as a measure of healthcare staffing) (H2) and healthy life years and perceived health by country, correlation models (Pearson correlation coefficients) are tested using Chi² testing.

11.3.1 Correlation-Analysis for Austria

The results for Austria are summarized in Table 10:

Table 10: Correlations and χ-significances for Austria

Austria		PH_A perceived health	HE_A health expenditure	HS_A health staff
HLY_A healthy life years	P. corr.	0,282	-0,286	0,568
	Sig. (2.sid.)	0,462	0,492	0,110
	N	9	8	9
PH_A perceived health	P. corr.	**1**	**.765***	0,073
	Sig. (2.sid.)		0,027	0,864
	N	9	8	8
HE_A health expenditure	P. corr.		1	0,142
	Sig. (2.sid.)			0,738
	N		8	8

Source: author

For Austria, only a single correlation is significant: healthcare expenditure and perceived health are positively correlated (χ^2 = 0.765*; Sig: 0.027). The is no significant effect of healthcare expenditure on the number of healthy life years, however (χ^2 = 0.282; Sig: 0.462). H1 is thus partly accepted for Austria. There is no significant correlation between health status and health staffing. Therefore, H2 is rejected for Austria.

11.3.2 Correlation-Analysis for Germany

The correlation results for Germany are summarized in Table 11:

Table 11: Correlations and χ-significances for Germany

Germany		PH_G perceived health	HE_G health expenditure	HS_G health staff
HLY_G healthy life years	P. corr.	0,616	0,664	-0,260
	Sig. (2.sid.)	0,078	0,073	0,500
	N	9	8	9
PH_G perceived health	P. corr.	**1**	**.879****	0,143
	Sig. (2.sid.)		0,004	0,735
	N	9	8	8
HE_G health expenditure	P. corr.		1	0,230
	Sig. (2.sid.)			0,584
	N		8	8

Source: author

For Germany, similar results as for Austria are observed: Healthcare expenditure is highly significantly correlated to perceived health (χ^2 = 0.879**; Sig: 0.004). All other correlations are insignificant. Neither healthcare expenditure nor healthcare staffing impact healthy life years. H1 is partly accepted, H2 is rejected for Germany.

11.3.3 Correlation-Analysis for Czechia

For Czechia, a series of significant effects are found:

Table 12: Correlations and χ-significances for Czechia

Czechia		PH_CZ perceived health	HE_CZ health expenditure	HS_CZ health staff
HLY_CZ healthy life years Czechia	P. corr.	-0,525	**-.755***	**-.795***
	Sig. (2.sid.)	0,146	0,030	0,010
	N	9	8	9
PH_CZ perceived health	P. corr.	**1**	**.900****	**.853****
	Sig. (2.sid.)		0,002	0,007
	N	9	8	8
HE_CZ health expenditure	P. corr.		1	**.720***
	Sig. (2.sid.)			0,044
	N		8	8

Source: author

Healthcare expenditure is significantly negatively correlated to healthy life years (χ^2 = -0.755*; Sig: 0.030), but highly significantly positively correlated to perceived health (χ^2 = 0.800**; Sig: 0.002). Results concerning H1 are equivocal. The hypothesis is partly accepted.

Healthcare staffing as measured by the number of physicians per 1,000 inhabitants, is significantly negatively correlated to healthy life years (χ^2 = -0.795*; Sig: 0.010)., highly significantly related to perceived health (χ^2 = 0.853**; Sig: 0.007) and positively correlated to health expenditure (χ^2 = 0.720*; Sig: 0.044). Also results concerning H2 are thus equivocal. The hypothesis is partly accepted.

Obviously, healthcare expenses and good healthcare staffing make people feel well supplied but do not have any factual effect on healthy life years. High health expenditures are correlated to diminishing life years, possibly due to the growing costs of an increasingly ill population.

11.4 Discussion and conclusions

Chapter 11.4 summarizes the statistical results, derives recommendations for health system development in the three analysed countries, and identifies areas for further research.

11.4.1 Summary of hypothesis tests

The following Table 13 summarizes the results of the hypothesis tests for the three countries:

Table 13: Summary of hypothesis test results

Country	**Hypothesis 1**	**Hypothesis 2**
Hypothesis	Healthcare expenditure is positively correlated to a) citizens' healthy live years b) citizens' perceived health.	Health system staffing is positively correlated a) citizens' healthy live years b) citizens' perceived health.
Austria	**health expenditure**	**health system staffing**
healthy life years	-0,286	0,568
perceived health	0,282	0,073
Test result Austria	**denied**	**denied**
Germany	**health expenditure**	**health system staffing**
healthy life years	0,664	-0,26
perceived health	0,879*	0,143
Test result Germany	**partly accepted**	**denied**
Czechia	**health expenditure**	**health system staffing**
healthy life years	**-0,755***	**-0,795***
perceived health	**0,900****	**0,853****
Test result Czechia	**partly accepted**	**partly accepted**

Source: author

The results on the relationship between healthcare expenditure and health system staffing vary by country and depend on the applied measure for health.

For Austria, no significant effects were found. In Germany, health expenditure has a significant effect on perceived health and has a tendency positively impact on healthy life years. For Czechia, health expenditure is negatively correlated with healthy life years and positively correlated with perceived health.

For Austria and Germany, health system staffing did not have a significant impact on health. However, in Czechia, health system staffing was positively correlated with perceived health, but negatively correlated with healthy life years.

Hypothesis H3 could not be tested quantitatively due to lacking time series data for healthy behaviour. Although the countries in question differ in lifestyle practices, the observed effects on health status are inconclusive.

The differing observations among the countries likely stem from idiosyncratic characteristics of their healthcare systems - which have not been analysed in this study. A possible interpretation of the results of H1 and H2 is:

Germany possesses a highly sophisticated and expensive healthcare system, requiring relatively fewer qualified physicians to organize healthcare. The system is comfortable from a patient's perspective and increases perceived health, independent of staffing. However, healthy life years are not significantly altered by the expensive concept.

Austria's rather expensive healthcare system does not contribute to perceived health nor augment healthy life years. Although Austrians practice a healthy lifestyle, they have the shortest span of healthy years in the sample. Their perceived health, however, is the highest in the sample. Their subjective well-being possibly originates in their healthy lifestyle.

Czechia possesses a cheap but comparatively staff intensive healthcare system. Although Czechs lead a comparatively unhealthy lifestyle, they feel well cared for by health professionals, which augments their perceived health. However, there is no measurable benefit in numbers of healthy life years. Growing healthcare expenditures may impair rather than augment health. It is important to note that these causal explanations are intuitive and not directly founded by quantitative results.

11.4.2 Recommendations for developments in the healthcare system

Based on these preliminary results, several useful recommendations for health policy can be derived:

In comparison to Czechia, Austria and Germany have highly expensive healthcare systems. In Germany, it is likely that bureaucracy or high technological standards are responsible for high costs, while the density of physicians is low. By staffing healthcare more intensely, Germany and partly Austria could enhance the impact on citizens' health more than by further technological overengineering and bureaucratic regulations.

Czechia spends less on public healthcare but enjoys a high density of physicians. By paying physicians better, healthcare costs would rise but citizens could potentially be provided with more effective services. Judging from the health-related behaviour as compared to Austria and Germany, Czechs could generally do more for their physical and mental health and thus could increase perceived health and expected healthy life years. Czechia's government and insurers should encourage healthy behaviour through information campaigns and insurance premiums rewarding a healthy lifestyle. Thus, Czechia could increase the physical well-being and performance of its citizens and save healthcare cost increases resulting from advancing technical standards of healthcare.

11.4.3 Study limitations, further research needs and outlook

In brief, the study finds differing relationships between healthcare expenditure, health system staffing and citizens' health in the three observed countries, but it cannot provide a definitive explanation. Several potential reasons contribute to this:

The analysis is based on a brief data set with few international comparisons which allow only two correlation analyses. The results suffer from lacking data on health-related lifestyle and allow few reliable conclusions. The insights suggest that further factors neglected here are responsible for differing healthcare costs and health status in the three countries, which could be based in differing structures and processes of the healthcare systems.

Further research should thus analyse the healthcare systems of German, Austria, and Czechia, in more detail comparatively based on a qualitative review first to find potential explanations for the results. Causalities should then be explored by applying quantitative methods and based on empirical data and a longer time frame.

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12. The influence of bitcoin on the volatility and performance of an investment portfolio

Martina Sobková

In the last decade, cryptocurrencies, led by Bitcoin, have evolved from a niche interest into a globally recognized asset class. Their characteristic extreme volatility makes them a speculative asset for many, yet their low correlation with traditional markets suggests a potential for portfolio diversification. The research aims to empirically answer whether allocating a portion of a portfolio to Bitcoin enhances its risk-adjusted performance or primarily increases its overall risk.

The research utilizes historical data from November 2014 to April 2025, analyzing Bitcoin's correlation with key ETFs representing stocks, gold, and bonds. Model portfolios were constructed with various Bitcoin allocations (5%, 50%, and Sharpe ratio-maximizing weights) and their performance (CAGR, Standard Deviation, Sharpe Ratio) was evaluated across different market regimes, including a baseline period (2016–2025), a high-interest-rate period, and a crisis period.

The study found that while adding Bitcoin consistently increases portfolio volatility, the associated dramatic increase in returns more than compensates for the added risk. This leads to a significant improvement in the Sharpe ratio across most tested scenarios, except for severe market downturns where correlations tend to increase. The most effective combinations were found with technology stocks (Nasdaq 100) and gold.

The study recommends that investors consider a small, strategic allocation to Bitcoin to enhance overall portfolio efficiency, subject to their individual risk tolerance and understanding of its behaviour during market stress.

12.1 Introduction

In the last decade, financial markets have been grappling with a new phenomenon – cryptocurrencies. At their forefront is Bitcoin, which has undergone a dramatic evolution since its inception in 2009. From its origins as a niche interest for tech enthusiasts, it has become a globally recognized asset, attracting the attention of both retail and institutional investors. Its market capitalization reaches hundreds of billions of dollars and is the subject of lively debates among economists, regulators, and investment strategists.

A characteristic feature of Bitcoin is its extreme volatility. Price fluctuations in the order of tens of percent within short periods are not uncommon. It is precisely this characteristic that makes it a highly speculative and risky asset in the eyes of many conservative investors, one that does not belong in a traditional, diversified portfolio. They argue that its unpredictability can disrupt portfolio stability and lead to unacceptable losses.

On the other hand, proponents of Bitcoin point to its historically high returns and, above all, its low correlation with traditional asset classes such as stocks and bonds. According to the principles of Modern Portfolio Theory, adding an asset with low correlation to a portfolio can reduce overall risk (measured by standard deviation) while increasing the expected return.

Bitcoin could thus theoretically serve as an effective diversification tool that improves the risk-adjusted return, most commonly measured by the Sharpe ratio.

The aim of this research is therefore to answer a key question: Does adding Bitcoin to a portfolio worsen its overall risk, or does it, on the contrary, increase its efficiency? This study aims to empirically verify the impact of allocating a portion of funds to Bitcoin on the volatility and performance of a portfolio composed of traditional assets. We will analyse different periods, including phases of growth, crises, and high-interest-rate environments, to provide a comprehensive view of the role that Bitcoin can play in a modern investment portfolio.

12.2 Literature review

The question of including Bitcoin and other cryptocurrencies in investment portfolios is being increasingly examined in academic literature, although the conclusions of studies often differ depending on the chosen period and methodology.

One of the first and most frequently cited works is the study by Klein, Hien, and Walther (2018) with the telling title “Bitcoin is not the New Gold”. The authors conclude that Bitcoin, unlike gold, does not serve as a reliable “safe haven” or as a hedging instrument (hedge) against stock market declines. Its correlation with stocks is unstable and tends to increase during periods of stress. According to them, the high volatility of Bitcoin often leads to an increase in the overall risk of the portfolio, which questions its diversification benefits.

Conversely, Guesmi et al. (2019) examined the diversification potential of Bitcoin in relation to stocks, bonds, and commodities. They found that in "normal" market conditions, Bitcoin exhibits a low to negligible correlation with other assets, making it an attractive tool for diversification. However, the authors caution that this effect weakens during periods of financial crises when correlations increase, a phenomenon observed across many asset classes.

Similar conclusions are presented by Akhtaruzzaman et al. (2020), whose study focused on the behaviour of Bitcoin during the COVID-19 pandemic. The results showed that while Bitcoin can improve diversification in calmer times, its correlation with US stocks rose sharply during the crisis sell-off in the spring of 2020. This suggests that in moments of market panic, investors shed risky assets across the board, including Bitcoin, which limits its ability to protect a portfolio.

Pichl and Kaizoji (2017) focused on the analysis of Bitcoin's volatility itself. Their research confirmed that the volatility of Bitcoin is exponentially higher than that of traditional financial assets, such as major currency pairs or stock indices. The authors argue that price movements are largely driven by speculative behaviour and the herd effect, which contributes to its extreme riskiness.

On the other hand, some studies focus on portfolio optimization and reach more positive conclusions. Bakry et al. (2021) showed in their work that even a small allocation to Bitcoin (typically in the range of 1–5%) can statistically significantly improve a portfolio's Sharpe ratio. Although the overall volatility of the portfolio increases slightly, the increase in return is so significant that the risk-adjusted performance grows. This effect was observed for portfolios with varying degrees of risk aversion.

From the literature review, it is clear that there is no unambiguous consensus. This research builds on previous studies and aims to provide an updated perspective using more recent data that includes periods of a bull market, as well as phases of decline and changes in the macroeconomic environment.

12.3 Methodology

For the purposes of this analysis, historical price data for selected assets were collected for the period from November 1, 2014, to April 30, 2025. The data was sourced from publicly available financial databases (Portfolio Visualizer) and includes daily prices.

12.3.1 Asset selection

The portfolio was constructed to represent a typical diversified strategy of a global investor who invests in stock indices rather than individual stocks – the goal is to eliminate the operational risk associated with individual stock titles. It therefore includes the following assets, represented by exchange-traded funds (ETFs) and the price of Bitcoin:

- **Bitcoin (BTC):** Represents the cryptocurrency asset class.
- **iShares MSCI World ETF (URTH):** Tracks the performance of large and mid-cap companies from 23 developed countries. Serves as a proxy for the global stock market.
- **Invesco QQQ Trust (QQQ):** Tracks the Nasdaq 100 index, which includes the 100 largest non-financial companies listed on the Nasdaq exchange. It primarily represents the technology and growth segment of the market.
- **SPDR S&P 500 ETF (SPY):** Tracks the S&P 500 index, which is considered the main indicator of the US stock market's performance.
- **Global X DAX Germany ETF (DAX):** Tracks the German DAX stock index, representing the largest economy in Europe.
- **iShares Gold Trust (IAU):** An ETF whose value is tied to the price of physical gold. Gold is traditionally seen as a safe haven.
- **iShares Short Treasury Bond ETF (SHV):** Invests in short-term US Treasury bonds with a maturity of up to one year. Represents a risk-free asset.

12.3.2 Analysed indicators

To evaluate the performance and risk of individual assets and portfolios, standard financial metrics were used:

- **Compound Annual Growth Rate (CAGR):** An indicator of the average annual return of an investment over a given period.
- $CAGR = \left(\frac{V_{\text{final}}}{V_{\text{initial}}}\right)^{\frac{1}{t}} - 1$
- Where V_{final} is the final value of the investment, V_{initial} is the initial value, and t is the number of years.

- **Annualized Standard Deviation:** A key indicator of volatility and risk. A higher value signifies greater price fluctuations and higher risk.
- $\sigma_{\text{annual}} = \sigma_{\text{monthly}} \times \sqrt{12}$
- Where σ_{monthly} is the standard deviation of monthly returns.
- **Sharpe Ratio:** Measures risk-adjusted return. It is calculated as the ratio of the portfolio's excess return (return above the risk-free rate) to its standard deviation. A higher Sharpe ratio indicates better performance per unit of risk taken. For the purposes of this study, the average performance of the SHV ETF was used as the risk-free rate.
- $S_p = \frac{R_p - R_f}{\sigma_p}$
- Where R_p is the annualized return of the portfolio, R_f is the annualized risk-free rate, and σ_p is the annualized standard deviation of the portfolio's return.

12.3.3 Portfolio construction and analysis

The analysis proceeded in several steps. First, a correlation matrix for all assets was calculated to reveal their mutual relationships. Subsequently, model portfolios were created, each combining one traditional asset (e.g., MSCI World) with Bitcoin in different proportions:

- **Portfolio with 5% allocation to BTC:** 95% of the portfolio consists of the traditional asset, 5% Bitcoin.
- **Portfolio with equal allocation (Equal):** 50% of the portfolio consists of the traditional asset, 50% Bitcoin.
- **Portfolio with the best Sharpe ratio (Best Sharpe):** Using optimization, a weight ratio between the traditional asset and Bitcoin was found that maximized the resulting portfolio's Sharpe ratio.

These portfolios were analysed in three different market regimes:

- **Baseline Period:** January 2016 – January 2025
- **High-Interest-Rate Period:** May 2022 – May 2025
- **Crisis Period (Downtrend):** February 2021 – February 2022

This approach allows for an assessment of whether the benefits of Bitcoin are robust and apply under various market conditions.

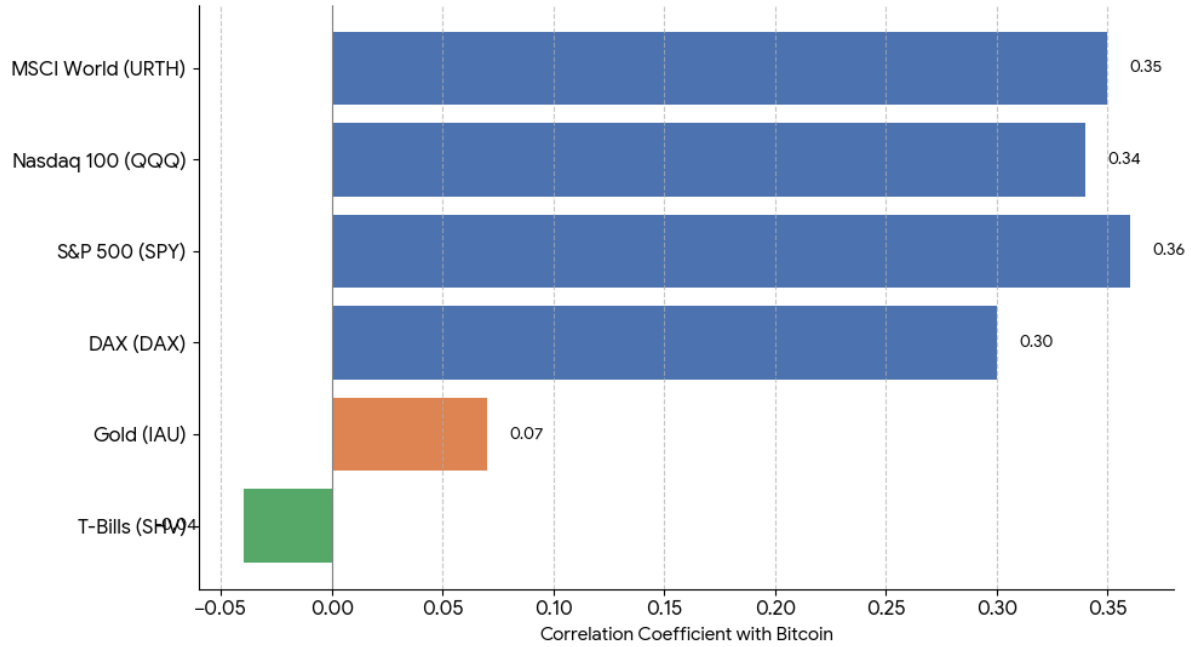
12.4 Research results

12.4.1 Correlation analysis

The basic prerequisite for successful diversification is low correlation between assets. Figure 27 visually demonstrates the correlation coefficients between Bitcoin and the selected traditional assets for the period 2014-2025. The graph clearly shows a positive but moderate correlation with major stock indices (0.30 to 0.36), confirming a loose but not overly strong

connection. Crucially, it highlights the near-zero correlation with gold (0.07) and the slightly negative correlation with short-term government bonds (-0.04), which are the strongest indicators of Bitcoin's diversification potential.

Figure 27: Corellation of bitcoin with traditional assets (2014–2025)

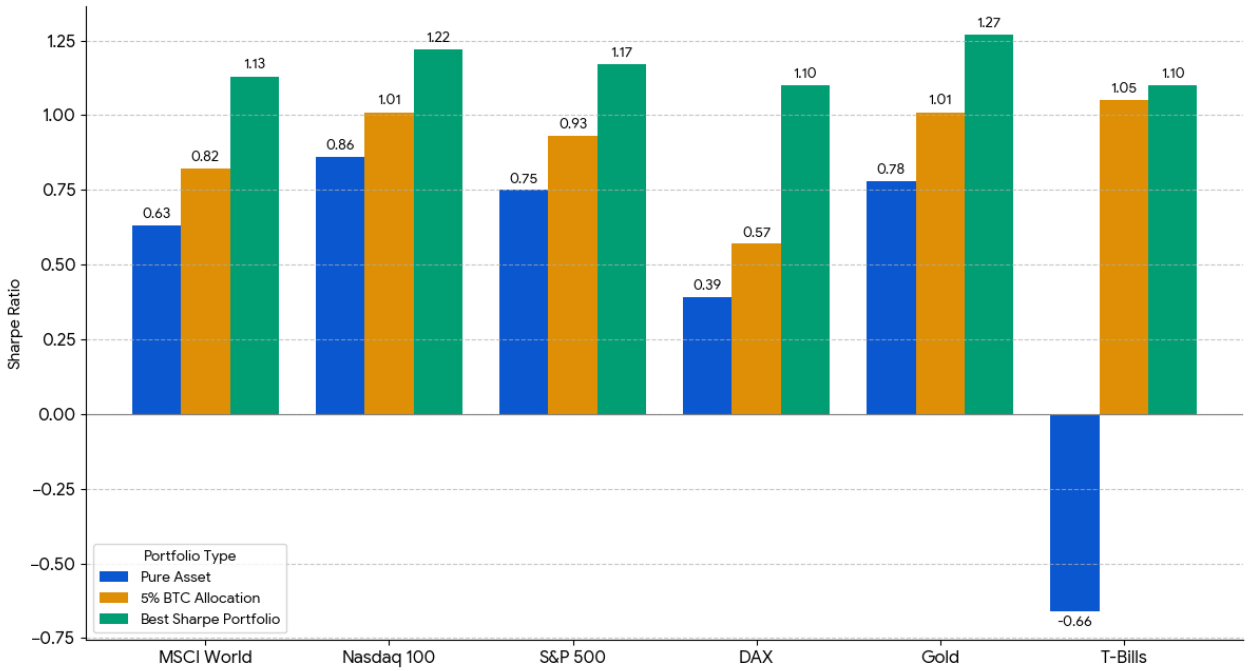


Source: author

12.4.2 Portfolio analysis in the baseline period (2016–2025)

The most important finding of this study is the consistent improvement of risk-adjusted returns after adding Bitcoin to a portfolio. Figure 28 compares the Sharpe ratios for four major asset classes across three portfolio types: the pure asset, a portfolio with a 5% Bitcoin allocation, and a portfolio optimized for the best Sharpe ratio. The chart clearly shows that for every asset class, both the 5% allocation and the optimized portfolio achieved a significantly higher Sharpe ratio than the asset alone. For example, the Sharpe ratio for a pure Nasdaq 100 portfolio was 0.86, which increased to 1.01 with a 5% BTC allocation, and further to 1.22 in the optimized portfolio. This demonstrates that while volatility increases, the dramatic increase in returns leads to a more efficient portfolio overall.

Figure 28: Sharpe ratio comparison (baseline period, 2016–2025)

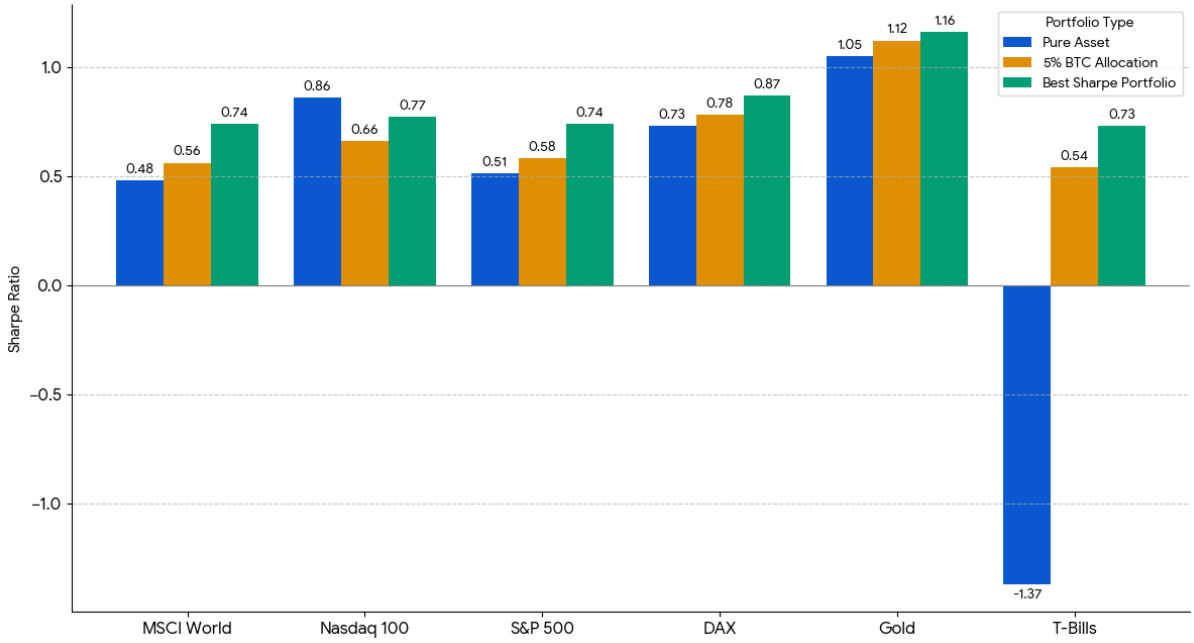


Source: author

12.4.3 Analysis in the high-interest-rate period (2022–2025)

To test the robustness of these findings, the analysis was repeated for a period characterized by restrictive monetary policy. Figure 29 illustrates the Sharpe ratios for the same portfolios during this high-interest-rate environment. The pattern remains consistent: adding Bitcoin improves the risk-adjusted return. The effect is particularly notable for Gold, whose already high Sharpe ratio of 1.05 is further improved to 1.16 in the optimized portfolio. This confirms that Bitcoin's benefits are not limited to periods of low interest rates.

Figure 29: Sharpe ratio comparison (high interest rate period, 2022–2025)

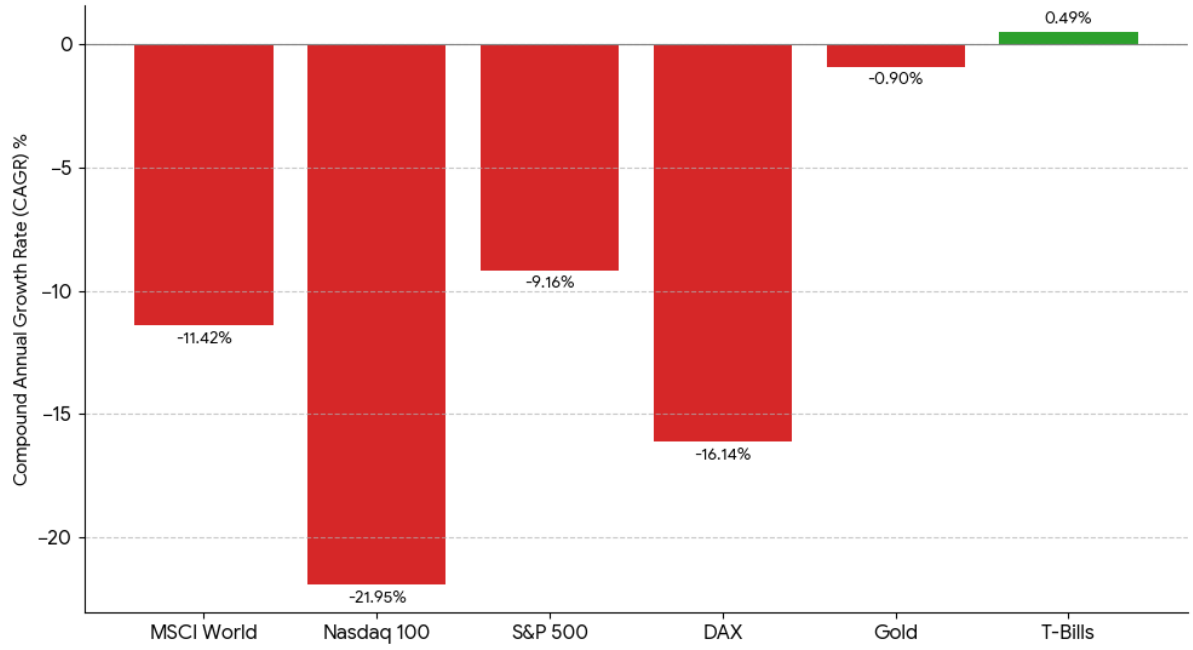


Source: author

12.4.4 Analysis in the crisis period (February 2021 – February 2022)

A key test for any diversification asset is its performance during a market downturn. Figure 30 displays the annual returns (CAGR) for each individual asset during the crisis period from February 2021 to February 2022. The graph starkly illustrates that all major risky assets, particularly technology stocks (Nasdaq 100 at -21.95%), suffered significant losses. This finding supports studies that argue Bitcoin's diversification benefits diminish in acute crisis phases, as correlations with other risk assets tend to rise. However, as the overall analysis shows, these crisis periods are, in the long term, more than compensated for by the outperformance during growth phases.

Figure 30: Asset performance during crisis period (Feb 2021 – Feb 2022)



Source: author

12.5 Discussion and conclusion

This research addressed the question of whether an allocation to Bitcoin is beneficial for a traditional investment portfolio. The results of the empirical analysis of data for the period 2014–2025 provide a relatively clear answer. Despite its reputation as an extremely volatile and risky asset, Bitcoin, when used correctly, can significantly contribute to improving portfolio efficiency.

The main finding corresponds with the principles of Modern Portfolio Theory. The low correlation of Bitcoin with major asset classes like global stocks, gold, and especially bonds, makes it a powerful diversification tool. Even though its addition inevitably increases the overall volatility of the portfolio, its ability to generate high returns leads to an increase in risk-adjusted performance, as measured by the Sharpe ratio. This phenomenon was observed consistently across different market scenarios, suggesting it is not a random event specific to one period.

This has important implications for investors. Ignoring Bitcoin solely based on its high volatility may mean missing an opportunity to optimize a portfolio. Even a small, strategic allocation in the single-digit percentages can have a positive impact. Our analysis showed that the optimal allocation for maximizing the Sharpe ratio is often higher than one might intuitively expect.

However, it is necessary to highlight the limitations of this research. The analysis is based on historical data, and as the well-known investment cliché states, past performance is no guarantee of future returns. The cryptocurrency market is still young and developing dynamically. Future regulations, technological changes, or a shift in investor sentiment could dramatically alter its characteristics, including volatility and correlations. Investors should

therefore approach an allocation to Bitcoin with caution and in accordance with their own risk tolerance.

In conclusion, Bitcoin deserves a place in the discussion on strategic asset allocation. It is not a “magic bullet” for all portfolio risks, but rather a powerful tool that, if properly understood and used, can help investors achieve better risk-adjusted returns. Future research could focus on analyzing other cryptocurrencies, using more advanced models for risk measurement (e.g., Value at Risk), and examining the impact of Bitcoin on portfolios in different geographical regions.

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13. Relationships between macroeconomic variables and stock prices from the perspective of fundamental analysis

Alžběta Zíková, Jitka Veselá

Stock price movements are determined by several diverse factors. A significant portion of these factors are examined by fundamental stock analysis, which uses various statistical tools to identify the relationships between macroeconomic, sectoral, and company factors and stock price movements. Analysts, investors, and portfolio managers then use their knowledge of the relationships between economic variables and stock prices to develop investment strategies and make investment decisions. Among macroeconomic factors, the most frequently analysed are the impact of GDP growth, interest rates, money supply, government expenditure, and inflation on stock price movements, represented in this case by the stock index.

The aim of this study is to identify the relationships between GDP growth, interest rates, changes in the money supply, government expenditure, inflation, and stock market returns represented by the stock index in the following nine countries: the Czech Republic, Poland, Sweden, Turkey, the United Kingdom, the United States, China, India, and Japan. To analyse the relationships between macroeconomic variables and stock indices as proxies for stock markets, we used a vector autoregressive (VAR) model with an optimally selected number of lags. The VAR model proves to be a useful tool for analysing multiple time series that are interrelated.

The results of the study show how macroeconomic factors, including fiscal and monetary shocks, affect stock markets and provide quantitative estimates of these relationships. The study provides new insights into the relationships between macroeconomic variables and stock markets in recent decades, which has important implications for the work of fundamental analysts and for investors in constructing investment strategies.

The study could be continued by extending and restructuring the period under review and expanding the range of countries covered. At the same time, it would be appropriate and useful to examine in more detail the interrelationships and influences between individual macroeconomic variables. This study provides an original analysis of the interrelationships between the movement of macroeconomic variables and stock prices using the VAR model, which allows for a deeper understanding of the interconnections and correlations. The analysis conducted in this study provides useful insights for the practical application of fundamental stock analysis, as well as applicable insights for further research into the functioning of stock markets.

13.1 Introduction

The analysis of the interrelationships between macroeconomic variables and stock markets is key to predicting future stock market developments. Macroeconomic factors such as GDP growth, interest rates, inflation, government expenditure, and monetary policy have a direct and indirect impact on stock market behaviour and, consequently, on aggregate economic activity. In this context, it is useful to apply methodologies that allow us to model and quantify the interrelationships between these variables.

The vector autoregression (VAR) model has established itself in empirical studies as an effective tool for analyzing relationships between multiple time series that are interconnected. This model is very suitable for this analysis because it does not require assumptions about the causal structure between variables, which is particularly useful when it is not possible to clearly identify exogenous and endogenous variables. The VAR model has been widely applied in analyses of the impact of monetary and fiscal policy, as well as economic shocks, on financial markets, as evidenced by publications (Fama, 1990) and (Bernanke, Gertler, 1999).

This study focuses on nine selected countries: the Czech Republic, Poland, Sweden, Turkey, the United Kingdom, the United States, China, India, and Japan. The selected variables include GDP growth, interest rates, changes in the money supply, changes in the government expenditure, inflation, and stock market returns represented by stock indices. The aim of the analysis is to provide empirical evidence on the types and intensity of relationships between these variables in the context of different national economies.

The results of this study have the potential to contribute to a deeper understanding of how macroeconomic factors interact with stock markets at the national level, which can provide valuable information for economic policy-making, fundamental analysis, optimization of investment strategies, investment management in portfolio construction and rebalancing, and finally for predicting economic and financial developments.

13.2 Literature review

From the perspective of fundamental stock analysis, various global, macroeconomic, sectoral, and corporate factors can be used to explain stock price movements. The influence of macroeconomic factors on stock price movements, as stated by Keran (1971), is relatively significant. According to Keran's econometric model for explaining stock price movements, the macroeconomic factors with the strongest impact on stock prices include interest rates, inflation, money supply, GDP, and government expenditure. Let us briefly summarize the relationships observed between these macroeconomic variables and stock prices.

Interest rate movements tend to have a negative impact on stock prices, as shown by several studies (Siegel, 1998), (Beyer et al., 2004), (Alam, Uddin, 2009), (Huang et al., 2015) and (Conrad, 2021), although the intensity of this relationship may vary over time, as stated by (Mouna, Anis, 2017). An unexpected rise in interest rates should therefore be followed by a fall in stock prices and vice versa.

The negative relationship between interest rates and stock prices can be explained using the basic principle of stock valuation, which consists of discounting future cash flows from stocks using interest rates. Furthermore, the competitive relationship between the stock and bond markets can be used to explain this relationship, where an unexpected rise in market interest rates can cause an increase in demand for bonds with coupon payments directly linked to interest rate movements (floating rate notes), and thus a partial outflow of demand from the stock markets. Finally, an unexpected increase in interest rates raises the cost of capital, which reduces the profitability of investment projects and, consequently, the profits of companies, whose share prices then fall. On the other hand, it should be noted that some studies, such as

(Al-Jafari et al., 2011) or (Caporale et al., 2024), have not demonstrated a long-term relationship between interest rate movements and stock prices.

A negative relationship has been observed between inflation and stock prices, although this relationship may not always be direct, but may be mediated by a third variable in the form of economic output or economic growth. A study (Pradhan et al., 2015) highlights a wide range of notable short-term and long-term causal links between inflation, economic growth, and stock market developments. According to financial theory, an increase in expected inflation may therefore be accompanied by a decline in stock prices and vice versa, although this relationship may be mediated. Modigliani and Cohn (1979) explain the negative relationship between the two variables through the money illusion hypothesis, in which they point to the fact that in an inflationary environment, nominal interest rates used to value stocks to discount future cash flows from stocks rise. Analysts may make the mistake of considering the nominal interest rate containing rising inflation but not adjusting their estimate of future income from the stock for inflation, which leads to a decline in the calculated intrinsic value of the stock and, consequently, a decline in stock prices. The mediated effect hypothesis, mentioned by Fama (1981), Geske, Roll (1983) and Kaul (1987) refers to the negative relationship between inflation and stock prices as indirect, mediated by a third variable in the form of expected economic output, with a positive relationship between expected economic output and stock prices and a negative relationship between inflation and expected economic output. According to this hypothesis, inflation is not a causal factor influencing stock prices. A rise in expected inflation causes a decline in expected economic output, to which stock prices also respond with a decline. The tax effect hypothesis, presented by Feldstein (1980), looks at the impact of how long-term assets are depreciated and how companies' inventories are valued in an inflationary environment and their impact on corporate net profits and stock prices. The real value of depreciation and the prices used to value inventories may not correspond to actual prices in an inflationary environment, resulting in an underestimation of deductible items from the tax base, an increase in the company's tax burden, and subsequently a decline in net profits and stock prices. The research shows that the negative relationship between inflation and stock prices prevails. However, there may occasionally be periods of one to several years when the relationship between the two variables temporarily becomes positive, as evidenced by a study by Antonakakis et al. (2017) conducted on US data over a very long period from 1791 to 2015. Only in the 1830s and 1840s, the 1930s, and 2011 was a positive relationship found between inflation and stock prices represented by the S&P 500 index. In the other years of the very long period under review (1791–2015), a negative relationship between inflation and stock prices was measured. In contrast, a study by Eldomiaty et al. (2019), conducted using data for the period 1999-2016, showed a negative relationship between inflation and stock prices represented by the DJIA 30 and NASDAQ 100 indices for the entire period under review. Contrary to theoretical assumptions, however, this study did not confirm a negative relationship between real interest rates and stock prices but rather found a positive relationship. A negative relationship between inflation and stock prices represented by the S&P 500 index was also identified by McMillan (2022) in US data for the period 1959-2008. According to the author, this relationship then changed to a positive one.

According to most financial theorists, such as Rogalski, Vinso (1977), Bernanke, Kuttner (2005), Maskay (2007), Pícha (2017), Sahu, Pandey (2020) and Conrad (2021), the relationship between money supply and stock prices is positive. Thus, an increase in the money supply will

lead to an increase in stock prices, although, as Keran (1971) points out, this relationship is not necessarily causal. According to the liquidity effect supported by the study by Ariff et al. (2013), an increase in the money supply releases additional monetary liquidity into circulation, which can be used for additional demand for investment instruments, including demand for stocks, resulting in an increase in stock prices. It should be borne in mind that this liquidity effect will only work if there is no change in the price level and if the additional liquidity in the economy leads to a fall in interest rates, which is another factor contributing to the rise in stock prices. However, if the price level rises and interest rates remain at the same level or even rise, the liquidity effect on stock prices will not materialize and stock prices will not rise or may even fall because of rising interest rates. An increase in the money supply, accompanied by a decline in interest rates, can reduce companies' capital costs, which can contribute to growth in their investment activity and profits. The growth in corporate profits would again be reflected in a rise in the share prices of these companies. Finally, the transmission mechanism highlighted by Friedman and Schwartz (1963) can also be mentioned as supporting the positive relationship between the money supply and stock prices. Growth in the money supply may initially prompt investors to buy bonds, depending on the market situation and their strategy. This activity will lead to an increase in bond prices and a decline in their yield. Investors will then move to the competitive stock market, which appears more attractive in this situation.

The positive relationship between economic output, usually measured by GDP, and stock prices is pointed out by some authors, such as Modigliani, et al. (1971), Bodie (1995), Nasseh, Strauss (2000), Al-Jafari et al. (2011), Hsing (2011), Siegel (2014), Mohapatra, Rath (2015), Setiawan (2020), and Muniswamy (2022). However, the nature of this relationship and its intensity vary depending on the time horizon considered. While a very close relationship between economic output and stock prices has been identified in the long term, this relationship is much weaker in the medium and short term. In addition, some authors, such as Modigliani, et al. (1971) or Siegel (2014), point out that in the short term, stock prices act as a leading indicator of economic output by several months. While the steady long-term (several decades) upward trend in stock prices, together with the upward trend in the economy, is explained by steady economic growth, in the short term, the fact that stock prices lead the economy by several months, or even the parallel relationship between the two variables, can be explained by the fact that investors make decisions and react mainly on the basis of expected financial variables (e.g., expected profit or expected profit margin). According to Modigliani, et al. (1971), changes in stock prices are caused by changes in consumer and business spending, i.e., changes in the behaviour, thinking, and expectations of economic agents, which are then reflected in the output of the economy. Stock price movements can also be triggered by changes in the money supply, interest rates, or inflation, as indicated above.

In Keran's model, government expenditure is one of the primary factors influencing stock price movements. A significant increase in government expenditure with unchanged or even declining state budget revenues can cause a state budget deficit in the long term, which is transformed into state debt. This budget deficit or state debt is financed by the issuance of government bonds. If the supply of government bonds on the market increases significantly, a decline in their prices and an increase in the yield on these bonds can be expected, which may attract some investors from the stock markets, where stock prices will then fall, leading

to a decline in capital returns on investments in stocks. Hsing (2011) points out the negative impact of the government budget deficit on the stock market, Nwaogwugwu (2018) confirmed the significant impact of government expenditure on the stock market, and Mumtaz, Theodoridis (2020) discovered the negative reaction of stock prices to the shock expansion in government expenditure after 1980, and McMillan (2022) identified the negative relationship between government bond yields and stock returns in the US market from 1959 to the financial crisis. At the same time, it can be assumed that the offer of government bonds with good credit ratings may be of interest to certain groups of investors (e.g., insurance companies, pension funds, certain investment funds) who pursue more conservative strategies or purchase government bonds for the purpose of diversifying risk in their portfolios, which will contribute to a partial outflow of certain types of investors from the stock markets.

13.3 Methodology

In this study, the vector autoregressive (VAR) model method was used to analyse the interrelationships between macroeconomic variables and stock markets.

The VAR model is a popular econometric technique used to analyse the mutual dynamic relationships between time series without the need to explicitly determine causality between variables. It is particularly suitable in situations where all analysed variables may be endogenous, allowing for the capture of mutual interactions and direct and indirect influences within the system.

The use of the VAR model is common in macroeconomics, where the effects of monetary policy, fiscal stimuli, or global shocks on economic indicators such as GDP, inflation, or interest rates are often examined. Specific examples are given by Sims (1980), who popularized the method and demonstrated its suitability for unbalanced and ambiguously identifiable systems, but also later studies such as Blanchard and Quah (1989), which used the VAR model to analyse the effects of supply and demand shocks on economic activity.

The VAR model can generally be expressed by the following equation:

$$Y_t = A_0 + \Sigma_{i=1}^{p} A_i Y_{t-i} + u_t \qquad (1)$$

Y_t - vector of endogenous variables at time t. This vector includes all variables that we model.

A_0 - vector of constants, this term represents constants for each of the variables in the model that are not dependent on other variables but may affect the value of the dependent variable.

$\Sigma_{i=1}^{p} A_i Y_{t-i}$ - sum of lagged values of endogenous variables. This term includes all variables with their lags up to the pth time (number of lags), which allows the model to consider historical influences on the current values of variables.

A_i - matrix of coefficients for each lag i. The coefficients A_i show how strongly each variable is influenced by the previous values of other variables.

u_t - white noise vector at time t. This term captures shocks or unobserved factors that affect the system at a given time. It is a random component that expresses all influences that are not modelled in the previous terms of the equation.

To analyse the interrelationships between macroeconomic variables and stock markets, annual time series of macroeconomic indicators and stock indices from nine countries were used: the Czech Republic, Poland, Sweden, Turkey, the United Kingdom, the United States, China, India, and Japan.

These data include the following variables:

- **GDP Growth:** Measures the rate of growth of real gross domestic product in each country. It is a key indicator of economic performance.
- **Interest Rate:** The annual interbank interest rate which reflects the cost of borrowing and is an important monetary policy tool that influences investment and consumption.
- **Money Supply M3 Change:** Indicates the growth of the money supply in the economy, which affects inflation, interest rates, and overall economic stability. At the start of 2016 harmonised monetary statistics became the main source for monetary data. Accordingly, the main monetary indicator was changed from the previously used national M2 monetary aggregate to the harmonised M3 monetary aggregate. M3 constitutes of: M2 + repurchase agreements + money market fund shares + debt securities up to 2 years (issued by MFIs). (Czech National Bank, 2016).
- **Government Expenditure Change:** Measures the growth or decline in government expenditure, which directly affects aggregate demand and economic growth. This variable is reported on the annual basis, therefore all analysis was based on the annual data.
- **Inflation:** The annual change in the consumer price index CPI, which affects the purchasing power of households and central banks' interest rate decisions.
- **Stock Index Return:** Reflects the performance of the stock market. It is one of the most important indicators monitored, used, and evaluated by investors. For each country the main stock index was chosen.

This data was modelled separately for each country, which made it possible to examine specific economic relationships in different regions and draw conclusions about how macroeconomic factors affect stock markets at the national level. The data was examined in three periods – the entire period, up to and including 2008, and the period 2009–2023 – to reveal differences in the behaviour of the variables.

Macroeconomic variables such as GDP growth, interest rates, inflation, and stock market returns are key to understanding the relationship between the real economy and capital markets. The reason for including these variables is that they influence both the real economy and capital market expectations, which, according to Mishkin (2014), affect stock price developments. Many studies, such as Campbell et al. (1997) Fama (1990), show that changes in macroeconomic conditions can have a significant impact on stock markets, which is the motivation for using a vector autoregressive model (VAR), which allows us to model the interrelationships between these variables and analyse the feedback between macroeconomic factors and stock markets.

The selection of these specific variables is based on their importance for the analysis of economic cycles and stock markets and is supported, for example, by studies by Bernanke, Gertler (1999) and Keran (1971).

The following data sources were used for the analysis:

- OECD (Organisation for Economic Co-operation and Development): interest rates, CPI (Consumer Price Index) and GDP growth for all countries included.
- World Bank: Data on changes in government expenditure and changes in the M3 money supply for each country.
- Investing.com, Finance.yahoo.com, Patria.cz: Data on the development of stock indices for individual countries.

The analysis was performed in the following steps:

1. **Data transformation:** The values of all variables (GDP growth, interest rate, change in money supply, change in government expenditure, stock index return, inflation) were logarithmized, which reduces heteroscedasticity and allows for the interpretation of changes in relative terms.
2. **Stationarity test:** An Augmented Dickey-Fuller (ADF) test was performed for each variable and country. The results confirmed the stationarity of the variables, allowing the application of the VAR model without further transformations.
3. **Model specification and estimation:** The optimal lag length was determined using the Akaike information criterion (AIC). The model was estimated in the EViews environment using the ordinary least squares (OLS) method.
4. **Validation and interpretation:** Tests were performed for autocorrelation (LM test) and model stability (eigenvalue test).

13.4 Results and discussion

We will comment on the results obtained by applying the VAR model to the nine countries under review from the perspective of fulfilling the theoretical assumptions. We will look at how stock prices represented by stock indices in each of the countries under review were influenced by government expenditure, interest rates, money supply, CPI, and GDP. Various lags were tested, and two years proved to be optimal.

Table 14: VAR coefficients – all years[2]

VAR coeff.	Czechia	Poland	Sweden	UK	USA	China	India	Japan	Turkey
CPI -1	-0,04	8,08	-10,94	-0,75	-7,94	-2,82	1,96	7,20	-6,81
CPI -2	0,19	-6,37	-7,52	1,50	-0,87	4,39	1,19	2,56	2,37
GDP -1	0,04	0,07	1,65	-1,03	0,42	0,86	-3,18	-1,45	-2,54
GDP -2	0,11	2,54	5,07	-0,55	1,12	6,93	0,80	0,71	-1,32
GE -1	-0,11	-1,72	4,21	0,71	-0,21	0,94	2,30	-8,29	7,68
GE -2	-0,04	-2,17	-5,30	-1,80	-1,38	0,18	1,48	3,31	-1,76
IR -1	0,21	-6,08	-2,47	-0,20	3,51	-8,35	3,87	-11,57	0,98
IR -2	0,17	-4,85	-1,81	-0,01	-1,10	-3,35	-1,69	8,75	-1,30
MS -1	-0,06	2,65	-2,91	0,52	1,67	1,54	0,38	1,23	1,55
MS -2	-0,03	1,30	1,31	0,13	1,53	-0,69	-2,88	-0,34	-0,87
index -1	0,03	-0,03	-0,17	0,02	-0,31	-0,40	-0,23	0,05	-0,07
index -2	0,42	-0,36	-0,18	-0,10	-0,09	-0,35	-0,13	0,06	0,52
n	26	25	27	30	29	29	28	27	29
period	1998-2023	1999-2023	1993 - 2019	1994-2023	1994 - 2022	1994 - 2022	1994 - 2021	1994 - 2020	1994 - 2022

Source: own calculation, Coefficient statistically significant at the 5% significance level, or 10% significance level

Table 15: VAR coefficients – before 2008

VAR coeff.	Czechia	Poland	Sweden	UK	USA	China	India	Japan	Turkey
CPI -1	0,07	25,04	-20,86	3,88	-10,25	-13,98	14,56	12,16	-7,83
CPI -2	0,39	-14,00	-15,31	0,03	26,20	14,35	4,06	-10,33	3,21
GDP -1	0,99	-13,01	10,95	-3,61	57,98	-7,25	-24,67	-5,97	-3,80
GDP -2	0,40	1,91	0,28	-11,76	-0,53	-31,48	16,16	-1,76	-2,74
GE -1	-0,28	NA	8,47	9,95	-8,71	-0,56	1,76	-13,22	9,24
GE -2	-0,05	NA	-7,45	-3,12	1,16	11,06	4,84	-2,26	-1,50
IR -1	NA	-6,09	-9,96	9,47	-9,43	-3,92	-13,55	-23,11	2,01
IR -2	NA	-18,23	-1,70	-5,81	-7,07	-3,31	-2,02	18,64	-2,00
MS -1	-0,25	8,81	-1,09	0,63	11,01	10,16	-14,07	-0,02	2,13
MS -2	-0,17	6,35	1,65	0,37	9,37	12,03	-16,39	-0,74	-1,98
index -1	-1,42	-0,84	-0,42	0,55	-1,16	-0,39	1,81	0,36	-0,17
index -2	-0,23	-0,87	-0,27	-0,05	-2,78	-0,32	-0,22	0,35	0,41
n	12	12	16	15	15	15	15	15	15
period	1997-2008	1997 - 2008	1993 - 2008	1994 - 2008	1994 - 2008	1994 - 2008	1994 - 2008	1994 - 2008	1994-2008

Source: own calculation, Coefficient statistically significant at the 5% significance level, or 10% significance level

[2] The differences in the selected period are due to the data adjustments necessary for the application of the VAR method.

Table 16: VAR coefficients – after 2008

VAR coeff.	Czechia	Poland	Sweden	UK	USA	China	India	Japan	Turkey
CPI -1	0,26	0,26	-0,42	-4,86	-17,10	12,87	5,45	NA	4,79
CPI -2	0,31	-5,66	-1,62	2,08	4,43	6,36	-1,35	NA	8,40
GDP -1	0,36	0,06	-4,42	-1,64	7,92	10,09	0,63	0,74	3,26
GDP -2	-0,14	-1,55	1,93	-0,23	-5,04	16,72	-8,24	4,60	-2,35
GE -1	0,00	-3,18	1,83	-3,72	24,19	-6,07	3,05	0,68	2,41
GE -2	-0,26	0,70	-4,25	-2,66	-16,20	-1,43	-2,87	5,39	-3,57
IR -1	-0,67	3,64	NA	1,39	-12,72	274,39	4,12	-7,19	-0,87
IR -2	-0,67	11,64	NA	5,42	-7,25	-181,87	-8,88	9,90	-5,40
MS -1	-0,34	-0,54	-0,46	1,01	8,69	9,78	NA	-0,30	5,96
MS -2	0,07	-1,86	-0,08	-0,49	-3,72	-14,56	NA	1,35	0,68
index -1	0,01	-0,40	-0,28	-0,46	-0,32	0,26	-0,65	0,12	-0,56
index -2	0,12	-0,48	0,03	-0,60	-1,31	1,38	0,08	-0,21	-1,48
n	15	15	15	15	14	14	13	14	14
period	2009-2023	1999-2023	2009-2023	2009 - 2023	2009 - 2022	2009 - 2022	2009 - 2021	2009 - 2022	2009-2022

Source: own calculation, Coefficient statistically significant at the 5% significance level, or 10% significance level

Over the **entire period** under review, i.e. from the 1990s to 2023, the influence of the macroeconomic variables under review on stock prices was demonstrated in **Sweden** (in five cases), **Turkey** (in four cases), **Poland** (in two cases) and the **Czech Republic** (in one case).

While in **Sweden** the identified relationships between government expenditure, CPI, GDP, and stock prices correspond to theoretical assumptions and previously observed relationships in fundamental analysis, even though the relationship between GDP and stock prices is reversed, the negative relationship between money supply and stock prices is, on the contrary, at odds with fundamental analysis. In **Turkey**, the relationships between money supply, inflation, and stock prices are fully consistent with the theoretical assumptions of fundamental analysis, but the relationship between government expenditure and stock prices does not confirm them. Thus, an increase in government expenditure does not lead to a significant outflow of demand from stock markets. In **Poland**, the money supply lagged by one period had a positive effect on stock prices, which is consistent with the theoretical assumptions of fundamental analysis, while the CPI lagged by one period had a positive effect on stock prices, which contradicts the theoretical assumptions. An increase (decrease) in the money supply can lead to a decrease (increase) in interest rates, to which stock prices may respond with an increase (decrease). An increase (decrease) in the money supply may be accompanied by a slight increase (decrease) in the price level, to which stock prices may not react if the change is not significant and unexpected. In **the Czech Republic**, a dependency has been demonstrated, i.e., a trend in stock prices, which is a basic prerequisite for the successful implementation of technical and fundamental analysis.

Between the **1990s and 2008**, relationships were discovered between the monitored macroeconomic variables and stock prices in the **Czech Republic** (in five cases), **Sweden** (in five cases), **China** (in five cases), and the **USA** (in three cases).[3]

[3] Government expenditure figures for Poland were only available from 1996. Insufficient data were available for the period before 2008. It was necessary to exclude the government expenditure variable from the calculations.

The relationships observed in **the Czech Republic** between money supply, inflation, and stock prices are not consistent with the theoretical assumptions of fundamental analysis. Regarding the relationship between GDP and stock prices, it is necessary to point out the opposite order in the reaction of both variables. The liquidity effect did not manifest itself here. Nor can the monetary illusion hypothesis be confirmed. In **Sweden**, on the other hand, the relationships discovered support the theoretical basis of fundamental analysis, with the theory-predicted negative relationship between government expenditure and stock prices appearing with a two-year lag. In **China**, support for the theory of fundamental analysis can be found in the relationships between the money supply, CPI delayed by one period, and stock prices during the period in question. The increase in government expenditure in China during the period under review did not lead to an outflow of investors from the stock markets. It should be noted that this phenomenon only occurs when there is a significant increase in government expenditure, which translates into a significant increase in the government budget deficit or government debt. The relationships discovered between money supply, GDP, and stock prices in the **USA** support the theoretical basis of fundamental analysis, even though the order of reaction between GDP and stock prices is the opposite of that considered in the analysis.

In the period **after 2008**, the number of identified relationships increased significantly in the **USA** and **China**.[4] In these countries, significant relationships between the monitored macroeconomic variables and stock prices were identified in all cases. In **Poland**, relationships were discovered in four cases, in the **United Kingdom** in three cases, in **India**[5] also in three cases, and in **Sweden** in one case.[6]

The variability in the nature of the relationships depending on the lag observed in the **USA** is a very interesting phenomenon, which may have been caused by the fact that some relationships between the monitored variables can manifest themselves within a few months, while others need several months, a year, or even longer to manifest themselves. In the relationships discovered in the case of the US, support for the theoretical basis of fundamental analysis can be found either in both monitored lags (interest rates) or in a lag of one period (money supply, inflation, GDP) or 2 periods (government expenditure), where a longer period of impact on stock markets can be expected due to the development of the government budget deficit and government debt.

Significant variability in the relationships between the analysed variables was also evident in **China** during the period under review, which greatly complicates the performance of serious fundamental analysis. Given the other results achieved, it is likely that this is a temporary phenomenon. In the case of **Poland**, the theoretical fundamental relationships between government expenditure and stock prices and between CPI and stock prices were confirmed. On the other hand, the relationship between money supply and stock prices did not

[4] Japan's CPI values were only available up to and including 2020, meaning that there was insufficient data for the period after 2008, and therefore it was necessary to exclude the CPI variable from the calculations.

[5] Money supply values were only available up to and including 2021, for the period after 2008 there was insufficient data available for calculation, and therefore it was necessary to exclude the MS variable from the calculations.

[6] Interest rate values were only available up to and including 2019; insufficient data was available for the period after 2008, and therefore it was necessary to exclude the interest rate variable from the calculations.

correspond to the theory at all, which may have been caused by the fact that the liquidity effect did not occur in this relationship. The relationships between government expenditure, money supply, and stock prices identified in the **UK** during this period are fully consistent with fundamental analysis theory. In contrast, the relationships between government expenditure, CPI, and stock prices in **India** are completely at odds with fundamental analysis theory. Thus, in this short period, the Indian stock market viewed the rise in government expenditure as additional liquidity, a stimulus for its growth. Given the results from other periods, the positive relationship between CPI and stock prices can be considered a temporary phenomenon. In **Sweden**, a negative impact of GDP lagged by one period on stock prices was observed in this shorter period, which is inconsistent with fundamental analysis theory, but given the results for the entire period under review, when a positive relationship between the two variables was confirmed in Sweden, this result can be understood as a short-term fluctuation.

13.5 Conclusions

The vector autoregressive model (VAR) has proven to be a useful tool for identifying interrelationships between macroeconomic variables and stock prices examined by fundamental analysis. These discovered relationships can then be used by fundamental analysts and investors to forecast stock market developments, from which investment strategies and investment behaviour can then be derived.

The calculations and analysis performed in the countries under review demonstrated the existence of relationships between macroeconomic variables and stock prices considered by fundamental analysis. However, the number and intensity of these relationships vary across the countries and periods studied. No significant fundamental relationships were identified in Japan, which may have been influenced by the unchanged and very low level of interest rates. A smaller number of significant relationships, which do not support the theoretical basis of fundamental analysis, were observed in India. Sweden was the only country among those surveyed where significant fundamental relationships were found in all periods under review. The number of statistically significant relationships observed increased dramatically in the last period under review after 2008, particularly in the case of the USA and China, with these relationships showing considerable variability when considering various lags.

At the same time, the results of the study suggest that in some of the countries under review, in some of the periods considered, the macroeconomic variables analysed did not represent a significant factor that fundamentally determined the development of stock prices in the given period (e.g., Japan, partly the Czech Republic, Turkey, or the United Kingdom). In these cases, stock price developments were influenced by other fundamental, technical, or psychological factors.

Most (but not all) of the relationships discovered between macroeconomic variables and stock prices support the theoretical basis of fundamental stock analysis. Analysts and investors can therefore base their fundamental stock analysis on these relationships, but at the same time they must consider the possible variability of these relationships and their intensity across periods, as well as the fact that there are different delays with which one variable reacts to another. At the same time, it is necessary to consider in the analysis the fact that in the economy, the two variables under consideration are always exposed to the influence of other variables, which can affect and disrupt this relationship. In many cases, the relationship

between a specific macroeconomic variable and stock prices may be indirect, mediated by another influencing variable. It is therefore appropriate to continue research in this direction, using the VAR model to examine the interrelationships between macroeconomic variables and their impact on stock market developments.

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14. Benchmarking ESG reporting of energy companies in the European Union

Jana Kotěšovcová

ESG reporting represents an essential instrument of communication between companies and their stakeholders in the field of sustainable development. European energy corporations, as key actors in the transition to a low-carbon economy, face increasing demands for transparency and the standardization of non-financial reporting. The purpose of this chapter is to conduct a benchmarking analysis of ESG performance among seven major European energy companies, to identify their strengths and weaknesses across the individual pillars of sustainability, and to highlight opportunities for improving non-financial reporting based on data from sustainability reports. The study applies a comparative benchmarking approach structured along the ESG pillars – environmental, social, and governance – using publicly available annual and sustainability reports as primary data sources. The results reveal substantial disparities in the scope, depth, and focus of ESG disclosures. While some companies emphasize decarbonization and social policies, others differentiate themselves through governance practices or the extent of data provided. The findings may serve as a valuable reference for advancing the harmonization of ESG reporting and for enhancing its relevance to investors and other stakeholders. The chapter thus provides a practical overview of current ESG reporting practices in the European energy sector and contributes by comparing multiple companies across Europe based on their own disclosures.

14.1 Introduction

Issues of sustainability and non-financial reporting have become an integral component of corporate governance in the European business environment. The energy sector, as one of the main producers of greenhouse gas emissions, faces growing pressure to reduce its environmental footprint while simultaneously ensuring transparent disclosure of its activities across all three ESG pillars – environmental, social, and governance. Sustainability reports (ESG reports) serve as a communication tool that provides investors and other stakeholders with access to corporate strategies, objectives, and performance in the area of sustainability, thereby enabling more informed decision-making (Benameur et al., 2023; Petrescu, 2020; Wagenhofer, 2024). Both empirical and review studies emphasize that these reports enhance transparency and comprehensibility for the market and for other groups of information users.

In the European context, the adoption of the Corporate Sustainability Reporting Directive (CSRD) significantly broadens the scope of companies required to report and establishes requirements regarding the quality, comparability, and verifiability of disclosed information (European Commission, 2025). These requirements are further specified in the European Sustainability Reporting Standards (ESRS), adopted through Commission Delegated Regulation (EU) 2023/2772 (European Commission, 2023). Practical implementation is additionally supported by methodological materials prepared by EFRAG, in particular implementation guidance and Q&A documents, which are intended to assist companies in applying the standards consistently and to strengthen comparability across firms and sectors (EFRAG, n.d.; EFRAG, 2023).

The aim of this chapter is to benchmark the ESG performance of seven major European energy companies, to identify their strengths and weaknesses within the individual sustainability pillars, and to highlight opportunities for improvement in non-financial reporting. The findings contribute to the ongoing debate on the quality of ESG reporting and its role in the transformation of the energy industry towards a more sustainable model.

14.2 Theoretical background

The concept of Environmental, Social, and Governance (ESG) reporting has gained substantial importance in both academic literature and corporate practice over the past two decades. Initially perceived mainly as a voluntary tool of corporate social responsibility, ESG disclosure has gradually evolved into a strategic instrument that supports risk management, enhances transparency, and strengthens stakeholder trust (Agosto, 2025; Buchetti et al., 2025; Martiny et al., 2024; Nian & Said, 2025).

The environmental pillar primarily addresses issues related to decarbonization trajectories, energy mix, emission intensity, and the extent of investments in renewable energy sources. The social pillar focuses on diversity, equity, and inclusion within organizations, employee development, occupational safety, and engagement. Governance reflects transparency in decision-making, board structures, compliance with ethical principles, and the mechanisms by which companies align managerial incentives with sustainability outcomes (Assael et al., 2023; Cesarone et al., 2024; Li, Q., Zhang, & Wang, 2024; Li, Z. & Yang, 2025). Together, these three dimensions provide a comprehensive framework for assessing corporate resilience in the context of climate change, social inequalities, and market uncertainties.

Despite the increasing relevance of ESG reporting, numerous studies emphasize the persistent problem of ESG rating divergence, i.e., methodological differences among rating agencies and inconsistencies in corporate disclosures. These discrepancies undermine comparability and limit the predictive power of ESG ratings with respect to financial performance (Deng & Lin, 2025; Ge, 2025). The academic debate highlights that this divergence is particularly significant in sectors undergoing profound transformation, such as energy, where structural differences in national energy policies and investment priorities affect corporate sustainability performance (Agosto, 2025; Benameur et al., 2023). In the European Union, the adoption of the Corporate Sustainability Reporting Directive (CSRD) and the development of the European Sustainability Reporting Standards (ESRS) represent decisive steps towards overcoming these challenges. The CSRD extends reporting obligations to a broader range of companies and imposes stricter requirements regarding the quality, comparability, and auditability of information (European Commission, 2025). The ESRS, introduced through Commission Delegated Regulation (EU) 2023/2772, provide a harmonized framework of sustainability disclosure at the European level (European Commission, 2023). Methodological support and practical guidance for companies are further developed by the European Financial Reporting Advisory Group (EFRAG), including implementation guidance and Q&A documents (EFRAG, 2023; EFRAG, n.d.).

Overall, the theoretical literature suggests that harmonization of ESG reporting standards can significantly increase transparency, reduce rating divergence, and enhance the usefulness of sustainability information for investors, regulators, and other stakeholders (Global Reporting Initiative, 2021; SASB, 2018; United Nations, 2015). At the same time, it underscores the

importance of sector-specific analyses, which can capture differences in sustainability performance across industries and regions.

14.3 Methodology

The research design is based on a comparative benchmarking approach, which allows for the systematic assessment of ESG reporting practices across leading European energy companies. The analysis covers seven corporations: ČEZ, EDF, EDP, ENEL, Iberdrola, RWE, and Vattenfall. These firms were selected due to their market significance, availability of sustainability disclosures, and their representation of different regulatory and energy policy environments within Europe.

The chapter draws primarily on publicly accessible sustainability and annual reports published by the companies for the year 2023. Supplementary information was obtained from official corporate websites, investor presentations, and databases maintained by international organizations. This triangulation of data sources contributes to the reliability and comparability of the results.

The benchmarking framework was structured around four analytical pillars: Environmental – indicators include the composition of the energy mix, carbon intensity, greenhouse gas emissions (Scopes 1–3), and investments in renewable sources. Social – indicators cover workforce size and structure, gender representation, employee training and development, occupational safety, and employee engagement. Governance – indicators comprise transparency in reporting, board diversity, reported violations of codes of conduct, and the extent to which ESG principles are embedded into corporate governance systems. EU Taxonomy – indicators assess the proportion of taxonomy-aligned revenues, capital expenditures (CAPEX), and operational expenditures (OPEX), reflecting the degree to which companies' activities are consistent with the EU's sustainable finance framework.

For the quantitative analysis, descriptive statistics and ratio-based measures were applied, including taxonomy-aligned revenues and investments, the ratio of women in management and supervisory bodies, accident frequency per million employees, and financial performance metrics such as EBITDA margin, CAPEX-to-revenue ratio, and OPEX-to-revenue ratio. To ensure comparability across firms of different sizes and operational scales, selected indicators were normalized. The companies were then qualitatively evaluated in relation to sectoral best practices, EU regulatory requirements, and trends in ESG reporting identified in the academic literature. This mixed-methods approach, combining quantitative benchmarking with qualitative interpretation, makes it possible to capture both measurable ESG performance and the contextual factors that shape reporting practices in the European energy sector.

14.4 Analytical Section: ESG Benchmarking of European Energy Companies

14.4.1 Environmental dimension

All the analysed companies – ČEZ, EDF, EDP, Enel, Iberdrola, RWE, and Vattenfall – systematically published sustainability reports even before the EU legislation on mandatory ESG reporting came into effect in 2024. In the environmental dimension, all firms exhibit a high degree of heterogeneity, both in the structure of reporting and in the level of detail provided.

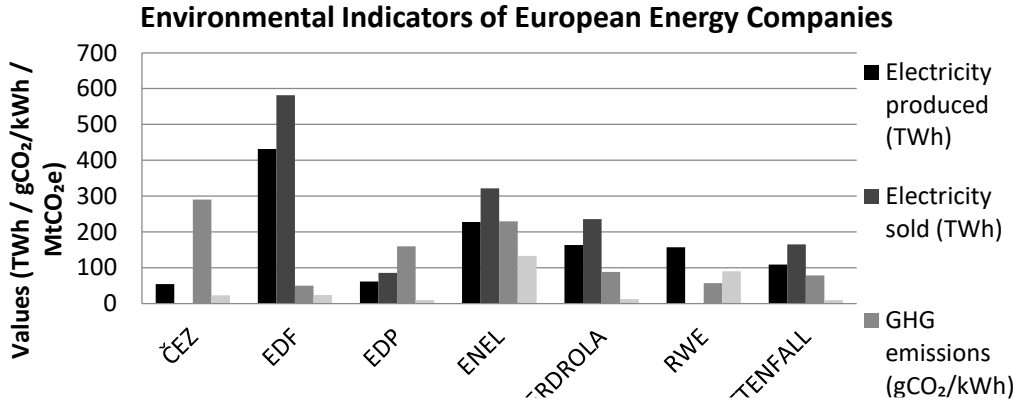
Analysis of the environmental dimension

The largest electricity producer in 2023 was EDF, followed by Enel (see Table 17: Environmental Indicators of European Energy Companies). In contrast, the lowest values were recorded for ČEZ and EDP. In terms of the generation mix (Table 18: Electricity production mix of European Energy Companies), EDF stands out with a 76% share of nuclear power, followed by ČEZ and Enel. RWE and Vattenfall are characterized by a significant share of hydropower, while Iberdrola is the leader in wind energy and EDP in solar generation. Although all companies declare their intention to increase the share of renewables, there are year-on-year differences in metrics, data aggregation methods, and interpretation. These divergences complicate direct benchmarking.

Table 17: Environmental Indicators of European Energy Companies

Indicator / Company	ČEZ	EDF	EDP	ENEL	IBERDROLA	RWE	VATTENFALL
Electricity produced (TWh)	54,3	431,7	61,4	227,8	163	156,8	108,9
Electricity sold (TWh)	n/a	582	85,6	321,1	236	n/a	165,3
GHG emissions (gCO_2/kWh)	290	50	160	229	88	57	78
GHG emissions (gCO_2/kWh)	22,5	24	9,4	132,9	11,9	89,6	9,6

Figure 31: Environmental Indicators of European Energy Companies



Source (both): Authors' compilation based on annual reports of ČEZ, EDF, EDP, Enel, Iberdrola, RWE, and Vattenfall (2023).

Discussion

The results of the analysis of environmental indicators confirm the conclusions of recent literature regarding significant heterogeneity in ESG performance across firms and sectors. Agosto (2025) points to the phenomenon of *aggregate confusion*, whereby divergent ESG rating methodologies complicate international benchmarking. In our case, this problem is evident in the contrast between the relatively low emission intensities of EDF, RWE, and Vattenfall on the one hand, and the high values recorded by ČEZ and Enel on the other. These differences can largely be explained by variations in the energy mix. EDF benefits from the dominant share of nuclear power, reflected in its exceptionally low emission intensity (50 gCO_2/kWh). Similarly, RWE and Vattenfall have accelerated their transition away from coal

towards renewables in recent years, which has improved their environmental indicators (Ge, 2025; Martiny, 2024). In contrast, ČEZ and Enel still exhibit a high share of fossil fuel–based generation, resulting in both high absolute and relative emissions (Deng & Lin, 2024).

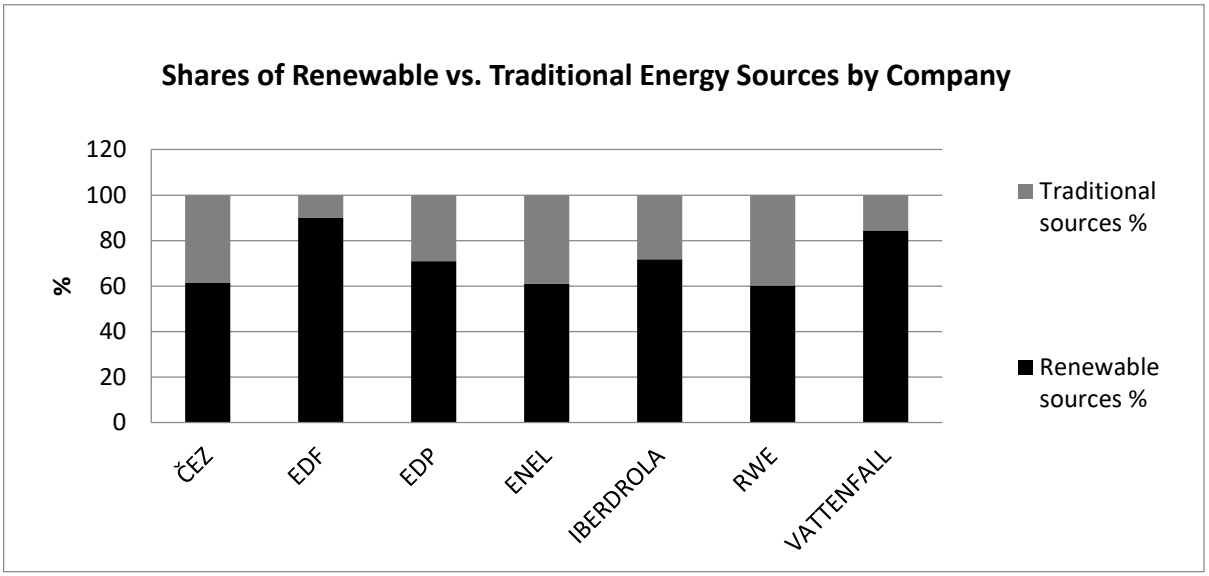
Another factor is company size and business strategy. While EDF reports a lower emission intensity, its absolute emissions remain high due to the scale of its production. Likewise, Enel records extremely high absolute emissions (132.9 $MtCO_2e$), reflecting not only production volume but also a slower pace of decarbonization. This relationship is supported by Li, Zhang, & Wang (2024), who demonstrate that environmentally intensive industries exhibit a direct link between resource mix and corporate financial performance. From an investment perspective, differences in emission indicators are directly reflected in ESG ratings, which influence investor behaviour (Cesarone et al., 2024; Ge, 2025). Firms with lower emission intensity are perceived as less risky and more attractive to "green investors." Conversely, companies with high emission levels face risks of reduced access to capital and stronger pressures to accelerate their transition (Nian & Said, 2025).

Overall, it can be concluded that the environmental performance of energy companies is shaped by a combination of historical investment decisions, the composition of the energy mix, and the degree of ESG strategy implementation. These factors not only explain the disparities among firms but also confirm the findings of the literature: that objective ESG evaluation requires consideration of both absolute and relative indicators of environmental performance.

Table 18: Electricity production mix of European Energy Companies

Indicator / Company	**ČEZ**	**EDF**	**EDP**	**ENEL**	**IBERDROLA**	**RWE**	**VATTENFALL**
Hydropower	3,9	8,2	19	22,7	20,5	41,6	36,7
Wind	0,5	6	19	19	36,2	18,6	11,5
Solar	0,3	1	14	5	7,6		
Geothermal				2,7			
Other		5,7	32	2			
Nuclear	56,7	76	11,6	5,5			38,6
Renewable sources	**61,4**	**89,9**	**71**	**61**	**71,8**	**60,3**	**84,5**
Combined production			23,9				
Biomass	1,4						0,8
Natural gas	4,5	8,5					
Coal	32,7	0,4	29	8,7		39,7	14,7
Fuel oil, mazut	0	0	6,4	28,2			
Traditional sources	**38,6**	**10,1**	**29**	**39**	**28,2**	**39,7**	**15,5**

Figure 32: Electricity production mix of European Energy Companies



Source (both): Authors' compilation based on annual reports of ČEZ, EDF, EDP, Enel, Iberdrola, RWE, and Vattenfall (2023).

The analysis of the electricity generation mix highlights significant differences among European energy companies regarding their reliance on renewable versus traditional sources. EDF and Vattenfall stand out with the highest shares of renewables (89.9% and 84.5%, respectively), largely reflecting their strategic reliance on nuclear and hydropower, as well as progressive investment in wind and solar technologies. This positioning aligns them with EU decarbonization objectives and provides them with a competitive advantage in terms of ESG performance (Li, Zhang, & Wang, 2024). Iberdrola and EDP also display strong commitments to renewable energy, with more than 70% of their portfolios based on clean sources. Both firms have heavily invested in wind and solar power, underscoring their leadership in the transition to sustainable energy systems (Ge, 2025). In contrast, ČEZ and RWE retain relatively high proportions of traditional sources (38.6% and 39.7%, respectively), with coal still representing a considerable share of their production mix. This reliance on fossil fuels exposes them to higher transition risks, as highlighted in the ESG literature (Deng & Lin, 2025; Nian & Said, 2025). ENEL occupies an intermediate position with a 61% share of renewables, but its notable reliance on natural gas and oil indicates ongoing challenges in achieving a fully sustainable mix. Nevertheless, ENEL distinguishes itself by incorporating geothermal energy, reflecting efforts to diversify and innovate in alignment with the principles of sustainable competitiveness (Martiny et al., 2024).

Implications

From a regulatory perspective, the EU CSRD directive and the ESRS standards emphasize transparency and comparability of energy mix disclosures (European Commission, 2023, 2025; EFRAG, 2023). These requirements put additional pressure on companies with carbon-intensive portfolios to accelerate their energy transition. Firms with progressive renewable profiles (EDF, Iberdrola, Vattenfall) are therefore better positioned to attract sustainable finance and investor trust, while coal-dependent companies face significant regulatory and market-related constraints.Overall, the results underscore that the energy mix composition is a decisive determinant of ESG performance, influencing both environmental outcomes and strategic positioning in the European energy market.

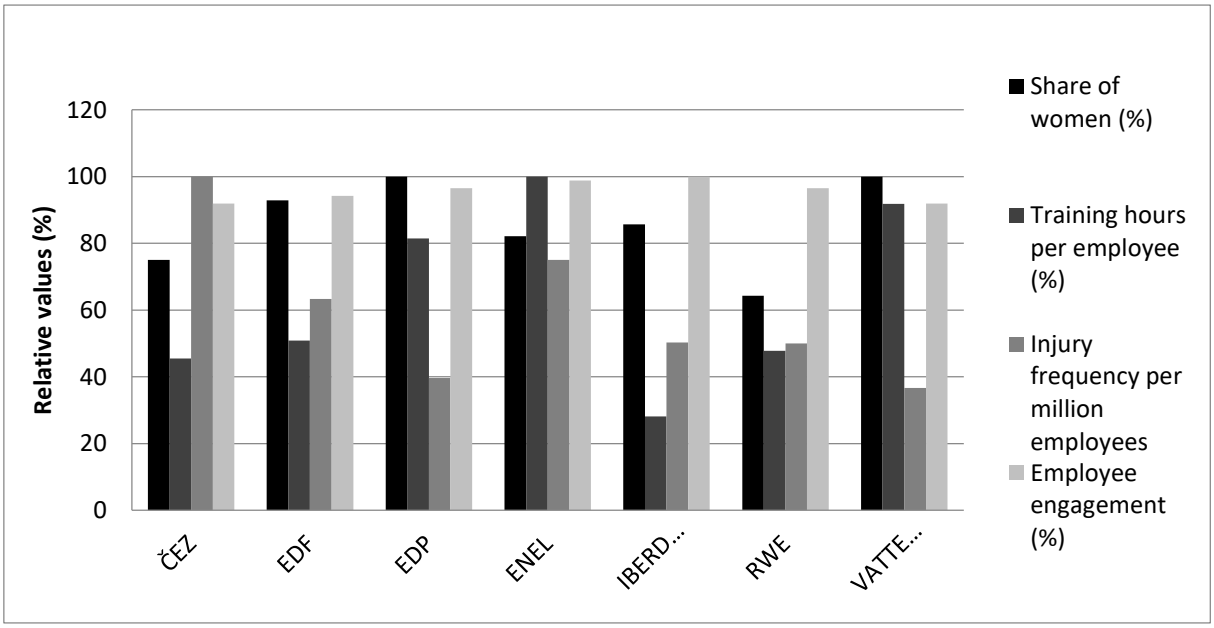
14.4.2 Social dimension

The social pillar of ESG reporting covers a wide range of areas, including employment, diversity, occupational safety, and employee engagement. EDF employs the highest number of workers among the analysed companies, while Vattenfall reports the highest share of women (see Table 19). Differences are evident not only in quantitative metrics (such as the number of employees or training hours) but also in the transparency of disclosed data. Low comparability of indicators complicates the assessment of performance across companies. Diverse data collection methods and the lack of standardized definitions (e.g., "training") further reduce the reliability and interpretability of reported information (Kotsantonis & Pinney, 2022; Eccles & Klimenko, 2019).

Table 19: Social Indicators by Company

Companies / Legend	ČEZ	EDF	EDP	ENEL	IBERDROLA	RWE	VATTENFALL
Total employees	28727	171490	13211	65124	40721	18827	19638
Share of women (%)	21	26	28	23	24	18	28
Employee training (hours)	1208721	6453195	309936	1245000	2764956	753080	409125
Training hours per employee (%)	2,38	2,66	4,26	5,23	1,47	2,5	4,8
Injury frequency per million employees	3	1,9	1,19	2,25	1,51	1,5	1,1
Employee engagement v %	80	82	84	86	87	84	80

Figure 33: Social Indicators by Company



Source (both): Authors' compilation based on annual reports of ČEZ, EDF, EDP, Enel, Iberdrola, RWE, and Vattenfall (2023).

Analysis of the social dimension

The analysis of the social dimension reveals significant differences among European energy companies in terms of workforce composition, training, and occupational safety. EDF has the largest workforce (171,490 employees), while EDP employs the fewest (13,211 employees). The share of women ranges from 18% at RWE to 28% at EDP and Vattenfall. The highest levels of employee training per capita are reported by ENEL (5.23%) and Vattenfall (4.8%), whereas Iberdrola records the lowest (1.47%). In the area of occupational safety, the lowest injury frequencies are reported by Vattenfall (1.1) and EDP (1.19), while ČEZ shows the highest rate (3). Employee engagement is strongest at Iberdrola (87%) and ENEL (86%), and lowest at ČEZ and Vattenfall (80%).

Discussion

The results confirm that human capital is a key determinant of sustainability and long-term competitiveness in the energy sector. Companies such as ENEL and Iberdrola, which demonstrate high employee engagement and strong investments in training, exhibit characteristics of a robust corporate culture and an enhanced capacity to adapt to changing market conditions. This finding is consistent with the literature emphasizing that employee education and participation are critical drivers of improved ESG performance (Zhou & Chen, 2024; Wang et al., 2025). The low proportion of women, particularly at RWE (18%), highlights persistent gender inequality within the sector, which may affect stakeholder and investor perceptions. Workforce diversity is increasingly recognized as a factor contributing to organizational innovation and resilience (Liu et al., 2023). Marked differences in injury frequency point to variability in the implementation of safety standards. The higher rate at ČEZ (3) suggests a need for more intensive investment in safety measures, whereas the lower values at Vattenfall and EDP may reflect long-term strategies focused on prevention and occupational safety.

Implications

From a regulatory perspective, the implementation of the CSRD and ESRS standards is of particular importance, as they mandate detailed and transparent reporting in the social dimension as well (European Commission, 2023, 2025; EFRAG, 2023). This framework exerts increasing pressure on companies to strengthen diversity, workplace safety, and employee engagement.

The main implications can be summarized in three key areas: Diversity and inclusion – companies with low female representation will face growing pressure from both investors and regulators to improve gender balance. Human capital development – substantial investment in training and education is directly linked to higher employee adaptability and engagement. Occupational safety – harmonization of safety standards is crucial to minimizing reputational and financial risks associated with workplace injuries. Overall, the results demonstrate that companies systematically investing in employee training and development, while simultaneously achieving high engagement levels, are better positioned to address long-term challenges in the ESG context.

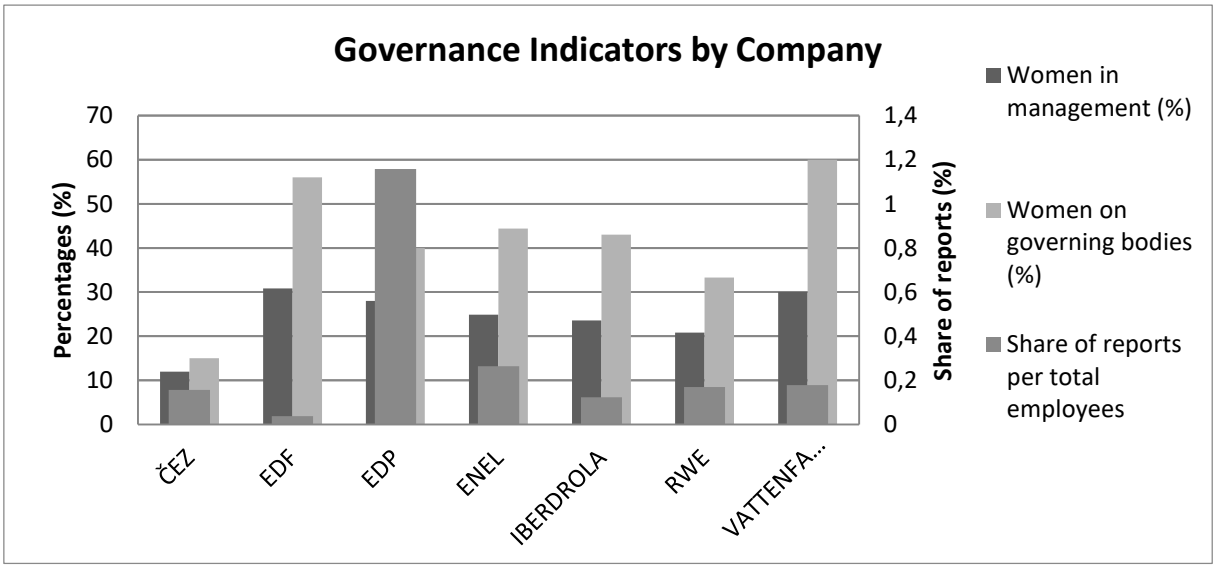
14.4.3 Governance

The governance pillar of ESG encompasses ethics, risk management, compliance, and corporate governance practices. In terms of the number of reported violations of the code of ethics, EDF and Enel record the highest figures (see Table 20: Corporate Governance and Management). EDF reports 31 violations, of which 50% were assessed as substantiated. Enel, by contrast, indicates 29 violations, yet only 16% of these were confirmed. A persistent challenge in this area is the lack of consistency in the reporting of governance metrics. The results suggest heterogeneous approaches to internal audits, whistleblowing culture, and compliance frameworks, which once again limits comparability across companies.

Table 20: Corporate Governance and Management

Companies / Legend	ČEZ	EDF	EDP	ENEL	IBERDROLA	RWE	VATTENFALL
Reports of violations of the Code of Ethics (number)	45	63	153	172	50	32	35
Total employees	28727	171490	13211	65124	40721	18827	19638
Share of reports per total employees	0,157%	0,037%	1,158%	0,264%	0,123%	0,170%	0,178%
Women in management (%)	12,0	30,8	28,0	24,9	23,6	20,8	30,0
Women on governing bodies (%)	15,0	56,0	40,0	44,4	43,0	33,3	60,0

Figure 34: Corporate Governance and Management



Source (both): Authors' compilation based on annual reports of ČEZ, EDF, EDP, Enel, Iberdrola, RWE, and Vattenfall (2023).

Analysis of ethical and gender indicators

The analysis of ethical and gender indicators reveals marked disparities among European energy companies. The relative share of reported violations of the code of ethics per employees is highest at EDP (1.158%) and ENEL (0.264%), whereas the lowest values are observed at EDF (0.037%) and Iberdrola (0.123%). With respect to gender diversity, the highest representation of women in management is found at EDF (30.8%) and Vattenfall

(30.0%), while the lowest levels are reported by ČEZ (12.0%) and RWE (20.8%). In governing bodies, Vattenfall (60.0%) and EDF (56.0%) show the strongest female participation, in contrast to ČEZ (15.0%), which demonstrates the weakest representation.

Discussion

The findings confirm that both diversity and ethical standards are highly differentiated across the European energy sector. EDF and Vattenfall demonstrate above-average female participation in leadership and governing bodies, consistent with research that links gender balance to greater innovation capacity and a more resilient corporate culture (Kanter, 2024; Johnson & Tan, 2025). Conversely, ČEZ records the lowest female representation, pointing to the persistence of gender inequality in certain national contexts.

Regarding ethics, the relatively higher reporting levels at EDP and ENEL may be interpreted in two ways. They may signal a greater incidence of ethical challenges, but equally they may reflect stronger whistleblowing systems and greater employee confidence in compliance mechanisms (Brown & Davis, 2023). The very low reporting rate at EDF, therefore, should not automatically be viewed as evidence of superior ethical culture but may instead reflect lower employee willingness to disclose misconduct.

These patterns emphasize that diversity and ethical governance are central components of the social dimension of ESG. Transparent processes and gender inclusivity directly influence corporate reputation and the degree of trust among investors and stakeholders.

Implications

A balanced representation of women in leadership positions is increasingly recognized as a factor that strengthens both investor confidence and corporate reputation. Companies such as EDF and Vattenfall, which report higher levels of female participation in management and governing bodies, are therefore likely to enjoy enhanced legitimacy and greater appeal in the capital markets. Ethical and compliance practices also play a critical role in governance evaluations. A higher number of reported violations does not necessarily reflect weaker ethical conditions, but can instead indicate greater transparency and employee trust in internal reporting mechanisms. This highlights the importance of interpreting governance data with caution and context.

Substantial differences remain between companies in their approach to diversity and ethics. Firms such as ČEZ and RWE continue to display relatively weak outcomes in gender balance, while others, including EDF and Vattenfall, have already achieved standards that correspond more closely to European regulatory and societal expectations. These differences are increasingly significant in light of the evolving regulatory environment. The implementation of the CSRD directive and the ESRS standards is expected to intensify the demand for harmonized and comparable reporting in the areas of diversity, ethics and compliance, thereby enhancing transparency across the sector (European Commission, 2023; EFRAG, 2023).

Overall, the findings suggest that companies which actively foster diversity and maintain robust and transparent ethical processes are better positioned for long-term success. Their commitment not only strengthens internal governance structures but also contributes to stronger ESG evaluations, which are critical for competitiveness in the European energy sector.

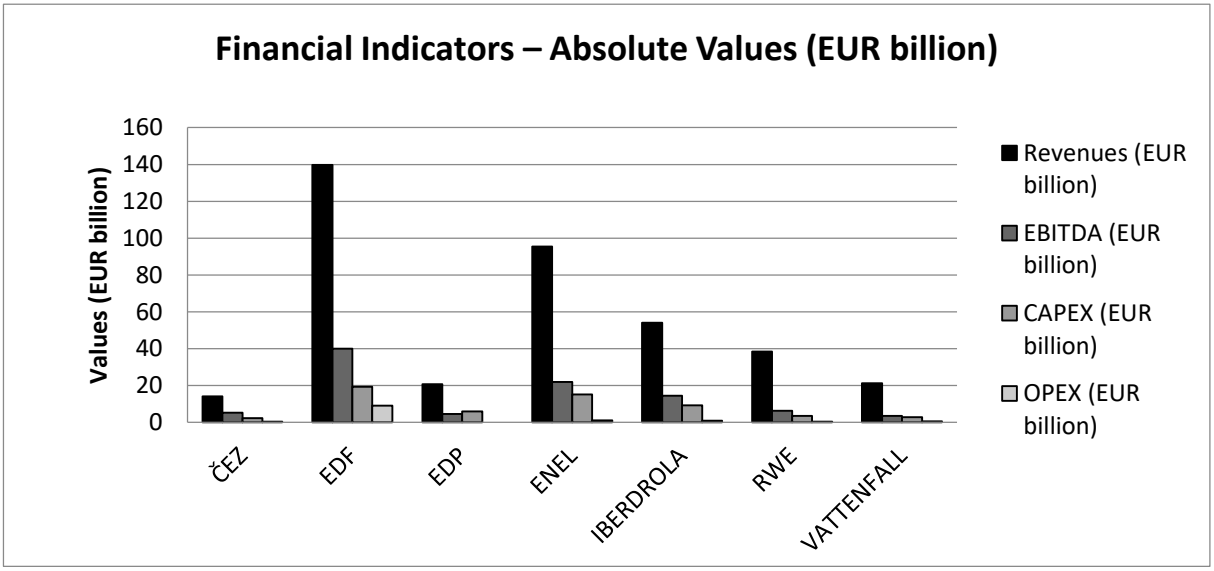
14.4.4 Taxonomy

The analysis of economic indicators based on the EU Taxonomy classification provides a new perspective on the ESG performance of companies. Among the key factors assessed are the eligibility of revenues, investments, and operating expenditures. EDF and Enel record the highest total revenues; however, in terms of taxonomy-aligned revenues, Vattenfall and EDF lead the group. EDP achieves the highest share of taxonomy-aligned capital expenditures (90 %), while ČEZ and EDF report the lowest values in this category. The highest EBITDA-to-revenue ratio is observed for ČEZ (see Table 21: Taxonomy, Financial Indicators).

Table 21: Taxonomy, Financial Indicators

Companies / Legend	ČEZ	EDF	EDP	ENEL	IBERDROLA	RWE	VATTENFALL
Revenues (EUR billion)	14,19	139,7	20,7	95,5	54	38,4	21,3
Share of revenues under taxonomy (%)	33,7	38	49	30,2	36,5	42	55
EBITDA (EUR billion)	5,2	39,92	4,52	21,97	14,42	6,32	3,46
EBITDA to revenues (%)	36,6	28,58	21,9	23,01	26,7	16,5	16,2
CAPEX (EUR billion)	2,28	19,315	6,018	15,088	9,283	3,501	2,759
CAPEX to revenues (%)	0,16	13,5	29,1	10,7	17,2	9,1	12,9
Share of CAPEX under taxonomy (%)	65,3	66	77	81,9	86,5	83	90
OPEX (EUR billion)	0,444	9,12	n/a	1,1	0,938	0,363	0,623
OPEX to revenues (%)	3,8	6,4	n/a	0,8	1,7	0,9	2,9
Share of OPEX under taxonomy (%)	52,6	72	n/a	66,9	52,2	49	71

Figure 35: Taxonomy, Financial Indicators



Source (both): Authors' compilation based on annual reports of ČEZ, EDF, EDP, Enel, Iberdrola, RWE, and Vattenfall (2023).

Analysis of financial indicators

The analysis of absolute financial indicators highlights significant disparities among the largest European energy companies. EDF stands out with the highest revenues (EUR 139.7 billion) and EBITDA (EUR 39.92 billion), reflecting its dominant market position and extensive customer base. ENEL follows with revenues of EUR 95.5 billion and EBITDA of EUR 21.97 billion, underlining its role as a leading multinational player with diversified activities.

In contrast, ČEZ and Vattenfall report comparatively lower revenues (EUR 14.19 and EUR 21.3 billion, respectively), but ČEZ achieves a relatively strong EBITDA margin (36.6%), suggesting efficient operations in relation to its scale. This efficiency is further evidenced by its high EBITDA-to-revenue ratio compared to larger competitors.

CAPEX levels reveal strategic differences in investment approaches. EDP and Iberdrola invest heavily relative to their revenues, indicating a focus on growth and renewable expansion. Conversely, RWE and ČEZ demonstrate relatively modest CAPEX values, which may reflect more conservative investment policies or structural reliance on traditional assets.

Overall, the results demonstrate that financial scale alone does not directly translate into efficiency or strategic alignment with sustainability goals. Smaller players, such as EDP, exhibit higher capital expenditure intensity, supporting their transition strategies, while larger incumbents like EDF and ENEL rely more on established revenue bases.

Discussion and implications

The financial indicators provide important context for evaluating the capacity of European energy companies to meet sustainability objectives under the EU Taxonomy and broader ESG frameworks. High revenues and EBITDA levels, as observed for **EDF** and **ENEL**, signal strong financial stability, which is essential for financing large-scale investments in decarbonization and renewable energy deployment. However, absolute financial strength does not guarantee alignment with sustainability goals. For instance, despite their size, these companies display relatively moderate shares of taxonomy-aligned CAPEX, highlighting the persistent challenge of redirecting investment flows toward eligible green projects (European Commission, 2023; EFRAG, 2023).

The results suggest that investment intensity (CAPEX relative to revenues) is a more reliable indicator of transition readiness than revenues alone. Firms such as EDP and Iberdrola demonstrate above-average CAPEX ratios, reflecting their strategic orientation toward renewable energy and their potential to achieve higher taxonomy alignment. This observation is consistent with recent literature, which emphasizes the role of targeted investment in driving ESG performance and long-term competitiveness (Buchetti, Rossi, & Di Carlo, 2025; Nian & Said, 2025).

By contrast, companies like ČEZ and RWE show relatively low investment intensity, which may limit their capacity to adapt to regulatory and market pressures for decarbonization. While ČEZ achieves high operational efficiency (as reflected in EBITDA-to-revenue ratios), limited investment in taxonomy-aligned activities could expose the company to transition risks, including stricter carbon pricing, reputational risks, and reduced investor appeal (Ge, 2025; Deng & Lin, 2024).

The analysis underscores the importance of integrating financial performance with sustainability reporting. Under the Corporate Sustainability Reporting Directive (CSRD) and

the European Sustainability Reporting Standards (ESRS), companies are required to disclose the proportion of revenues, CAPEX, and OPEX aligned with the EU Taxonomy. This regulatory framework enhances comparability across firms and ensures that financial strength is evaluated in conjunction with environmental performance.

In conclusion, companies that combine strong financial fundamentals with high taxonomy-aligned investment shares (e.g., Iberdrola, EDP) are better positioned to meet EU sustainability objectives and attract sustainable finance flows. Conversely, firms with strong revenues but limited green investment (e.g., ČEZ, RWE) risk falling behind in the transition and may face increasing pressure from both regulators and investors.

14.4.5 Synthetic results of solved dimensions

The comparative analysis of European energy companies across the ESG dimensions and EU Taxonomy alignment highlights significant structural and strategic differences with direct implications for both corporate sustainability and long-term competitiveness.

From an environmental perspective, firms with a high share of renewable energy sources, such as Iberdrola, EDP and Vattenfall, demonstrate lower carbon intensity and greater alignment with EU decarbonization targets. In contrast, companies that continue to rely heavily on fossil fuels, including ČEZ and RWE, face greater transition risks as a result of their exposure to carbon-intensive production. These results confirm that the production mix remains one of the most decisive factors influencing environmental performance.

The social analysis reveals substantial variation in workforce composition, gender diversity, training intensity and occupational safety. Companies such as ENEL and Iberdrola achieve high employee engagement and invest significantly in training, which strengthens adaptability and corporate culture. However, persistent gender imbalances, particularly in companies such as ČEZ and RWE, highlight continuing challenges in inclusivity and equality. The findings emphasize the central role of human capital in driving innovation, resilience and overall ESG performance.

Within the governance dimension, the results demonstrate marked disparities in ethical reporting practices and female representation in management and governing bodies. EDF and Vattenfall show above-average female representation, which is consistent with research linking gender diversity to stronger innovation capacity and higher governance quality. By contrast, ČEZ records the lowest participation of women, indicating the persistence of structural inequalities. In addition, a higher number of reported violations of the Code of Ethics in companies such as EDP and ENEL may reflect more effective internal reporting systems and greater employee trust rather than a weaker ethical culture, which illustrates the complexity of interpreting governance-related indicators.

The taxonomy-based financial analysis provides a more nuanced understanding of alignment with EU sustainability objectives. Companies such as EDP and Iberdrola report a high share of taxonomy-aligned capital expenditures, which reflects their proactive investment strategies in renewable energy and green infrastructure. Although EDF and ENEL are financially robust, they demonstrate lower taxonomy alignment, which reveals a gap between financial scale and readiness for sustainability transition. This supports the argument that relative investment intensity is a more reliable predictor of transition preparedness than absolute revenues or profits.

14.5 Conclusions

The findings confirm that financial and sustainability performance cannot be assessed separately. Strong revenues and profits provide stability, but resilience in the low-carbon transition depends above all on the structure of energy production, the orientation of investments, the development of human capital and the transparency of governance practices.

The study further demonstrates the importance of combining ESG reporting frameworks with EU Taxonomy metrics. This integrated approach improves comparability between companies and enables stakeholders to distinguish between firms that pursue genuine transition strategies and those that continue to rely on legacy business models.

Overall, the evidence shows that companies which systematically invest in renewable capacity, human capital, gender diversity and transparent compliance structures, such as Iberdrola, EDP and Vattenfall, are better positioned to meet EU climate objectives, attract sustainable finance and maintain long-term competitiveness. In contrast, firms that continue to rely on fossil fuels, invest insufficiently in taxonomy-aligned activities or lag in social and governance practices are at greater risk of regulatory misalignment, reputational damage and loss of investor confidence.

The analysis therefore demonstrates that ESG and Taxonomy reporting should not be viewed solely as compliance obligations. Instead, they represent strategic instruments for building resilience, enhancing competitiveness and strengthening legitimacy in a rapidly evolving energy landscape.

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15. Setting the national scene – Czechia and Slovakia: Together except of Banking Union

Dominik Králik

This chapter examines the divergent trajectories of Czechia and Slovakia within European financial integration following the dissolution of Czechoslovakia. Although sharing comparable banking structures—both dominated by foreign parent banks and characterised by strong financial soundness—Slovakia's adoption of the euro and full participation in the European Banking Union has placed it under the direct supervisory and resolution framework of the European Central Bank and Single Resolution Board. In contrast, Czechia maintains regulatory autonomy through the Czech National Bank, opting to remain outside the Banking Union despite its high degree of alignment with European standards. The chapter contextualises these developments in the broader evolution of EU financial governance, underscoring the role of European law as both the foundation and driver of economic stability, crisis management, and supranational coordination.

Through legal, economic, and political analysis, the chapter evaluates the implications of possible Czech participation in the Banking Union. It explores the potential benefits of shared risk-mitigation mechanisms, harmonised supervision, and increased investor confidence, balanced against concerns regarding loss of national discretion, financial contributions to common resolution funds, and the perceived strength of Czech domestic regulation. The comparison illuminates how similar banking sectors can diverge institutionally due to political choices, historical pathways, and strategic preferences, offering a nuanced perspective on the evolving nature of supranational financial governance in Central Europe.

15.1 Introduction

The dissolution of Czechoslovakia on 1 January 1993 led to the emergence of two independent states – the Czech Republic and the Slovak Republic. Both countries acceded to the European Union on 1 May 2004. Although their historical, cultural and economic proximity could suggest an identical trajectory of integration, their subsequent development demonstrates a significant divergence, particularly in the field of Economic and Monetary Union (EMU) and the Banking Union. Slovakia adopted the euro on 1 January 2009, thereby becoming a full member of the euro area, while the Czech Republic continues to remain outside the monetary union and retains its national currency. This divergence was accentuated by the creation of the Banking Union in 2014, which Slovakia joined, whereas the Czech Republic chose not to participate.

The purpose of this paper is to analyse the differing positions of both countries in relation to the Banking Union, to assess the implications for their respective banking sectors, and to consider whether participation of the Czech Republic in the Banking Union – even on the basis of the "close cooperation" instrument – would be rational and desirable (Ministry of Finance, 2021).

15.2 European integration and the role of law

15.2.1 Historical background

European integration after 1945 represented a fundamental response to the devastating experience of two world wars. The central impulse was the replacement of the conflictual paradigm of the nation-state with a paradigm of economic cooperation and institutional coordination. European law gradually established itself as a dual phenomenon: on the one hand, as the **object of integration** (creating an autonomous legal order), and on the other, as the **instrument of integration,** steering economic, political and social processes towards deeper integration (Haltern, 2017).

15.2.2 European law as a basis of peace and prosperity

One of the key objectives of European integration is the promotion of stability and prosperity. European law not only ensures the functioning of the internal market but also provides the framework for a transparent and predictable financial system. Within this context, the Banking Union constitutes a major project of recent integration, aiming at unified banking supervision, effective crisis resolution, and the prevention of financial market renationalisation.

Beyond its economic and regulatory functions, European law also plays a strategic role in aligning national policies with collective objectives. By establishing common rules and standards, it reduces the scope for competitive distortions and promotes mutual trust among Member States. This legal framework fosters an environment in which financial institutions can operate across borders with predictable obligations and consistent enforcement, thereby enhancing both investor confidence and market stability. In the context of the Banking Union, European law not only defines the competences of the European Central Bank and the Single Resolution Board but also ensures that national authorities adhere to uniform supervisory and resolution procedures, thereby safeguarding the cohesion and integrity of the euro area financial system.

15.3 The creation of the European banking union

15.3.1 From the financial to the sovereign debt crisis

The global financial crisis of 2008 and the subsequent sovereign debt crisis in the euro area revealed the structural weaknesses of the European financial system. It became evident that the close interconnection between banking systems and public finances endangered the stability of the entire monetary union. A banking crisis in one Member State could easily escalate into a systemic crisis across the euro area. These crises exposed the limitations of national regulatory frameworks, which were often unable to contain cross-border contagion or prevent the renationalisation of financial risks. They also highlighted the moral hazard created when national governments were expected to rescue banks using public funds, linking the solvency of financial institutions directly to the fiscal capacity of individual Member States. Consequently, the need for a supranational supervisory and resolution mechanism became increasingly urgent to safeguard financial stability and restore confidence in the European banking system (Teixeira, 2020, p. 184).

15.3.2 Institutional and legal framework

The response came with the decisions of the European Council and the Euro Summit in 2012, resulting in the establishment of the Single Supervisory Mechanism (SSM) under Article 127(6) TFEU and Regulation (EU) No 1024/2013 (SSMR). The ECB assumed direct supervisory responsibility over "significant" banks and was granted extensive powers in licensing, prudential supervision, enforcement of sanctions, and imposing structural measures. In parallel, the Single Resolution Mechanism (SRM) was created by Regulation (EU) No 806/2014 (SRMR), centralising procedures for bank resolution.

Beyond the formal legal instruments, the institutional architecture of the Banking Union also represents a novel hybrid of centralised and decentralised governance. While the ECB holds ultimate supervisory authority over significant banks, operational tasks are delegated to national competent authorities, which retain a role in day-to-day monitoring and enforcement. This arrangement allows for the integration of local knowledge and expertise while maintaining a coherent European-wide supervisory approach. Similarly, the SRM balances the authority of the Single Resolution Board (SRB) with the involvement of national resolution authorities, creating a structured framework for decision-making that mitigates moral hazard and ensures that both national and European interests are represented. This dual-level system reflects a careful calibration between supranational oversight and national discretion, providing both flexibility and credibility within the European financial architecture.

15.3.3 Towards a banking federation

The Banking Union represents the most advanced form of supranational integration in the European financial system to date. It embodies a model of "executive federalism," whereby key competences are shared between the European Central Bank (ECB) and national supervisory authorities. This sharing of competences is structured around a distinction between significant banks, which are directly supervised by the ECB, and less significant banks, which remain under national supervision but within the harmonised framework established by the ECB. This dual-level system allows for centralised oversight of systemically important institutions while preserving a degree of operational flexibility for smaller, domestically focused banks. Although the Banking Union does not constitute a federal model in the strict constitutional sense, it represents a substantial step towards supranational governance of the financial sector. It establishes binding obligations and decision-making authority at the European level, effectively limiting the discretion of national authorities for significant banks. In doing so, it enhances the credibility, transparency, and predictability of supervision, which are critical for investor confidence and the stability of cross-border banking operations.

The Banking Union also introduces new institutional mechanisms that resemble elements of a federal system. For example, the Single Resolution Mechanism (SRM) centralises the planning and execution of bank resolutions, pooling risk across participating Member States and reducing the reliance on national fiscal resources. The combination of ECB oversight and SRM responsibilities illustrates a shift from purely intergovernmental coordination towards a structured, rule-based European framework, where the subsidiarity of national authorities is preserved only within defined limits.

From a legal and economic perspective, this hybrid model demonstrates how supranational integration can be achieved incrementally: competences are carefully delineated, decision-making is shared, and national autonomy is preserved for smaller institutions while systemic risk is addressed at the European level. In this sense, the Banking Union can be seen as a precursor to a potential future banking federation, providing both a template and a practical laboratory for experimenting with partial federal structures in European financial governance.

15.4 Comparative perspective: Czechia and Slovakia

15.4.1 Structure of the Czech banking sector

The Czech banking sector is predominantly composed of subsidiaries of foreign parent banks, with Austrian, French, and Belgian institutions holding the largest shares. This high level of foreign ownership provides both stability, through access to parent bank capital and liquidity support, and a degree of dependency, as strategic decisions are often influenced by institutions headquartered abroad.

In terms of financial soundness, Czech banks exhibit strong capital adequacy ratios, low levels of non-performing loans, and high liquidity. These characteristics have contributed to a banking sector that is resilient and stable, even when compared to many other European Union member states. The conservative lending approach, with a focus on retail and mortgage portfolios, has supported long-term stability while maintaining moderate exposure to household indebtedness.

The Czech National Bank (CNB) actively implements prudential oversight and macroprudential measures, including limits on loan-to-value ratios and capital buffer requirements, to ensure systemic stability. Despite not being a member of the Banking Union, the Czech banking system maintains a robust regulatory framework aligned with European standards, allowing for effective supervision and crisis management within the national context.

Unlike Slovakia, Czech banks are not subject to direct supervision by the European Central Bank under the Single Supervisory Mechanism. Instead, the CNB retains full supervisory authority, which preserves regulatory autonomy but also places the entire responsibility for crisis prevention and resolution at the national level. Consequently, while the sector remains stable and well-capitalised, it lacks the additional safety net and harmonised oversight provided by the Banking Union, which could be considered both a limitation and a reflection of national control.

Overall, the Czech banking sector demonstrates resilience and stability comparable to its Slovak counterpart, but the institutional framework differs significantly. The absence of ECB supervision means that risk-sharing and integration within the euro area financial architecture are limited, highlighting the key distinction between Czech and Slovak banking systems.

15.4.2 Structure of the Slovak banking sector

The Slovak banking sector, although smaller in absolute terms compared to larger euro area economies, shares structural similarities with the Czech banking sector. It is largely dominated by subsidiaries of foreign banking groups, particularly Austrian, Italian, and Belgian

institutions. This ownership structure provides stability, as foreign parent banks can offer capital and liquidity support, but it also creates potential vulnerability, as local financial conditions may be influenced by decisions taken at the parent bank level abroad.

In terms of resilience, Slovak banks generally exhibit strong capitalisation and profitability. The banking sector's conservative lending approach, focused primarily on retail and mortgage lending, has contributed to stability while simultaneously increasing household exposure to debt. The National Bank of Slovakia (NBS) has actively employed macroprudential measures, such as limits on loan-to-value and debt-to-income ratios, to contain systemic risks and maintain sector stability.

A critical distinction from the Czech model lies in Slovakia's institutional integration into the Banking Union. Since adopting the euro in 2009, the largest Slovak banks have been directly supervised by the European Central Bank (ECB) under the Single Supervisory Mechanism (SSM). This ensures harmonised prudential oversight and reduces the potential for national regulatory forbearance. Smaller banks remain under NBS supervision, but within the framework established by the ECB, ensuring consistency across the sector.

Furthermore, Slovak banks participate in the Single Resolution Mechanism (SRM), with resolution planning and execution coordinated by the Single Resolution Board (SRB). This integration mitigates reliance on national fiscal resources in the event of bank failures, while also requiring contributions from Slovak banks to the Single Resolution Fund. As a result, the sector benefits from a shared financial safety net, which would not be available outside the euro area framework.

Overall, Slovakia's Banking Union membership enhances credibility with international investors, strengthens systemic resilience through common resolution tools, and fosters integration into the euro area financial system. At the same time, it reduces national regulatory discretion and imposes financial contributions to shared mechanisms, which may be proportionally more significant for a smaller economy. Despite these constraints, the benefits of harmonised supervision, risk-sharing, and institutional integration generally outweigh the associated limitations.

15.4.3 Interconnection with Austria

Austrian banking capital plays a central role in both the Czech and Slovak banking sectors, with Austrian parent banks holding significant shares in the largest domestic institutions. This historical presence dates back to the Austro-Hungarian period, when banking networks were first established across the region, and has been reinforced by subsequent waves of foreign investment after 1990. The long-term presence of Austrian banks has shaped the structure, governance, and risk profile of the local banking markets.

Economic and geographical proximity further strengthens these connections. Austria's role as a major investor and financial hub in Central Europe ensures that both the Czech and Slovak banking sectors remain closely integrated into wider European capital and liquidity networks. This integration enhances stability by providing access to capital injections and liquidity support in times of stress, but it also creates potential channels for cross-border contagion if economic or financial shocks affect Austrian parent institutions.

The significance of Austrian banking capital is particularly relevant when evaluating the Czech Republic's potential participation in the Banking Union. On one hand, strong ties to Austrian banks mean that Czech banks already benefit indirectly from European supervisory standards and financial discipline imposed at the parent level. On the other hand, formal inclusion in the Banking Union would shift part of regulatory authority to the European Central Bank, harmonising supervision and resolution mechanisms, which could reinforce systemic stability and reduce national fiscal exposure in case of a banking crisis.

In Slovakia, Austrian ownership aligns seamlessly with Banking Union membership, providing an additional layer of risk-sharing and integrated oversight. In the Czech context, however, this interconnection raises both strategic opportunities and policy dilemmas: the Czech Republic must weigh the benefits of institutional integration against the desire to maintain national regulatory autonomy, particularly in a banking system already largely dependent on foreign capital.

Overall, the Austrian presence underscores the transnational character of both banking sectors and highlights the extent to which cross-border financial integration interacts with national regulatory choices. It is therefore a critical factor in assessing the costs and benefits of Czech participation in the Banking Union.

15.5 Implications for Czech participation in the Banking Union

15.5.1 Economic and legal considerations

Participation of the Czech Republic in the Banking Union would carry several significant economic and legal implications. Economically, it would provide access to the common European framework for crisis management and resolution, ensuring that in the event of a bank failure, the costs and risks would be shared across the euro area rather than borne solely by the national budget. This mechanism reduces the systemic vulnerability of the Czech banking sector to idiosyncratic shocks and enhances the overall resilience of the financial system. By integrating into a supranational supervisory structure, Czech banks could also benefit from harmonised prudential standards, early intervention measures, and access to liquidity support, thereby strengthening market confidence.

Legally, participation would require the Czech Republic to adapt its national legislation to align with the rules and procedures of the Banking Union. This includes harmonising supervisory practices, implementing regulatory instruments defined by the European Central Bank (ECB) and the Single Resolution Board (SRB), and ensuring compliance with European directives and regulations governing crisis resolution. While this alignment enhances legal certainty and integration into the European financial architecture, it inevitably entails a partial loss of national regulatory autonomy, as certain key supervisory and resolution decisions for significant banks would be delegated to the ECB.

Furthermore, membership in the Banking Union would entail financial obligations, including contributions to the Single Resolution Fund (SRF) proportionate to the size and risk profile of Czech banks. These contributions, while serving to reinforce collective resilience, represent a tangible cost to national institutions and, indirectly, to the state. The trade-off between these

obligations and the stabilising benefits of risk-sharing is a central consideration in any assessment of the Czech Republic's potential participation.

In summary, the economic and legal considerations present a complex calculus: participation could enhance financial stability, reduce dependence on national fiscal capacity, and strengthen alignment with European supervisory standards, but it also requires legislative adaptation, partial surrender of regulatory control, and financial contributions to collective mechanisms. The decision therefore hinges on whether the Czech Republic values institutional integration and shared risk mitigation more than the preservation of full national autonomy in banking supervision.

15.5.2 Political Dimension

The decision for the Czech Republic to join the Banking Union is ultimately a matter of political strategy, involving both domestic and European considerations. Unlike Slovakia, whose adoption of the euro naturally led to full integration into the Banking Union, the Czech Republic remains outside the euro area, which makes any potential participation conditional upon a formal agreement for "close cooperation" with the European Central Bank. Such a step would require not only political consensus at the national level but also the negotiation of technical and legal arrangements with EU institutions.

A key factor influencing this political decision is the domestic perception of the Czech banking sector. The sector is widely regarded as stable, well-capitalised, and prudently managed, benefiting from a robust regulatory framework under the Czech National Bank. This perceived resilience reduces the immediate urgency for supranational oversight and may lead policymakers to prioritise regulatory autonomy over the potential benefits of ECB supervision.

At the same time, political considerations must account for external pressures and expectations. Integration into the Banking Union could signal a stronger commitment to European financial governance, enhancing the Czech Republic's credibility in international markets and among EU partners. It would also align the country more closely with euro area standards and risk-sharing mechanisms, which may be particularly relevant given the significant presence of foreign, especially Austrian, parent banks in the Czech market.

Therefore, the political dimension involves a careful balancing act between preserving national sovereignty in banking regulation and maximising the strategic advantages of institutional integration. This includes weighing the reputational and systemic benefits of joining the Banking Union against potential constraints on domestic policy-making and the fiscal responsibilities associated with shared resolution mechanisms. In essence, the Czech Republic faces a choice between maintaining full national control over its banking sector and participating in a broader European framework that could provide long-term stability and financial resilience.

15.6 Conclusion

The comparison of the Czech Republic and Slovakia demonstrates that both countries share similar banking structures, dominated by subsidiaries of foreign parent banks and exhibiting above-average indicators of financial soundness within the EU. The essential divergence lies

in their institutional frameworks: Slovakia participates in the Banking Union and is subject to the supervisory and resolution powers of the ECB and the SRB, whereas the Czech Republic remains outside this regime.

The key question for the Czech Republic is therefore whether Banking Union membership – despite the absence of the euro – is desirable. Arguments in favour include stronger risk-sharing, access to a unified supervisory and resolution framework, and enhanced credibility vis-à-vis investors. Arguments against stress the loss of regulatory autonomy and the fact that the Czech banking sector is currently stable and well-capitalised even outside the Banking Union.

From the perspective of European law and political economy, membership in the Banking Union represents an option rather than an obligation. Accession could increase institutional integration and strengthen the Czech Republic's role in shaping European banking law, but at the cost of reduced national flexibility. The decision is thus a matter of strategic choice, requiring careful consideration of both economic efficiency and political sovereignty.

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Bringing it all together

The monograph Financial Markets and Flows in an Era of Monetary, Fiscal, and Societal Challenges represents a comprehensive research synthesis addressing the interdependence of financial systems, public budgets, and societal transformation. The collective findings of its contributors reveal that contemporary economic stability depends both on isolated market mechanisms and even more on the structural coherence and adaptability of institutions operating under unprecedented uncertainty.

Synthesis of Results

The results across the studies confirm three broad tendencies shaping the present economic order.

First, financial markets and fiscal systems are undergoing structural rather than cyclical transformation. The evidence presented indicates that monetary transmission mechanisms have become less predictable due to digitalisation, global capital flows, and behavioural shifts in money circulation. Similarly, fiscal balances once shaped by the economic cycle are increasingly determined by demographic ageing, climate transition, and geopolitical instability. This structural reconfiguration implies that policy responses must evolve from short-term stabilisation to long-term systemic adaptation.

Second, institutional resilience has emerged as the principal determinant of sustainable economic performance. Effective crisis management and fiscal sustainability are shown to rely on the quality of coordination among monetary, fiscal, and prudential authorities. Comparative evidence demonstrates that small and medium-sized economies can maintain investor confidence not primarily through austerity or insulation, but through transparent, credible, and well-communicated policy frameworks embedded in European and global governance structures.

Third, the research confirms that sustainability, digitalisation, and social policy are now integral elements of financial analysis. Empirical and conceptual chapters demonstrate that environmental, social, and governance (ESG) standards, healthcare financing, and demographic trends are key channels through which financial and fiscal flows are being redirected. These domains, traditionally viewed as external to financial theory, are now central to risk assessment, investment strategy, and long-term market behaviour.

Methodological and Conceptual Advances

The monograph advances the analytical toolkit for studying financial and fiscal systems under complex conditions. Its contributors combine formal quantitative approaches – econometrics, correlation analysis, game theory, and agent-based modelling – with comparative institutional and qualitative reasoning. This methodological pluralism makes it possible to identify nonlinear relationships and feedback effects that conventional models often obscure. Several studies employ Czech and Central European data, thereby enriching international research with detailed insights from smaller open economies where the effects of policy reforms and external shocks can be observed with clarity.

Conceptually, the research reframes the notion of financial sustainability. It is no longer limited to the ability to balance accounts or maintain solvency but extends to the capacity of financial systems to absorb shocks while preserving long-term developmental objectives. Fiscal prudence must therefore coexist with strategic investment in health, education, digital infrastructure, and the green transition – areas that underpin productive potential and social cohesion.

Policy Relevance

The findings collectively underscore the necessity of strategic flexibility in economic governance: policies must remain responsive to short-term disturbances while preserving credibility over the long term. This dual requirement implies that fiscal and monetary frameworks should be complemented by robust institutional mechanisms ensuring transparency, evidence-based decision-making, and effective communication with markets and the public.

In financial regulation, the research points to the importance of integrating climate-related and digital risks into prudential frameworks and of improving the comparability and reliability of ESG reporting. In fiscal policy, the results highlight the need to align demographic and social expenditures with sustainable revenue bases, and to design reform sequences that protect universalism in healthcare and pensions without jeopardising fiscal stability.

Future Research Directions

The outcomes of this monograph suggest several promising lines for further inquiry:

- Digital transformation and monetary policy – exploring how digital currencies, fintech ecosystems, and behavioural heterogeneity influence money velocity and central-bank transmission mechanisms.
- Fiscal adaptation under demographic and technological change – modelling fiscal sustainability when the dependency ratio, health costs, and innovation dynamics evolve non-linearly.
- Integration of ESG and risk modelling – developing frameworks that link corporate sustainability data to macro-prudential and investment decision models.
- Systemic resilience and cross-sectoral linkages – constructing models that jointly account for financial, energy, and social variables to anticipate systemic vulnerabilities.
- Behavioural and cooperative dimensions of finance – extending game-theoretic and behavioural approaches to study co-opetition, trust, and innovation in evolving financial markets.

These research pathways reflect a gradual shift in economic analysis – from equilibrium-based models towards dynamic, interconnected frameworks capable of capturing complexity, feedback, and institutional learning.

Concluding Reflection

The overall conclusion of this monograph is that financial stability and fiscal sustainability must be understood as adaptive and relational phenomena. They arise not from static balance but from the continual interaction between market mechanisms, institutional design, and societal

objectives. The research presented herein provides both empirical evidence and conceptual clarity for this view.

In doing so, the volume reinforces the necessity of thorough inquiry combining macroeconomics, finance, public policy, and sustainability studies. It also emphasises that future policy success will depend on bridging theoretical insight with pragmatic design – linking data-driven analysis, transparent governance, and strategic foresight.

Financial Markets and Flows in an Era of Monetary, Fiscal, and Societal Challenges thus stands as both an incarnation of current scholarly debate and a call for continued research into the systemic interconnections that define modern economic life.

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ESG and Accounting Contexts. 2023. Prague: Wolters Kluwer. ISBN 978-80-7676-723-2.

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is currently the head of the Department of Finance at the University of Finance and Administration, where she has been teaching since 2003. She earned her doctorate in finance with a thesis on the methodological aspects of sovereign ratings. She teaches courses in corporate financial management, corporate finance, accounting, business valuation, and management accounting in both Czech and English, for example at the University of North Virginia. She has extensive experience in international educational projects, such as The Future Finance and Banking and Sustainability Finance and Banking, which are taking place in many EU countries. She is actively involved in research projects and has submitted several TA ČR projects as the principal investigator. Recently, she has been writing articles on ESG issues for peer-reviewed scientific journals, such as the article "ESG Performance and Disclosure: National Composite Indicators for Monitoring Sustainable Growth Conditions in the EU-27."

Dominik Králik

is a Czech lawyer and academic specializing in commercial, financial, and European law. He graduated from the Faculty of Law at Charles University in Prague and completed a postgraduate program in European and international economic law at Ludwig-Maximilians-Universität in Munich. He worked at the Ministry of Finance of the Czech Republic, where he participated in the creation of tax legislation and the implementation of European Union regulations, and also at the Office of the Government of the Czech Republic, where he was responsible for the compliance of Czech tax regulations with EU law. He has practical experience in advocacy, particularly in the area of financial and regulatory affairs. He currently works as an assistant professor at the University of Finance and Administration and is the author of a number of professional publications focused on European and financial law.

Tomáš Kremr

Tomáš Kremr is a distinguished professional known for his unique blend of extensive hands-on experience in global business and profound academic expertise.

He built his initial career in top-tier management roles within leading international corporations. Over two decades, he held senior positions at major firms, including Mars, Danone, Pepsi Cola, and the Bertelsmann Group. This tenure provided him with invaluable practical experience in strategy, commercial operations, and team leadership on a global scale.

For the past ten years, Dr. Kremr has dedicated himself to the academic sector, focusing on teaching, research, and publishing. He serves as an educator at the University of Finance and Administration (VSFS) and the CEVRO Institute. His teaching portfolio includes crucial disciplines such as Ethics, Macro and Microeconomics, and Management.

Dr. Kremr's career trajectory effectively bridges the gap between theoretical knowledge and real-world application, making him a highly respected expert who integrates the efficiency of the corporate world with a responsible and ethical approach.

Hana Lipovská, Jana Bobošíková

Hana Lipovská and Jana Bobošíková, both economists from the Czech Republic, co-authored the chapter Velocity of Money in the Digital Economy: an Agent-Based Model Calibrated with Czech Data (2000–2025). Their joint research connects theoretical economics with the real-world experience of policy, business, and media. Hana Lipovská, lecturer at the University of Finance and Administration in Prague, brings academic precision and expertise in monetary and fiscal policy modelling; Jana Bobošíková, former Member of the European Parliament and long-standing commentator on economic sovereignty and public affairs, contributes her extensive insight into institutional and societal dynamics shaping economic policy. Together, they explore how digitalization, fintech innovation, and behavioural heterogeneity transform the classical Fisherian concept of money velocity. Their agent-based model, calibrated with Czech data across a twenty-five-year horizon, demonstrates how technological and structural shifts alter the transmission of monetary policy in small open economies. The chapter blends rigorous quantitative modelling with an understanding of the political economy of monetary circulation, offering a rare synthesis of academic and practical perspectives on how digital transformation redefines financial stability and national autonomy in the modern age.

Lubomír Lízal

Mr. Lízal graduated at the Faculty of Electrical Engineering at the Czech Technical University. In 1998 he obtained a PhD in economics at CERGE, Charles University and in 2006 he qualified as an associate professor in economics at Charles University.

Since 1993 he has worked as a researcher at the Economics Institute of the Czech Academy of Sciences. In 2003–2008 he has been Director of both the Economics Institute of the Czech Academy of Sciences and CERGE, Charles University. He is a member of the Scientific Council of the Faculty of Electrical Engineering at the Czech Technical University, and other scientific boards. He was a member of the National Economic Council of the Government and a member of the supervisory board of energy company ČEZ. Lubomír Lízal has been a member of the Czech National Bank Board from February 2011 till February 2017. In years 2018-2019 he served as the President of the Anglo-American University in Prague and in 2020-2021 he was CEO of Expobank CZ.

He currently holds associate professor position at the Czech Technical University and at VŠFS.

Jan Mertl

He works at the University of Finance and Administration, Faculty of Economic Studies, where he has long been involved in teaching and research in the areas of public finance, macroeconomics, health economics, and social policy. In his professional focus, he combines the economic and social aspects of the functioning of the public sector and systematically examines issues of efficiency, fairness, and sustainability of public spending. His work is characterized by an emphasis on analyzing the practical impact of public policies on citizens'

living standards, budgetary relations between the state and citizens, and balancing the role of public and private resources in financing social systems.

Jan Mertl is the author and co-author of a number of monographs, scientific studies, and articles in Czech and foreign journals. His research focuses primarily on healthcare financing, social insurance mechanisms, the relationship between universal and supplementary financing of public services, and the macroeconomic context of the welfare state in the context of a changing economic reality. He is also involved in teaching and popularizing economic topics with the aim of contributing to a better understanding of the role of public finances and social policy in modern society.

Patrick Mini

Patrick Mini is a doctoral student at the University of Finance and Administration (Vysoká škola finanční a správní), Czechia. He is head of sales in a financial services company and an expert in health insurance with 12 years of experience. In his chapter, "The impact of public healthcare expenditure on people's health status – a comparison of the countries Germany, Austria, and Czechia for the years 2013 to 2021," he examines how different trajectories of public health spending relate to population outcomes across three neighbouring health systems. Drawing on official statistics and comparative indicators for the period 2013–2021, his analysis combines clear visualizations with careful interpretation to separate signal from noise in cross-country comparisons. Beyond this contribution, Patrick is passionate about translating complex quantitative findings into practical insights for citizens, clinicians, and decision-makers alike—always with the aim of improving people's health and making public resources work better.

Martina Sobková

Martina Sobková is the Editor-in-Chief of the professional B2B magazine Bankovnictví and a PhD candidate at the Prague University of Economics and Business. As part of her doctoral research, she focuses on capital markets and portfolio management. Her publications include the article Comparison of the Performance of Czech Actively Managed Funds and ETFs in the Finance and Accounting Journal. Within the conference Financial Markets and Flows, she authored a study on The Impact of Bitcoin on Portfolio Volatility, which examines how Bitcoin affects portfolio volatility and the Sharpe ratio—the risk-adjusted return measure. Her research concludes that although Bitcoin increases portfolio volatility, it significantly improves the portfolio's Sharpe ratio across various time periods and asset combinations

Helena Sůvová

The author has been professionally engaged in banking regulation since 2001, with a particular focus on prudential frameworks and their implementation in the Czech Republic. Her expertise spans credit risk modelling, leverage ratio, capital buffers, and the strategic implications of regulatory developments for banks. In recent years, she has also focused on the integration of ESG factors into regulatory and supervisory practices. Between 2023 and 2025, she contributed to academic teaching in banking regulation at the University of Finance and Administration (VŠFS). She holds a degree in economics, complemented by postgraduate studies in banking at the Prague University of Economics and Business (VŠE), and has completed several specialized short-term courses in financial regulation and risk

management. Her work combines analytical depth with a practical understanding of regulatory impacts on financial institutions.

Radim Valenčík

Mathematician and philosopher, he studied mathematics at Odessa University (1972–1977) and in 1984 defended his PhD thesis at the Institute of Philosophy and Sociology of the Czechoslovak Academy of Sciences. He works as a university lecturer at the University of Economics in Prague, where he habilitated in 1987, and later worked at the Czechoslovak Academy of Sciences. Since 1999, he has been working at the University of Finance and Administration in Prague, where he served as vice-dean and head of the Department of Economics and International Relations. He is a leading expert in game theory, microeconomics, the philosophy of economics, and redistribution systems. In 2008, he published a monograph entitled Game Theory and Redistribution Systems, which is based on his long-term research. As a researcher for GA ČR projects, he focuses on investments in social capital and the effectiveness of redistribution mechanisms. He is the founder and editor of the electronic magazine Marathon, which connects philosophy, economics, political science, and game theory. Since 1998, he has been organizing conferences on the topic of "Human Capital and Investment in Education" at VŠFS and leading seminars on game theory, e.g., relationships and cooperation in social networks. He is active in the ISEA institute and on the editorial board of ACTA VŠFS. His application of game theory to redistribution systems shows that society can create balances that increase trust, stability, and efficiency—or, conversely, fall into uncooperative patterns leading to polarization and loss of motivation.

Jitka Veselá

She lectures at the Prague University of Economics and at the University of Finance and Administration in courses focused on financial markets. She specializes in the area of capital markets and instruments traded on them. She has extensive theoretical and practical experience in conducting fundamental and technical analysis of stocks, bonds, currencies and commodities.

Jaroslav Vostatek

is a Czech economist, professor of finance, and renowned expert on public finance, social policy, pension systems, insurance, and taxation. He works at the University of Finance and Administration, where he has been involved in teaching and research in the areas of social security, social and private insurance, public finance, and tax policy. He has got lifelong experience in those topics and is known for his insightful, precise and inspirative approach to research problems and the academic debate. His professional activities have recently focused primarily on pension reform, the relationship between public and private insurance systems, the interconnection of tax and social systems, and the economic sustainability and fair structure of the welfare state financing. His work is highly valued for its combination of strong theoretical depth and practical recommendations for economic, social, and tax policy. Prof. Vostatek has been actively involved in the public debate on the form of pension reforms, the social and health insurance system, and the Czech tax system, emphasizing the need for a balance between economic efficiency and social justice, and aiming for rationality, simplicity, functionality and effectiveness of public finance mechanisms.

Alžběta Zíková

She works at the Prague University of Economics in the Department of Statistics and Probability and lectures there subjects focused on statistics. Her research focuses on the analysis of relationships between macroeconomic variables and the development of capital markets. She specializes in the use of statistical methods and models in forecasting the development of stock, currency and commodity prices on financial markets, but also in forecasting and analysing the development of macroeconomic variables.