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EDITORIAL

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Editorial

JAN MERTL

Dear readers,

I would like to kindly introduce the newest issue of ACTA VSFS journal. In the diverse landscape of economic, social, and healthcare dynamics, five peer-reviewed studies underscore the nuanced interplay of policies, practices, and outcomes across geographies. These studies, each a significant scholarly contribution, illuminate complex systems through rigorous analyses and comparative perspectives. Though diverse in scope, they collectively highlight the importance of localized strategies, cross-border learning, and nuanced policymaking.

The first paper **"Post-pandemic inflation dynamics: a comparative study of the fiscal theory in the Czech Republic and France"** critically examines the fiscal theory of inflation within the challenging economic milieu of the Czech Republic and France. By leveraging empirical data, the study elucidates how fiscal policies influence inflationary trends and debt sustainability. The authors argue for a recalibrated macroeconomic understanding where fiscal strategies, market expectations, and national debt intersect. This perspective becomes especially salient as governments contend with inflationary pressures exacerbated by geopolitical disruptions and post-pandemic recovery.

The second paper "**The impact of stokvel and banking sector efficiency: an econometrics model using (ARDL) approach to cointegration"** is from a foreign author. In this work, the relationship between stokvels – community-based savings schemes – and banking sector efficiency in South Africa is explored using the ARDL cointegration approach. The study reveals a long-term association between these informal financial systems and banking efficiency. The findings highlight the critical role of stokvels in fostering financial inclusion for low- and middle-income households. By doing so, the research bridges the gap between formal banking institutions and the unbanked population, emphasizing the need for policies that harmonize these parallel systems.

A Study **"Classification of European Union countries in the context of tax burden: cluster analysis"** examines tax burden indicators to classify European Union countries into four clusters, using data from 2009 to 2021. Through correlation and cluster analyses, it identifies that nations joining the EU later often have lower tax burdens, while earlier members generally exhibit higher burdens. The paper highlights the scope for greater tax harmonization, emphasizing the influence of geographical, political, and historical factors on clustering patterns.

The article **"Correlation between wages and house prices: an analysis of regional differences in the Czech Republic"** examines the relationship between wages and house prices across different regions of the Czech Republic from 2015 to 2023. Using panel regression with fixed effects and interaction terms, the authors found that the impact of wages on house prices varies by region and time period. In Prague, factors such as limited supply and high demand have a greater influence on house prices than wages alone. The

study recommends supporting affordable housing in high-price regions and investing in emerging regions with steadily growing wages and house prices. The findings provide valuable insights for developing regional housing and economic development strategies.

A final, fifth contribution called **"Comparative analysis of financial flows in the healthcare systems of Germany, Austria, and Czechia"** contains a comprehensive analysis that delves into the financial frameworks underpinning healthcare systems in Germany, Austria, and Czechia. By comparing public and private expenditure, health insurance contributions, and administrative costs, the study identifies both challenges and opportunities for savings. Key recommendations include integrating care services, streamlining administrative processes, and leveraging digital health technologies to enhance efficiency. This work contributes to the global discourse on sustainable healthcare financing, offering actionable insights for policymakers navigating demographic changes and rising healthcare costs.

These five studies presented in this issue of ACTA VSFS reflect the interconnectedness of global challenges, from inflation and financial inclusion to tax policies, healthcare financing, and regional housing dynamics. Each underscores the importance of tailoring policies to specific regional, social, and economic contexts while fostering cross-border collaboration and innovation.

By bridging empirical research with actionable recommendations, these works contribute to a deeper understanding of the complex systems shaping our societies. This editorial invites researchers, practitioners, and policymakers to engage with these findings and contribute to the ongoing dialogue shaping the future of economic, social, and healthcare systems.

Doc. Ing. Jan Mertl, Ph.D.

Editor-in-Chief

Post-Pandemic Inflation Dynamics: a Comparative Study of the Fiscal Theory in the Czech Republic and France

PETR MAKOVSKÝ, IRENA DESCUBES, FRANTIŠEK HŘEBÍK

Abstract

Background: In the post-2021 era, Central Europe grapples with enduringly high inflation rates, challenging the effectiveness of conventional monetary policy tools.

Objective: This study aimed to shed light on these complex dynamics, offering insights into the effectiveness of fiscal strategies in an environment where conventional monetary policies appear increasingly inadequate.

Methods: The Fiscal Theory of Inflation offers a straightforward model to examine the financial exchanges between governments and the public within a two-day economic setting. The framework explains the recurring patterns in government borrowing, taxation, and public expenditure, highlighting their impact on inflation and presents the focal point of this study.

Results: Utilizing empirical survey data primarily from the Czech Republic and France, sourced from the Czech Statistical Office, the Czech National Bank, Banque de France, and INSEE, this study engages with the Fiscal Theory of Prices to elucidate these phenomena. Central to this analysis is the Fiscal Theory of Inflation, which argues that unanticipated inflation results in the devaluation of nominal treasury bonds, prompting a corresponding adjustment either in expected primary surpluses or the discount factor. This adjustment is crucial to ensure alignment between the total government debt's actual value and these surpluses' present value.

Recommendation: The study aims to provide insights into these intricate dynamics, offering implications for the efficacy of fiscal strategies in an environment where conventional monetary policies increasingly prove inadequate.

Practical relevance: This paper explores the implications of these persistent inflationary trends, focusing on the imperative of government debt recovery, as recognized by the newly elected government in the autumn of 2021. This research is helpful for any economist who opposes inflation measurement, targeting, or, most importantly, the belief that money grows on trees, allowing the government to fund public expenditures that many view as crucial.

Originality/value: The paper is original, based on the ideas of J.H. Cohrane. The paper is an empirical test of the so-called fiscal theory on the example of France and the Czech Republic.

Keywords
Fiscal Sustainability, Monetary Policy, Inflation, Consumer Price Indices

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E23, E58

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Introduction and overview

Presently, industrialized economies are grappling with one of their most formidable challenges in the real economy: the emergence of excessively high and sustained inflation rates after the global pandemic in 2019-2020 and the later conflict in Ukraine. Notably, the inflation rates within the Eurozone economies are comparatively lower, prompting a multitude of rationalizations. This scenario has seen the application of traditional economic methodologies alongside innovative responses facilitated by exchange rate dynamics.

The study aims to shed light on these complex dynamics, offering insights into the effectiveness of fiscal strategies in an environment where conventional monetary policies appear increasingly inadequate.

The variability of discount rates appears as a critical determinant in the potential for mitigating inflation, as explained by the fiscal Theory of Inflation. This phenomenon extends beyond merely expected future surpluses in governmental finance. It also encapsulates investor expectations about diminished returns on government bonds, positing a theoretical framework where inflationary pressures are likely to recede in an economic downturn.

This perspective, fostered by the fiscal Theory of Inflation, imparts a recalibrated understanding of macro-financial dynamics, particularly concerning national debt and budgetary deficits. In this revised conceptualization, these elements are not fiscal metrics but have significant implications for broader economic trends and policy considerations. This theoretical approach underscores the interconnectedness of fiscal policy, market expectations, and economic cycles. It accentuates the imperative for nuanced understanding and strategic management of fiscal variables to effectively navigate the complexities of inflation control within the contemporary economic landscape. The fiscal Theory of Inflation, thus, serves not only as an analytical tool but also as a guiding framework for policymakers in reshaping economic strategies in alignment with evolving market realities.

In the Czech Republic, the recent overhaul of the Central Bank's governance, involving the regrettable removal of the governor and banking board, has culminated in the

new board electing to continue the trajectory set by its predecessors. This path is contentiously characterized by aggressive monetary constraints, notably the elevation of basic interest rates following their rapid reduction during the COVID-19 pandemic. The current strategy of the central bank's board of directors, adopting a cautious 'wait-and-see' approach, has compelled them to intervene in the currency rate, diminishing the nation's foreign exchange reserves. This situation focuses on the contemporary Fiscal Theory of Inflation, which the Czech Republic's administration is presently using as a foundation for advocating the restoration of public finances. However, it is discernible that specific measures undertaken may be more politically driven than economically rational. In addressing such complex issues, an open-minded approach is paramount, given that proposed solutions often worsen problems rather than resolve them, irrespective of their origin. Political factions often perceive crises as opportunities to advance their populist, ideologically driven agendas.

As a benchmark for comparison, France is chosen as one of the most developed E.U. countries. Furthermore, France is characterized by a robust public sector. We expect a different reaction compared to the situation in the Czech Republic, in which the public sector is weakened.

Literature Review

Recent literature explores the fiscal theory of inflation, particularly in economies with persistent primary budget deficits, despite the risks of growing national debt. Brunnermeier et al. (2020) examine factors leading to low inflation rates in such economies, showing a pivotal link to the government bond market. The discrepancy between lower government bond yields and higher economic performance, noted by Cochrane (2023) and Brunnmeier (2020), challenges traditional fiscal perspectives.

Cochrane (2001) disrupts conventional thinking by arguing that the nominal debt value and future state budget surpluses do not solely determine economic prices, highlighting the significance of government debt's maturity structure. His VAR-based empirical analysis (Cochrane, 2023) further reveals that changes in discount rates predominantly drive unexpected inflationary trends.

Bianchi et al. (2023) suggest that post-pandemic fiscal policies are primary inflation drivers, supported by the stabilization effects seen in the U.S. following COVID-19 legislation. Kim (2023) introduces a structuralist view, linking inflation to structural variables like labor share, while Corhay et al. (2023) posit that adjusting the national debt's maturity structure can mitigate inflationary shocks.

Makovský (2022) provided a comprehensive analysis of the term structure of interest rates across Central Europe, a crucial aspect for understanding the region's financial dynamics. His review aims to synthesize the key findings from this and related studies, mainly focusing on the nuances of term premiums in Central European nations. In the

Czech Republic, Brůna's (2006) research played a pivotal role in examining the influence of the central bank's repo rates on immediate adjustments in swap and forward rates. His study, spanning a decade from 1998 to 2008, revealed that despite disinflationary policies, these monetary tools had minimal immediate impact on market rates. This observation suggests a lag in the market's response to central bank policies, underscoring the complex relationship between central bank actions and market reactions. Brůna's findings also pointed to the diminished credibility of the central bank due to inaccurate investor expectations about economic growth, impacting the country's trajectory towards a low-inflation state.

Creel (2016) and Aldama and Creel J. (2017) developed the Regime-Switching Model-Based Sustainability test, allowing for periodic (or local) violations of Bohn's (1998) sustainability condition. They assume a Markov-switching fiscal policy rule whose parameters stochastically switch between sustainable and unsustainable regimes. Their findings are about how long-run fiscal sustainability depends on regime-specific feedback coefficients of the fiscal policy rule and the average durations of fiscal regimes. Initially, the importance of fiscal policy in France was strengthened after WFC 2008, as described in Creel et al. (2009) and Creel et al. (2005).

Compared to France in the Czech Republic, Mackiewicz-Łyziak, J. (2015) speaks about assessing fiscal sustainability in the Czech Republic, Hungary, and Poland. She tests the existence of fiscal dominance in these countries in the context of the fiscal theory of the price level. The empirical study uses unit root tests and co-integration analysis with possible structural breaks. The approach is consistent with the backward-looking approach for fiscal dominance testing proposed by Bohn (1998). The results suggest that fiscal dominance prevailed in the Czech Republic and Poland in the analyzed period, while monetary dominance prevailed in Hungary. The result for Hungary may be caused, however, by a one-time reduction in debt resulting from changes in the pension system. Mackiewicz-Łyziak, J. (2016) also develops the findings on the effects of inflation targeting in the CEE countries. Wesołowski (2018) contributes with the effects from the real economy variables evidence from Poland. Kučera et al. (2017) created a decomposition of the Czech treasury bonds yield curve to show the effect of expectations on the price level change. A similar analysis was conducted in Hungary by Kicsák (2017).

Cochrane (2023), a leading authority in the Fiscal Theory of Inflation, has dedicated years to examining the fiscal underpinnings of inflation. The financial ramifications of the pandemic particularly galvanized his commitment to developing this theory. A historical parallel can be drawn with the U.S. economy during World War II, which was able to fund the war effort due to a transformed economic reality – a contrast to the Cold War era, which, despite its significant expenditures, fortuitously bolstered the USA's global standing. Furthermore, the U.S. has experienced robust long-term GDP growth, primarily attributed to supply-side factors such as labor productivity and technological advancement, with only a marginal expansion in social security systems. The U.S. has also historically maintained low-interest rates and exerted control over financial capital through stringent financial regulation. Neither the United States, the Czech Republic, nor France exhibit these conditions.

Kladívko (2010) added another dimension by approximating the yield curve of Czech government bonds. His interest in applying forward rate dynamics to forecast errors sheds light on the challenges of accurately predicting market movements. The absence of a fully developed yield curve model for Czech government bonds during this period highlights the limitations and potential areas for further financial modeling and forecasting research. Kučera et al. (2016), employed by the Czech National Bank, made significant contributions by validating the structure of futures premiums. Their efforts to deconstruct the yield curve into its constituent parts provided valuable insights into market expectations for upcoming macroeconomic changes and investors' risk perception. This approach enhanced the understanding of futures premiums and revealed essential trends in risk-neutral rates and term premiums. The post-2009 financial crisis period is particularly notable for the observed trends in falling term premiums and risk-neutral rates, characteristics indicative of declining bond yields. This period also saw an increased focus on credit risk, a direct consequence of the financial crisis's impact on global markets.

Kladívko and Sterholm (2019) present a significant analysis of the Swedish economy's key financial indicators, proving a notable performance against the stochastic random walk method across various financial horizons. Their research explicitly highlights four critical financial indicators, displaying their predictive accuracy over specific timelines. The random walk model outperformed market predictions for the five-year Treasury yield and the repo rate over extended periods. However, the research shows no significant differences in forecast accuracy between the SEK/USD and SEK/EUR exchange rates, suggesting predictability and stability in these currency pairs. This analysis contributes to a deeper understanding of the Swedish financial market's behavior, particularly in terms of long-term consumption and the structure of interest rates. The ability of the random walk model to outperform market participants in specific scenarios while showing parity in currency exchange rate predictions offers valuable insights into market efficiency and the predictability of financial indicators in the Swedish economy.

Further, Joyce et al. (2010) explore U.K. interest rates dating back to October 1992. Their model introduces an arbitrage constraint between nominal and real yields, breaking interest rates into several components: expected exact interest rates, expected inflation, the actual premium, and inflation itself. This model offers a comprehensive framework for understanding the dynamics of U.K. interest rates and their underlying drivers. By decomposing interest rates into these fundamental elements, Joyce et al. illuminate the complexities of interest rate movements and their correlation with economic variables.

Greenwood et al. (2015) delved into central banks' monetary policy tools in developed nations, focusing on forward guidance and quantitative easing (Q.E.). Their study highlights how Q.E. alters the maturity structure of publicly available government debt by buying long-term government bonds and other securities. This alteration impacts bond risk premiums and long-term interest rates by shifting the duration risk borne by market participants. Similarly, forward guidance significantly influences long-term rates by signaling the central bank's commitment to maintaining low short-term rates in the future. These tools, pivotal in modern monetary policy, are critical in shaping the interest rate landscape and influencing economic behavior.

Continuing the examination of global financial dynamics, Bauer and Rudebusch (2016) address the structural issues influencing long-term interest rates. Notably, they show slower productivity growth and excessive global savings as critical factors contributing to the historically low levels of long-term interest rates. This environment of low rates has likely led to reduced expectations for steady-state interest rates, further driving these rates down over extended periods. The implications of this trend are significant, as it affects the overall investment climate and economic growth potential. Furthermore, Bauer and Rudebusch (2016) saw that the term premium on long-dated bonds has diminished, a trend likely influenced by accommodating monetary policies implemented both domestically and internationally. This decrease in term premiums affects a range of financial instruments and markets, notably affecting returns on futures, which are inherently expectation-based. The dynamics of these long-term interest rates and term premiums offer essential insights into the current state of global financial markets and monetary policy effectiveness.

The Fiscal Theory of Inflation, while receiving high regard in theoretical circles, confronts the practical challenge of persistent inflation in developed economies, particularly after the 2021 pandemic crisis. This period marked a distinct shift in inflation dynamics, diverging from traditional fiscal explanations. Data show that central banks and monetary authorities need to work on effectively controlling this persistent inflation. This challenge is notably prevalent in Central and Eastern European countries, which experience some of the highest inflation rates regardless of their currency alignment.

This literature review shows the gap in empirical research concerning the impact of fiscal stimuli on inflation, specifically in the Central and Eastern European context. This article aims to bridge this research gap by exploring the connections between national debt indicators and inflation, using the tools and concepts of the Fiscal Theory of Inflation. Doing so aims to provide a more comprehensive understanding of the fiscal drivers of inflation in these regions, offering valuable insights for policymakers and economists in addressing the challenges of post-pandemic economic recovery and stabilization.

Methodology of Fiscal Theory

The Fiscal Theory of Inflation, as discussed by Cochrane (2023), offers a straightforward model to examine the financial exchanges between governments and the public within a two-day economic setting. This framework explains the recurring patterns in government borrowing, taxation, and public expenditure, highlighting their impact on inflation and presents the focal point of this study.

Well before Cochrane, Sargent and Wallace's hyperinflation theory (1981) examined how monetary policy can lead to rapid price increases when fiscal policies are unsustainable. Their framework suggested that government deficits, financed by money creation, can spiral out of control if not complemented by fiscal discipline, ultimately leading to hyperinflation and eroding the value of the currency. They argued that in situations where

government debt is high and fiscal policy remains fixed, monetary authorities may have limited control over inflation rates.

Sims (2011) presented a seminal approach to understanding macroeconomic dynamics by emphasizing the significance of incorporating policy analysis into econometric models. He argued that traditional econometric methods often miss capturing the inherent complexities and interdependencies of economic variables over time. By employing Vector Autoregressions (VARs), researchers can better account for these factors, allowing for a more nuanced and accurate depiction of economic phenomena according to him.

Finally, Bianchi and Melosi (2019) provided a comprehensive exploration of macroeconomic dynamics, primarily focusing on the dynamics of monetary policy and its broader implications on economic stability. Their work is grounded in the context of post-financial crisis economic landscapes, where they analyze how central banks can manage the dual objectives of inflation stabilization and economic growth. By employing econometric models, Bianchi and Melosi assessed how expectations and forward guidance played vital roles in shaping outcomes in unconventional monetary policy environments.

For the purpose of clear framing of this study, we shall focus on the critical aspect of the assumption that individuals only keep money after some time in the Fiscal Theory of Inflation model (Cochrane, 2023). It leads to two distinct economic behaviors: some individuals, having a surplus after paying taxes, increase their consumption and buy more products and services, while others, facing a shortage, are compelled to liquidate assets to fulfill their tax obligations. When the total purchases surpass total sales, it creates a condition where aggregate demand exceeds aggregate supply, contributing to inflationary pressures.

The government's role in this model is pivotal in influencing inflation. Printing money in the morning to redeem bonds and then "burning" the money collected from taxes in the evening is a simplified representation of fiscal activities. When the government issues more debt than it can cover through taxation, it requires the authorization of future primary surpluses for the next day. Inflation can be further worsened when the government, facing inflation on the first day, collects more nominal taxes in the evening, potentially leading to an imbalance in the fiscal cycle. The possibility of increasing transfers, which future primary surpluses may partially cover, adds another layer of complexity to this model. It highlights the delicate balance governments must keep between issuing debt, managing taxation, and controlling inflation.

It is essential to delve deeper into the relationship between government debt and inflation, particularly in primary surpluses and their present value. According to the Fiscal Theory of Inflation, the present value of real primary surpluses equates to the actual worth of nominal debt. This concept suggests that a government with significant debt yet supporting financial stability might not induce inflation. Such a government could effectively run primary surpluses, balancing its financial obligations without resorting to inflationary measures. Conversely, a government with minimal debt might face inflationary pressures if public confidence in its fiscal management, particularly its ability to finance

and realize future deficits, wanes. The key determinant in such scenarios is the present worth of the primary surpluses. Hence, to avert acceleration in inflation, especially when discount rates are high, a government must aim for more significant surpluses, as greater discount rates reduce the present value of these surpluses.

This analysis leads to the understanding that primary surpluses play a dual role in enforcing inflation. First, they act as a measure of a government's fiscal health, and second, the level of these surpluses compared to interest rates influences the total interest payable on government debt. Higher interest rates, by increasing the interest part of the government debt, can reduce primary surpluses, thereby influencing inflation. The Fiscal Theory of Inflation does not hinge on a unique demand for money or financial frictions. It is indifferent to why individuals engage with government-issued money or alternative financial instruments.

Managing the money supply, whether through the gold standard or pegged exchange rates, is optional under this framework. As Adam Smith initially noted, this perspective distinctly separates the Fiscal Theory of Inflation from monetarist and neo-Keynesian price level theories. Thus, the Fiscal Theory of Inflation provides a comprehensive framework for understanding the intricate dynamics between government debt, primary surpluses, and inflation. It highlights the importance of public confidence in fiscal policy, the impact of interest rates on government debt, and the pivotal role of primary surpluses in maintaining economic stability.

In the Fiscal theory of inflation's two-day model, the first day sets the foundational dynamics of the government's interaction with the public about taxation and bond issuance. On this first day, the government's primary activity is to issue bonds to cover its previous debt obligations. The public, in response, buys these bonds with their available funds, essentially lending money to the government. As the day progresses, individuals engage in their usual economic activities. A crucial transition occurs by evening: the government collects taxes from its citizens. Tax collection is pivotal in this model as it is not just a revenue-generating mechanism for the government but also a means to regulate the money supply in the economy. The end of the first day in this model sets the stage for the second day's activities.

The government's approach changes on the second day of this two-day economic model. Unlike the first day, the government does not issue any new bonds. Instead, it focuses only on collecting taxes and paying off its total debt. This shift leads to an interesting economic situation with virtually no demand for more money. Here is where we see a direct link to inflation. People who do not have enough money to pay their taxes are obliged to sell their possessions. If this leads to more people wanting to buy than sell, the demand in the economy overshadows the supply. This imbalance results in too much money chasing too few goods, causing prices to rise. The rise in price levels continues as the government collects more taxes and does not issue new bonds. Essentially, the extra money that the government pumped into the economy on the first day to settle its debts gets absorbed back as taxes. The cycle of spending, taxing, and not issuing new bonds on the second day increases price levels until the extra money in circulation is balanced by the taxes collected.

So, in this simple two-day model, we see how the government's decisions on bond issuance and tax collection can directly impact inflation. It illustrates the delicate balance governments must maintain in their fiscal policies to prevent inflation from spiraling. The cycle of issuing bonds, tax collection, and government debt repayment, intricately woven over these two days, brings to light the complex relationship between fiscal policy, public economic behavior, and inflation.

The culmination of the two-day cycle manifests in a scenario where escalating price levels persist until the augmented monetary supply, initially infused by the government to settle nominal debts, is effectively neutralized by accumulating primary surpluses through evening tax collections. This intricate interplay of fiscal activities – encompassing bond issuance, tax levying, and debt redemption – unfolds throughout the delayed period, explaining the multifaceted interdependencies between fiscal policy, public economic conduct, and the phenomena of inflation. This dynamic underscore the pivotal role of fiscal policy in steering economic conditions, where the government's strategic decisions in financial management directly influence market liquidity and purchasing power. The increase in price levels, a direct consequence of these fiscal maneuvers, shows the delicate balance that governments must strike in their economic stewardship to regulate inflationary tendencies. Moreover, this theory provides a framework for understanding how government actions in the financial realm reverberate through the economy, affecting public behavior and market stability. It highlights the criticality of synchronizing fiscal policy with economic realities to keep equilibrium within the financial ecosystem.

During the first day, the government initiates the issuance of bonds to repay past obligations, prompting citizens to purchase these bonds using their accessible resources. This initial transaction lays the foundation for subsequent economic engagements as individuals continue daily business exchanges. By the end of the day, a reversal occurs: citizens remit taxes while the government introduces new bonds for the subsequent day. This continuous cycle facilitates the transfer of funds back to the public, ultimately offsetting the expenses of previously issued bonds. On the following day, this dynamic continues with similar operations, maintaining the cyclical nature of fiscal activities that aid in managing inflationary pressures.

Data and Results

In this empirical investigation was used secondary data procured from the Czech National Bank (CNB) and the Czech Statistical Office (CZSO), encompassing an array of economic indicators. These files formed a time series of data on key economic variables such as interest payments, deficits, primary deficits, and Gross Domestic Product (GDP). Additionally, to provide a more comprehensive analysis, we juxtaposed these findings with the time series data of the Consumer Price Indices (CPI), which were computed based on the prices from the previous year. The analysis involved evaluating the frequency percentages of each variable annually, covering the period from 1995 to 2022, thereby yielding eighteen observational data points.

Our study defines' inflation' as the annualized average percentage change in the CPI according to national accounting principles ESA (European Statistical Accounts). One of the primary focal points of our comparison involved examining the ratios of government debt to GDP and primary deficit to GDP, commonly referred to as the Maastricht criteria. Our findings indicated a pronounced correlation between the time series of the primary deficit/GDP ratio and the CPI percentages, particularly in the period spanning from 1999 to 2019. This observation is pivotal in understanding the dynamics of inflation about fiscal variables.

Cochrane (2023) provided a counter-perspective to the notion that the post-World War II economic growth in the United States was predominantly driven by high government debt. Our analysis reveals that after this period, the U.S. government debt experienced a gradual decline caused by inflation, the generation of primary surpluses, GDP growth, and relatively low-interest rates. This trend suggests that both surpluses and deficits significantly influence the value of government debt. Interestingly, surpluses in our study showed characteristics akin to s-shaped processes rather than showing positive correlations or following first-order autoregressive stochastic processes.

Considering historical records, it becomes clear that the surge in inflation within the United States during the 1970s was predominantly attributed to structural phenomena rather than primary deficits per se. This inflationary trend coincided with the dissolution of the Bretton Woods system, a consequential devaluation of the dollar, and the start of inflation. Subsequently, the economic expansion post-1982 fostered considerable primary surpluses, directly influencing the debt-to-GDP ratio and signaling the cessation of inflationary pressures. Cochrane (2023) posits that an efficacious strategy for inflation control requires an integrative approach encompassing monetary, fiscal, and microeconomic policies. Fiscal reforms should aim at tax augmentation and microeconomic modifications that bolster GDP growth, thereby enhancing governmental revenue streams. The United States' experience, as delineated by Cochrane, suggests that the termination of inflation was primarily a result of these microeconomic and fiscal alterations.

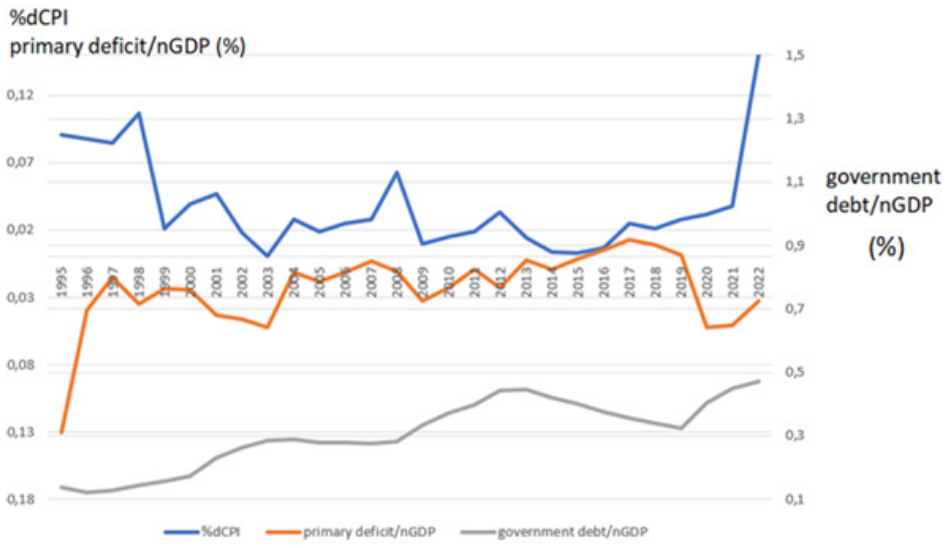
In the ensuing decades, particularly post-2000, and more acutely after 2008 and 2023, the fiscal landscape of the United States underwent significant transformation. The prior trend of primary surpluses shifted towards primary deficits, especially pronounced over the past two decades. Government budgets often register surpluses during economic recovery phases, albeit accompanied by rising inflation rates. This phenomenon shows a robust correlation between primary surpluses, unemployment rates, and inflation, challenging the fiscal theory to develop more sophisticated predictive models that transcend this clear correlation.

The readiness of bond investors to lend to the U.S. government at low-interest rates, grounded in their understanding of the manageability of the country's World War II-incurred debt, has been a longstanding feature of the financial markets. However, anticipating long-term risks and expanding the treasury bond market have precipitated chronic inflation issues. In this context, monetary policies alone appear insufficient to rectify these challenges. The pivotal first measure, as advocated, is the enhancement of investor confidence through comprehensive tax reforms and microeconomic restructuring, both of which are instrumental in stimulating economic growth and augmenting income tax

revenues. While not predominantly influential, monetary policy's role is supportive, yet it may sometimes introduce conflicting outcomes in the economic scenario.

To offer a thorough empirical examination of the Czech Republic, it is essential to emphasize the significant expansion of its public debt over time. Beginning nearly from zero in 1990, the debt escalated to 45% by 2022. While this level of debt is relatively low compared to other developed countries, it has been steadily growing. More precise government strategies must be used to reduce this debt-to-GDP ratio, which might give creditors some confidence. The Czech economy is notably open, comparable to some of the most open economies among developed nations. This openness could be advantageous, mainly if it follows the prudent economic behaviors of larger economies. Investor attitudes towards Czech bonds are influenced by the perceived sustainability of public debt in larger economies like the U.S. or Europe. The data from the Czech Republic shows a positive link between inflation and primary surpluses or deficits, but this depends on public belief in staying stable. The inflation rate and primary surpluses do not always move together when the economy transitions. The Czech economy can be divided into two pivotal periods: pre-1999 and post-2018. This distinction contrasts with the U.S. experience in the 1970s, which was characterized by a supply shock. Analyzing Czech data reveals that a rise in the primary surplus typically leads to an initial inflation increase, followed by a subsequent decrease. However, inflation tends to persist when the government debt to GNP ratio gets too high, especially during significant drops in GDP. This observation suggests that the mechanisms by which inflation permeates the economy could be more intricate than the amount of money in circulation. Employing the Taylor rule for inflation targeting improves the central bank's capacity to regulate crucial interest rates. Such an approach could serve as a fundamental aspect of controlling inflation through fiscal policy, underscoring the necessity for policies that account for both fiscal and monetary influences.

Figure 1: Inflation in comparison to the government debt (the Czech Republic)



Source: own calculations in the MS Excel

Table 1: Characteristics of the time series (The Czech Republic)

	Mean	Median	Standard deviation	ADF test (p-value)	DW stat.	J-B test (p-value)
%dCPI	0,037857	0,0265	0,035231	0,31	1,61	16,064 (0,001)
primary deficit /nGDP	-0,02409	-0,0206	0,027654	0,0001	1,35	49,452 (0,000)

Source: Own output in Eviews (p-values in parentheses)

We see that time series statistical features offer pertinent data. The CPI dynamics first adopt traits from the financial market. Though it is undeniably nonstationary, its differences stay stationary. The primary deficit to nominal GDP ratio appears constant compared to the CPI trends. According to how closely it relates to the political cycle, it is significantly more rigid and dependent on the real economy. This information could be more dependable because of the short duration of the observation period and the small number of observations. However, it is essential to note the statistical aspects. We do not intend to develop any simulations or prediction models for this study because it is primarily comparative. No data features regarding the nominal GDP ratio or government debt have been examined.

Case Study: Czech Republic

The data shows a significant correlation between government debt and inflation rates in the Czech Republic. An in-depth analysis of this relationship reveals how fiscal policies, particularly in the post-2020 period, have influenced inflationary trends. The case study includes graphical representations of data trends and a statistical analysis highlighting key findings.

To provide complete empirical evidence about inflation, we will discuss the statements of inflation of the Ministry of Finance in the Czech Republic and the same statements from the Czech National Bank (CNB, Czechia Central Bank). The significant inflation dynamic increase started in 2021.

In January 2021, M.F. ČR stated about inflation that the fourth quarter of 2020 saw a marked slowdown in the annual growth of consumer prices, with the inflation target set by the Czech National Bank falling back below the upper 3% tolerance band. At the same time, the environment marked by a decline in consumer demand appears to be gradually overcoming supply-side economics frictions, and there has been a noticeable slowdown in the growth of food prices. 2020 saw an average inflation rate of 3.2%. More significant

pro-inflationary factors should be absent in 2021 (apart from oil prices), and inflation should moderate to 1.9% because of declining unit labor costs and a continuing negative output gap.

The CNB spring Monetary Policy Report from 2021 indicates that at its meeting in May, the Banking Council decided to keep the two-week repo rate at 0.25%, consistent with the new macroeconomic forecast CNB's base case. He expects an increase in interest rates starting in the second half of this year, following the initial period of stability. Growing rates will guarantee that inflation stays stable at the target level as the adverse effects of the coronavirus epidemic diminish in the context of building collective immunity. The forecast carries the potential for the pandemic to subside at a slower pace alongside prolonged closures and a cyclical deceleration in both domestic and international economies. This scenario's potential anti-inflationary effect is juxtaposed with the risk of disruptions in global manufacturing and the supply chains of the world economy.

Autumn 2021 is from the point of view of M.F. C.R. about inflation, which is characterized by the growing rates of inflation turning into serious macroeconomic issues. September 2021 saw 4.9% annual inflation. As a result, inflationary pressures are substantially greater than expected in the macroeconomic forecast from August. Other prices gradually reflect the high cost of energy and other commodities. The primary cause of inflation seems to be supply-side issues, while demand is bolstered by continued rather lax fiscal and monetary policy. Furthermore, the economy will perform better than it could the following year. As a result of the combination of these variables, we have raised our estimate of the average inflation rate for 2021 to 3.5% and for 2022 to 6.1%.

The Autumn 2021 situation of inflation from the point of view of the Central Bank is as follows: the two-week repo rate was increased to 2.75% by the Banking Council during its meeting in November. The CNB's autumn macroeconomic forecast served as the foundation for this choice. It predicts that early in the next year, inflation will approach 7% and continue to rise sharply. The forecast calls for a steady increase in market interest rates at the close of this year and the start of the next. Along with the previously mentioned increase in interest rates, the economy's current exceptionally strong domestic and foreign inflationary pressures will eventually fade, and inflation will start to decline over the upcoming year. Inflation will drop to nearly the level of the horizon monetary policy at the turn of 2022 and 2023. Long-term global production chain overloading poses a risk to this outlook, as it may result in even higher inflation than expected, especially when combined with a declining exchange rate, a notable increase in energy prices, and imputed rent. If public finances are consolidated in 2023, there is a moderate risk that things will go in the other direction. We see the impossibility of CNB to manage inflation alone, and this is the first significant proclamation to the central government.

April 2022 macroeconomic report from the M.F. C.R. describes the situation of inflation in that significant inflation diminishes the population's standard of living and hinders economic growth. This year, the expected average rate of inflation is 12.3%. For the rest of the year, inflation is predicted to be in the double digits year over year, with a peak of over 13% in Q2. The unusually robust increase in consumer prices is expected to be driven mainly by natural gas, electricity, and oil costs. The prices of goods and services later reflect the rising costs incurred by businesses. Supply chain issues and private sector

labor costs will also contribute to inflation. Nevertheless, the increase in the monetary policy rate will lessen domestic demand pressures and help strengthen the koruna relative to the euro, which will have an anti-inflationary effect.

The two-week repo rate was increased to 5.75% by the Banking Council during its meeting in May 2022. This decision is a long-term response to the escalating inflationary pressures brought on by the start of the war in Ukraine, and it is based on the CNB's spring macroeconomic forecast. inflation will reach 15% in the upcoming months. It will concern the ongoing increases in household gas and electricity costs, the ongoing acceleration of the growth in food prices, and the ongoing high core inflation. The tightening of domestic credit markets and the extraordinary price pressures will slow down if inflation falls below 10% at the start of next year. As a result, inflation will keep declining quickly before moderating to almost reach the 2% target in the second half of 2023. According to a basic forecast scenario, market interest rates will continue to rise sharply until the second half of this year and gradually decline from this fall. The central bank will set interest rates to meet the 2% target over the standard monetary policy horizon regardless of the source of inflationary pressures. The Central Bank Council decided that substantial risks and uncertainties were associated with the spring forecast's base scenario in both directions. Before deciding, it evaluated the sources of the rising inflationary pressures, primarily powerful external price shocks. As a result, the banking board chose to slightly tighten monetary policy instead of the forecast's base case. It examined the simulation's tone, which had a longer monetary policy horizon than his, and the standard setting in the CNB forecasting device.

M.F. C.R. Winter Report 2022 states that elevated inflation diminishes the population's standard of living and hinders economic growth. The energy-saving package should result in a significant decrease in inflation year over year in the fourth quarter. Thus, this year's average rate of inflation should be 15.0%. The extraordinarily robust increase in consumer prices is mainly due to the contribution of various categories of goods and services, as well as food, fuel, electricity, natural gas, and imputed rent. Domestic demand pressures also contribute to inflation, but the prior rise in monetary policy rates should mitigate them. This factor should support the koruna's strengthening versus the euro over the forecast period, which will have an anti-inflationary effect in addition to the current foreign exchange interventions. By 2023, the typical average inflation could slow to 9.5%.

In comparison, the Czechia Central Bank Winter Report 2022 speaks about how the two-week repo rate was increased to 4.50% by the Banking Council during its meeting in February.

The CNB's winter macroeconomic forecast served as the basis for this decision, which was made in response to the persistently high pressure on inflation domestically and internationally. The rise in market interest rates at the start of this year aligns with the prognosis. Throughout the year's first half, inflation will increase to 10%. This will consider several factors, including the rise in core inflation and the cost of gas and electricity. The extreme strength of price pressures will be eliminated, and tighter domestic monetary policy will contribute to this. As a result, inflation will begin to decline in the third quarter of this year. Inflation is expected to drop sharply at this year's and next year's

turning points and approach the 2% target in the first half of 2023, the monetary policy horizon. These are the risks associated with this outlook. In general, the monetary section supports inflation. Weakening in this direction poses a particular risk to anchored inflation expectations, and the koruna exchange rate potentially strengthens more slowly due to a sharp tightening of foreign monetary policy. Conversely, consolidating public finances poses a moderate risk in the direction of anti-inflation.

Finally, in the 2023 spring report, M.F.C.R. announces persistent inflation. Moreover, inflation diminishes the population's standard of living and hinders economic growth. The extraordinarily robust increase in consumer prices is mainly due to the contribution of various categories of goods and services, not just food, electricity, natural gas, or imputed rent. Domestic demand pressures also contribute to inflation, but higher monetary policy rates should mitigate them. Additionally, the strengthening of the koruna has a deflationary effect. Inflation should drop sharply year over year in the first half of this year before rising to high single-digit levels in the second. The base effect of the energy-saving tariff will be applicable in the year-over-year comparison at the end of the year. The annual growth in consumer prices for 2024 may already be in the upper half of the tolerance band of the Czech National Bank's inflation target. As a result, the average inflation rate may rise to 10.9% this year and then decrease to 2.4% in 2024.

The CNB report from May 2023 is about how the Banking Council kept the two-week repo rate at 7%. The fundamental scenario of the CNB's spring macroeconomic forecast is the basis for this decision. Here, the central bank considers a monetary policy horizon of 12 to 18 months. Currently, these are the second and third quarters of 2024. First, the base scenario spring forecasts align with the market interest rates remaining stable at their current high level, guaranteeing that the inflation target will be met in the upcoming year. Considering that, interest rates are expected to be reduced in the latter part of this year. Domestic economic activity will be muted at the beginning of this year since the Czech economy's performance will be further hampered by a sharp decline in real household incomes and sluggish expansion in foreign demand. There will be an economic recovery in the upcoming year. Domestic inflation will drop further in spring and summer, reaching single-digit levels by mid-year. Price growth will drastically slowdown in 2024 and reach the CNB's 2% target on the monetary policy horizon. The board for banking assessed that the fundamental scenario of the spring macroeconomic forecast carried distinct and significant risks and uncertainties. The Banking Board deliberated over two additional prognostic scenarios and the basic scenario. These presuppose longer-term interest rate stability at the current level, and one of them alerts policymakers to the possibility of overshooting the inflation target on the monetary policy horizon when paired with higher inflationary expectations.

The Autumn Report 2023 from M.F. C.R. expects an inflation rate of 3-4 %. Hopefully, this will end the persistent abnormal price level increase in the Czech Republic for the last two years. This year, high inflation also lowered the population's living standard and slows economic growth. The extraordinarily robust increase in consumer prices is mainly because of the contribution of various categories of goods and services besides food, electricity, and natural gas. Raising monetary policy rates is already reducing the strength of domestic demand pressures. This year, inflation quickly fell year over year, but the base effect of the energy-saving tariff will cause inflation to rise in the fourth quarter. This year,

the average inflation rate might be as high as 10.8%. The annual growth in consumer prices could be between 3 and 4% in 2024. For the entire year, we expect a decrease of 3.3%.

The latest 2023 report from the CNB describes how the period of high inflation is still fading. However, because of the statistical impact of last year's inclusion of the savings allowance energy tariff to the consumer price index, it was suspended in October, and inflation will rise year over year. However, this effect will end in January, and inflation will decline annually to the upper bound of the target's tolerance band. The notable abatement of recent large price shocks and the discernible reduction in domestic inflationary pressures cause persistent dis-inflationary trend results. It can also be observed in core inflation decrease, which shows how the tight monetary policy dampens inflation. The likelihood of low inflation values in the upcoming year may make it seem unnecessarily tight to keep the current monetary policy setting. Therefore, a drop in interest rates is consistent with the monetary section's basic scenario, which calls for rates to decline in the fourth quarter of 2023. The Banking Board decided that there were significant risks to the outlook and forecast uncertainties and that these risks were moving toward inflation. They are especially vulnerable to increased inflationary expectations, which may materialize in wage negotiations and create a more substantial revaluation at the start of the following year. Thus, the Banking Council kept the two-week repo rate at 7% at the November 2023 meeting.

Case Study: France

In France, the inflationary trends are meticulously monitored and analyzed by the Banque de France and the Institut National de la Statistique et des Études Économiques (INSEE). From the Banque de France database, the "Inflation Expectation Report" spanning from the third quarter of 2023 to the current date was identified, derived from the broader document titled "Macroeconomic Projections." This section elaborates on the inflation--related insights encapsulated in these projections.

December 2020: Macroeconomic Projections revealed a cautious outlook on inflation within a deteriorating macroeconomic context. The projections anticipated a gradual reinforcement of inflation, which was expected to remain subdued across the projection horizon. Based on preliminary flash estimates, a significant reduction in the Harmonized Index of Consumer Prices (HICP) was observed, decreasing from 1.7% at the beginning of the year to 0.1% in October and 0.2% in November. This decline was primarily due to a substantial drop in energy prices in the first quarter of 2020, which only saw a partial recovery subsequently. Additionally, a consistent deceleration in service prices, especially in the transportation and accommodation sectors, and temporary price increases in certain services due to new health measures were noted. These factors, however, were transient and did not have a lasting influence on the general inflation trajectory.

March 2021: Projections highlighted an expected volatility in inflation, with a temporary uplift anticipated in 2021, followed by a period of containment in 2022 and 2023. January 2021 saw a surprising uptick in HICP inflation due to a trio of contributing factors: a notable recovery in oil prices beyond the projections of December 2020, a postponement

of winter sales affecting manufactured goods inflation, and an unexpected resilience in service prices in the short term due to specific sectoral increases. These developments led to an upward revision of the inflation forecast 2021, reflecting these unanticipated factors alongside a reevaluation of oil price forecasts and labor market conditions.

June 2021 and September 2021: Projections adjusted inflation expectations considering changing commodity prices and the momentum of economic recovery. The June update predicted a marked increase in inflation in 2021 driven by heightened commodity prices, with an expected stabilization of around 1.2% in the subsequent years. By September, the projections affirmed a significant resurgence in headline inflation, propelled by oil price rises and a revival in inflation excluding food and energy, with moderate increases projected for the following years.

December 2021: The projection envisaged headline inflation peaking near 3.5% towards the end of 2021, heavily influenced by the energy sector, before moderating to below 2% by 2022. This trend was forecasted to stabilize, with inflation expected to oscillate around 1.5-1.6% in 2023 and 2024, supported by a resurgence in service prices.

As the projections moved into 2022, adjustments were made to account for the impact of the Ukraine and other macroeconomic variables. The March 2022 Projection expected higher inflation rates for 2022 and possibly 2023, driven by the conflict's impact on energy prices and supply chain disruptions. This scenario underscored the significant uncertainties and potential for increased inflation rates, dependent on the economic impacts of the conflict and the paths to recovery.

This year-by-year analytical approach underscores the complexity and variability of inflationary trends in France, shaped by a confluence of global and domestic factors, including shifts in energy prices, the post-pandemic economic recovery, and geopolitical tensions. The Banque de France's projections offer a detailed and nuanced understanding of these dynamics, providing valuable insights into the expected evolution of inflation within the French economy over various time horizons.

The December 2022 macroeconomic projection delineated an expectation that inflation would reach its zenith in the first half of 2023, after which it embarked on a downward trajectory towards 2% by the end of 2024 and into 2025. The Harmonized Index of Consumer Prices (HICP) has been on an upward trend recently, culminating at 7.1% in November. This inflationary surge, unprecedented in recent history, was initially propelled by the post-Covid recovery dynamics of 2021 and further worsened in 2022 by the conflict in Ukraine, leading to a dramatic increase in energy prices. The cascading effect of these shocks had permeated other inflation components, which were escalating at rates significantly above long-term averages. Specifically, food prices have ascended beyond 10% since October, fueled by heightened production costs and supply deficits for certain commodities. Concurrently, manufactured goods inflation had surpassed 5% since November, driven by robust growth in production costs, which was only gradually being transmitted to consumer prices. Although industrial production prices began decelerating in the latter half of the year, there was an anticipation of a moderation in consumer prices for manufactured goods moving forward. Services inflation, while accelerated, had remained relatively subdued (below 4% in recent months), primarily driven by wage inflation, as evidenced by adjustments to the minimum wage (salaire

minimum interprofessionnel de croissance, SMIC) and sector-specific wage negotiations.

The March 2023 macroeconomic projection indicated that inflation, excluding energy and food, was expected to peak slightly later than headline inflation before gradually subsiding and converging towards 2% by the end of 2024 into 2025. This divergence in inflationary trends over the projection horizon was anticipated to be marked by distinct temporal and component-specific variations, facilitating the economy's gradual adjustment to past shocks—a cornerstone for sustainable growth. After reaching 7.1% in October and November 2022, inflation, as measured by the Harmonized Index of Consumer Prices (HICP), declined to 6.7% year-on-year in December amidst falling energy prices following a sharp drop in oil prices. However, headline inflation temporarily increased again to 7.0% and 7.3%, respectively, year-on-year in January and February 2023. Core inflation, excluding energy and food, was recorded at 4.2% in January and 4.6% in February. During these months, the energy component of the index was bolstered by a 15% hike in regulated gas and electricity prices in January and February, respectively. Food prices, and to a lesser extent, manufactured goods prices, continued to rise rapidly, reflecting the strong growth in producer prices observed in mid-2022. After remaining stable at 3.6% year-on-year from October 2022 to January 2023, services inflation slightly increased to 4.0% in February 2023.

Throughout 2023, headline inflation markedly declined, particularly in the year's second half, with the annual average rate settling at 5.4% and inflation excluding energy and food at 4.3%. Both headline inflation and inflation excluding energy and food were expected to align at 3.8% year-on-year in the fourth quarter of 2023. This significant reduction in inflation was primarily attributed to changes in the energy and food components. Firstly, despite being driven by the increased regulated gas and electricity prices in early 2023, energy inflation was expected to quickly subside within the year as international wholesale prices, which had begun to fall in the fourth quarter of 2022, continued their downward trajectory. Unlike before 2021, when wholesale energy prices were quickly passed through to consumer prices, the pass-through of current gas prices to consumer prices was being tempered by the price shield, making it weaker and slower. Secondly, food inflation was projected to remain more persistent in the first half of 2023. This persistence could be particularly reinforced by a rise of around 10% in the prices paid by large retailers to suppliers of major food brands, a development announced after the conclusion of negotiations between manufacturers and large retailers on 1 March. While these negotiations are a distinctive aspect of the French market, leading to comparatively lower food inflation in France than in neighboring euro area countries in 2022, a catch-up effect was anticipated in the subsequent months. Following the peak in the second quarter, food inflation was expected to recede, aided by the anticipated easing of agricultural input and international agricultural commodity prices. For the other components of inflation, excluding energy and food, the impact of past shocks was anticipated to persist, affecting non-energy goods prices for some time. Services inflation, in particular, was expected to remain more persistent throughout the year, propelled by wage increases resulting from the upward revisions to the SMIC and industry-level negotiated pay raises.

In 2024, the anticipated easing of energy and food commodity prices, as projected by futures markets, is expected to lead to a decline in all components of inflation, except for

services prices, which are likely to continue being supported by delayed wage and rent adjustments. HICP inflation, excluding energy and food, is projected to decrease to 3.0% annually, with headline inflation expected to drop sharply to 2.4%.

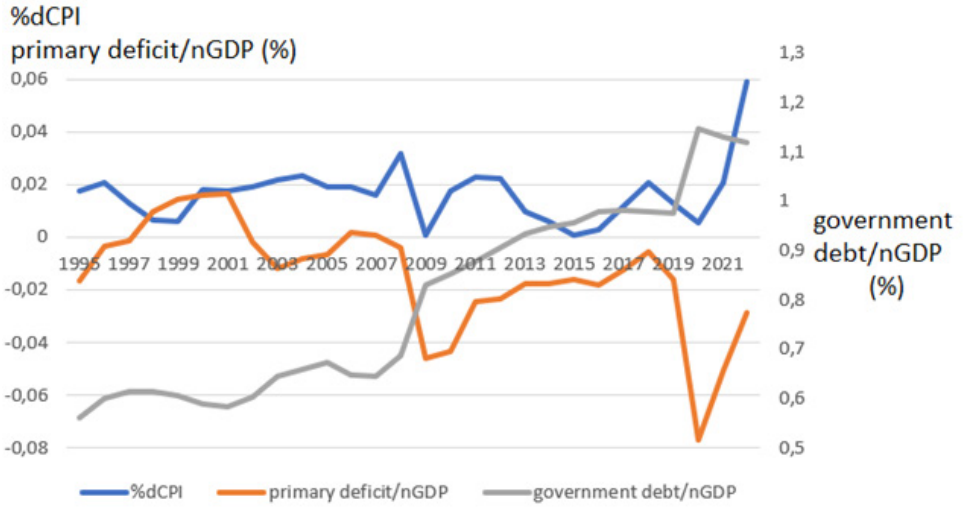
In 2025, the downward trend in headline inflation is anticipated to continue, broadening to an annual average of 2.1%, with underlying inflation also slowing to 2.2%. This decline is expected to bring headline and underlying inflation rates down to 1.9% in the fourth quarter of 2025. This broader trend is attributed to the progressive normalization of commodity prices, further reductions in core inflation, and the mitigating effects of monetary policy tightening. Services inflation, in particular, is expected to ease, reflecting smaller nominal wage increases than in previous years, albeit still enabling real wages to maintain robust growth, reminiscent of the patterns observed between the early 2000s and the financial crisis at the end of that decade.

Overall, the gradual reduction in inflation across the projection horizon, particularly in 2024 and 2025, is expected to be supported by monetary policy tightening aimed at preventing a detachment of economic agents' inflation expectations, thereby steering inflation rates by the European Central Bank.

According to INSEE, the Statistical Office in France, food was the main contributor to headline inflation between September 2022 and September 2023. However, since April 2023, the prices of food products have slowed substantially, and this trend is set to continue until June 2024. This is not only suggested by the business tendency surveys of traders (Figure 4) but is also the result of the decline in agricultural product prices after they peaked in May 2022. Food inflation is thus expected to reach +1.5% year-on-year in June 2024, compared to +5.7% in January. Similarly, the prices of manufactured products are likely to contribute a little more to inflation over the forecasting period. Inflation is bolstered by services prices, driven by dynamic wage levels: in June 2024, they are expected to rise by 3.0% year-on-year. Overall, the inflation rate should settle at about +2.5% year-on-year from spring, with core inflation likely slightly lower at around +2%. It is visible on the following chart from France.

Food was the main contributor to headline inflation between September 2022 and September 2023. However, since April 2023, the prices of food products have slowed substantially, and this trend is set to continue until June 2024. This is not only suggested by the business tendency surveys of traders (Figure 4) but is also the result of the decline in agricultural product prices after they peaked in May 2022. Food inflation is thus expected to reach +1.5% year-on-year in June 2024, compared to +5.7% in January. Similarly, the prices of manufactured products are likely to contribute a little more to inflation over the forecasting period. Inflation is bolstered by services prices, driven by dynamic wage levels: in June 2024, they are expected to rise by 3.0% year-on-year. Overall, the inflation rate should settle at about +2.5% year-on-year from spring, with core inflation likely slightly lower at around +2%.

Figure 2: Inflation in comparison to the government debt (France)



Source: Own calculations in the MS Excel

To present a focused empirical analysis of France, it could be more interesting that there is a significant increase in its public debt, starting from around 56% (GDP ratio) in 1995, which rose to 112 % by 2022. We see a very indebted economy. We also see an apparent dependency of inflation on the total government debt and primary deficit to GDP ratio. The central bank's interest rate management is weak. The government's tweaked discipline became more significant after the COVID pandemic, as is described in the so-called fiscal theory of inflation. But the total impact is much lower in France than in the Czech Republic as a small and very open Economy. Further statistical analysis would have explained the validity of all the factors. We see apparent empirical evidence of inflation in France in 2007 and 2021 (stylized facts).

Table 2: Characteristics of the time series (France)

	Mean	Median	Standard deviation	ADF test (p-value)	DW stat.	J-B test (p-value)
%dCPI	0,01656	0,0178	0,011328	0,20	1,38	44,797 (0,000)
primary deficit /nGDP	-0,01405	-0,0120	0,021182	0,21	1,67	7,019 (0,0300)

Source: Own output in Eviews (p-values in parentheses)

We also performed an analogous test on the French data sample. We offer the data features by analysis done using Eviews output. The primary finding concerns the non-stationarity of the French time series under analysis. Does it recall the same characteristics as the Czech Republic? Both the primary deficit/GDP ratio and the percentage exhibit high rates

of heteroscedasticity in France. Its differences begin to remain stationary even though it is nonstationary. Let us bring it up again. We do not intend to develop any simulations or prediction models for this study because it is primarily comparative. No data features are analyzed for the nominal GDP ratio or the government debt. This is the stock value. Its flows are every other year's deficits. More specifically, the ratios are different. Moreover, the dynamics of the primary deficit to GDP ratio is also still increasing after 2008.

Discussion

We have provided an in-depth analysis of the inflation dynamics in the Czech Republic and France, two developed E.U. nations. We can also discern ex-post expectations on inflation and the actual situation based on a thorough description of the comments made by the relevant institutions in both countries. We now know that, throughout the previous three years, French inflation was among the lowest compared to the Czech Republic. It is now evident that a new paradigm is required. The "fiscal theory of the price level" is a significant method established following the 2008 global financial crisis. It is important to note that numerous scientists, such as Cochrane (2001) and Cochrane (2023), It is immediately evident from the analysis of both countries that inflation increases in tandem with both a country's growing public deficits and a swift rise in the government debt to GDP ratio. Thus, achieving fiscal sustainability rather than controlling interest rates is the solution to combat inflation. After the pandemic, the Czech Republic's political representation reduced citizen income taxes and created instability in public spending. The budgetary sustainability is broken, which has led to extremely high inflation dynamics. Due to the War in Ukraine, the starting position is the same as in France: 6%. However, the Czech Republic's incorrect decisions and situational circumstances account for an additional 12% in 2022. These are primarily the inflation expectations resulting from fiscal factors and the inflation of energy, basic food, clothing, and services in the Czech Republic. Despite having a public debt that is far higher than that of the Czech Republic, France is a favorable benchmark for the future due to its strong public sector, energy policy decisions, and fiscal sustainability.

The French inflation period began in January 2022 (having crossed the 3% oscillation range level) and lasted for two years, ending in January 2024. The National Bank of the Czech Republic raised interest rates earlier than any other developed nation. Although it has been anticipated that inflation rates may be far higher, the inflationary phase must be shorter. The Czech Republic's inflationary era (over the 3% dynamics) runs from July 2021 to January 2024. There is a much larger amplitude and a more extended period.

The reasons for this can be found elsewhere other than in the traditional monetary policy approach. The structure of inflation in the Czech Republic at its peak in 09/2022 is as follows: basic food and drink expenditure: 3.7%; cooked food away from home and accommodation: 1.5%; alcoholic beverages and tobacco: 0.5%; housing, water, energy, fuel: 6.7%; reconstruction, housing equipment: 0.8%; transport: 1.8%; recreation and culture: 1.1%; health: 0.2%; services: 0.8%; Total: 17,1%.

By comparison, the inflation rate for food and tobacco is higher in France. All this can be seen from the graphs as consumer goods. These items increased inflation for the whole market. We also see two peaks in the inflation trend in the Czech Republic. This is explained by the fact that the new Governing Board in the Czech Republic's National Bank, in the middle of the inflation period, canceled using interest rates and used an exchange rate. There are also many consequences of whether to join the eurozone and its currency, the euro.

Implications for Practitioners

The findings of this study have significant policy implications for the Czech Republic, France, and potentially other European Union countries. This section will delve into recommendations for fiscal and monetary policies, considering the insights gained from the Fiscal Theory of Inflation. It will also discuss broader implications for the European Union's economic strategies. The study's findings are helpful to all practitioners who are dissatisfied with how inflation has changed, particularly in the countries of central Europe. We witness negative ideas that have been brought about by the political cycle in the central banks. These damaging ideas have also been made possible by the central bank board and politically indoctrinated (i.e., closed-minded) representatives. The decisions taken were not supported by actual evidence, current knowledge, or experiences, nor were they debated with experts in the public.

This research is helpful for any economist who opposes inflation measurement, targeting, or, most importantly, the belief that money grows on trees, allowing the government to fund public expenditures that many view as crucial.

Conclusions and Future Research

This study aimed to shed light on these complex dynamics, offering insights into the effectiveness of fiscal strategies in an environment where conventional monetary policies appear increasingly inadequate. Emphasizing the topic's realness and the method's empirical nature is crucial. The conclusion is not to reject the monetary approach altogether but rather to add obvious and significant necessary criteria to manage as such. We have demonstrated that under actual conditions in many countries, the monetary management of central banks failed to achieve stable inflation. According to the fiscal theory of prices (inflation), this is highly helpful. We have demonstrated that the possibility of sovereign debt leads to higher-than-anticipated inflation in the Czech Republic.

Compared to France, a nation with a far more advanced economy. There was considerably better control over the inflation. Budgetary theory discusses how budgetary sustainability will be the primary determinant of future inflation. Based on empirical research, it has been shown that the larger economy in the European Union's core (France) has outperformed a smaller, highly open country that had a brief period of fiscal unsustainability due to pandemics (the Czech Republic). France and the Czech Republic have relatively similar

inflation structures. However, the inflation rate in the Czech Republic is three times higher. Complete econometric analysis using multi-regressions, panel co-integration method, two-stage regressions, and the general method of moments will be the focus of future studies on this topic.

In conclusion, this study underscores the importance of considering fiscal factors in understanding and managing inflation, particularly in complex economic scenarios like those presented by the post-2020 world. The findings suggest that while fiscal policies play a crucial role, they operate within a broader economic context, including monetary policies and external factors. The paper concludes with suggestions for future research, particularly exploring the interplay between fiscal and monetary policies in inflation management.

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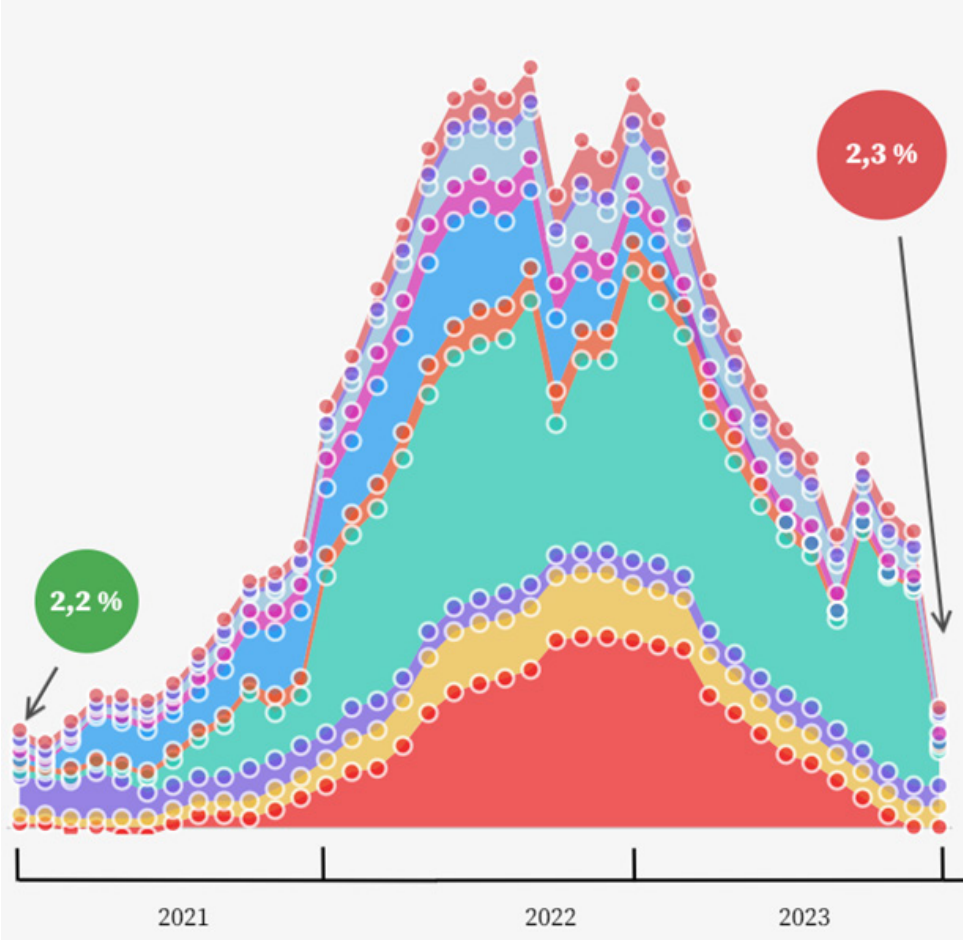
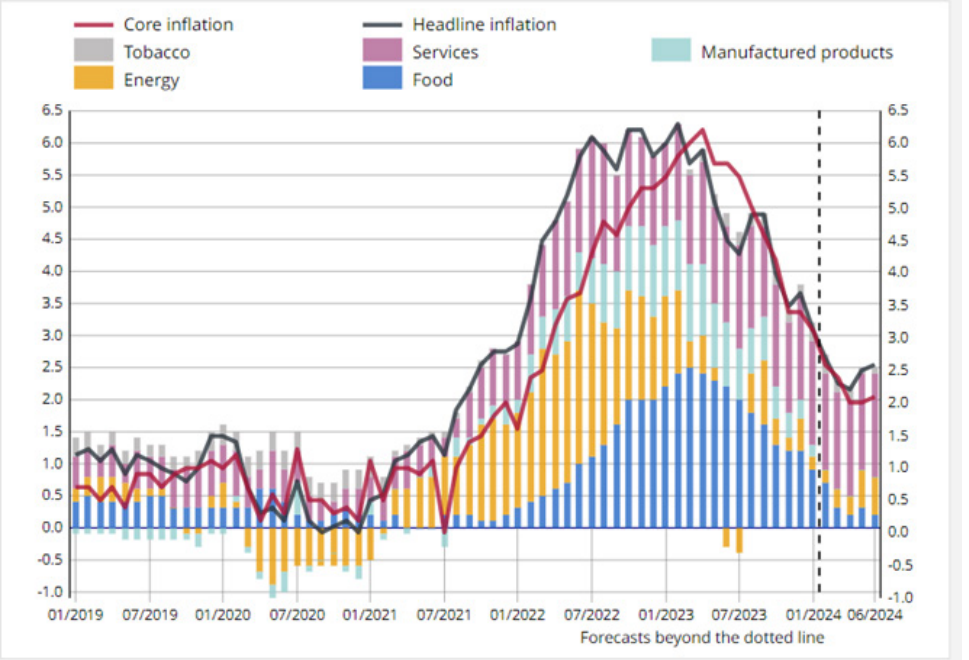
Supplement

Supplement 1: Structure of postpandemic inflation in the Czech Republic



Source: Czech Statistical Office Database

Supplement 2: Structure of postpandemic inflation in the France



Note: for January 2024, headline inflation is a provisional estimate, core inflation is a forecast.

How to read it: in January 2024, the consumer price index increased by 3.1% year-on-year, according to the provisional estimate. Services contributed 1.6 percentage points to this increase.

Source: INSEE.

Source: INSEE Database (France)

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The Impact of Stokvel and Banking Sector Efficiency: an Econometrics Model using (ARDL) Approach to Cointegration

LINDIWE NGCOBO

Abstract

Background: Despite playing second fiddle to formal banking institutions, stokvel are community-based savings schemes aimed at improving the lives of low- and middle-income earners.

Aim: The aims are to attempts to capture the relationship between stokvel and banking sector development across its proxy of banking sector efficiency. The aim is to determine the relative attractiveness of the needs of low- and middle households saving with banking sector/financial institutions.

Methods: Using Autoregressive Distributed-lag (ARDL) Bounds Testing Approach using quarterly time series secondary data ranging from 2009Q4 to 2020Q2 collected from the South African Reserve Bank and Old Mutual South Africa.

Results: The Bounds F-tests integration statistics of the combined cointegration test revealed a long-run association between stokvel and banking sector efficiency. Additionally, using the error correction model, a short-run relationship was observed between stokvel savings and banking sector efficiency. The negative and statistically significant coefficient of the error correction model (ECM) also confirmed the prevalence of a causal relationship between stokvel and banking sector efficiency. The standard diagnostics tests confirmed that ARDL results are significant and serially correlated. Stability tests were carried out using the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of the squares of recursive residuals (CUSUMSQ) measures of model stability and the results showed that the models were highly stable over the sample period. Thus, it can be said that including stokvel in the banking system does not help with the development of the banking sector.

Recommendation: A similar study can be conducted with the inclusion of all banks that make up the banking sector and their impact on South Africa's economic growth.

Keywords

Stokvel, Banking Sector Efficiency, Gross Domestic Product Growth; ARDL, South Africa

JEL Codes

C01, D14, G23

DOI

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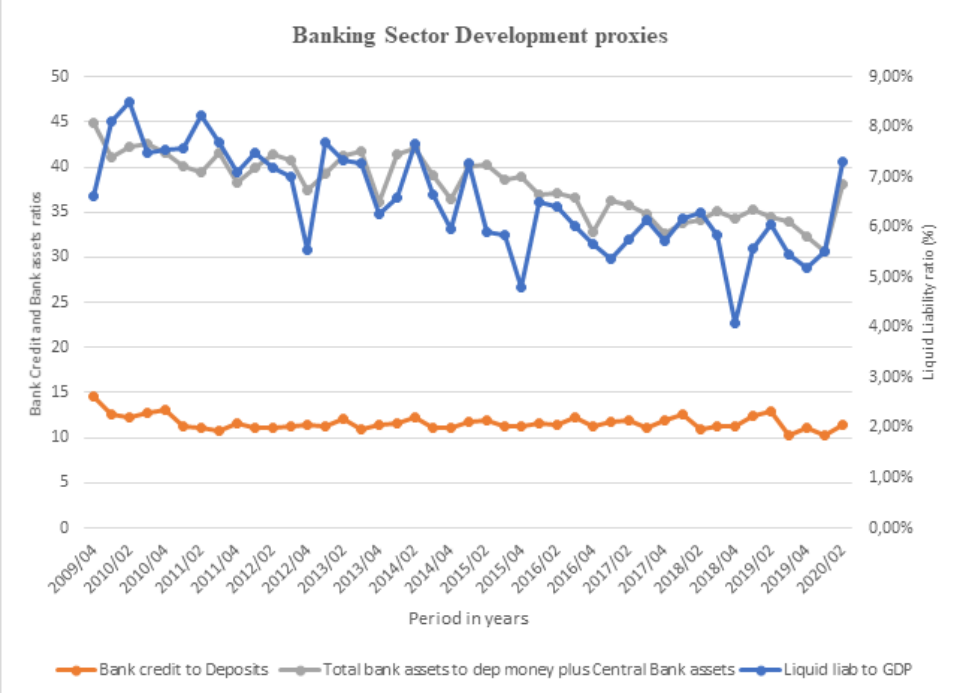
Introduction

Stokvel are community-based savings schemes aimed at improving the lives of low- and middle-income earners (Van Wyk, 2017; Floro and Seguino, 2002). Worldwide, stokvel are commonly known as rotating savings and credit associations (ROSCAs) (Bophela and Khumalo, 2019, Mashigo and Schoeman, 2012, Verhoef, 2001). Apart from conducting common banking functions, banks play a paramount role in the economic development of South Africa, a country characterised by low- and middle-income households. South Africa is home to various types of banking institutions. These include locally controlled banks, mutual banks, co-operative banks, international banks and foreign banks. Banks in South Africa hold a total of around R6 trillion in deposits. Yet, despite its size, low- and middle-income households deeply mistrust the banking sector, which is rooted in fears of exploitation (Duvendack and Mader, 2019).

Low- and middle-income households prefer saving with stokvel because of the transparency of transactions and the control it brings to their money (Bophela and Khumalo, 2019; Storchi, 2018). Money in this pool is then paid in full or partially to every member participating in the stokvel, either on a rotational basis or in times of financial need (Verhoef, 2008; Matuku and Kaseke, 2014; Nyandoro, 2018). Low- and middle-income households often use precautionary savings for stokvel, which are meant to safeguard against any possible future unexpected income shocks, often referred to as "rainy days" or "emergency savings" (Simleit, Keeton and Botha, 2011; Floro and Seguino, 2002:1). Stokvel provide an alternative savings for low- and middle-income households which cannot meet the requirements of the banking sector (Nyandoro, 2018; Mboweni, 1990). This view is supported by Oji (2015), who observed that African countries have a proportion of financially excluded people, which reflects a lack of access to financial resources.

Figure 1 provides a trend analysis of the proxies for Banking Sector Development based on data obtained from the South African Reserve Bank (SARB) and Old Mutual SA from 2009Q4 to 2020Q2.

Figure 1: Trends of banking sector development proxies in South Africa



Source: Authors' Analysis, data from SARB and Old Mutual SA, 2020

When using the ratio of bank credit to total deposits (Banking Sector Efficiency), the results show that Banking Sector Development slowed down, especially from 2009Q4 to 2011Q4. This decline may be attributed to the global financial crisis of 2008/2009, which resulted in the introduction of restrictions on credit growth in response to a steep rise in defaulting debtors (Verick & Islam, 2010). However, since then, relative stability has been observed. On 1 March 2020, the SARB cut the repo rate by 25 basis points. Bureau information from the National Credit Regulator notes that consumers with impaired credit records increased as of 2019Q3 (GCR Ratings, 2020). However, banking sector financing conditions for low- and middle-income households remain uncertain, contributing to currency weakness. Furthermore, the banking sector experienced stress and was forced to reduce the supply of credit to the economy. This could impact low- and middle-income households (GCR Ratings, 2020). The advent of the Covid-19 pandemic has caused a negative impact on asset quality for the banking sector in South Africa (GCR Ratings, 2020).

This research is different from prior similar empirical studies because using the multiple regression model is that its results are more likely to be accurate because of its completeness. This is because it includes all the important variables in a single study, for example, the dependent variable banking sector efficiency (BSE), independent variable stokvel (STOKV) and the control variables gross domestic product growth (GDPG) and money supply (M3). The objective of this study was to attempt to capture the relationship

between stokvel and banking sector efficiency using the autoregressive distributed lag (ARDL) bounds testing approach to cointegration developed by Pesaran, Shin and Smith (2001). The remainder of the paper is structured as follows: A relevant review of literature is presented in section 2 while explain data and methodology in section 3. In section 4, results are analysed and section 5 concludes the paper.

1 Literature Review

1.1 Conceptual Review

1.1.1 Background

Landman and Mthombeni (2021), Hossein (2017), and African Response Research (2012) showed that stokvel members pool their savings together and are effective vehicles for encouraging saving among low- and middle-income households. Similarly, Maseng (2022), Matuku and Kaseke (2014), and Gugerty (2007) argued that stokvel contribute to social cohesion when people frequently assist each other financially within their communities. Moreover, Oranu, Onah and Nkhonjera (2020:23) and Naong (2009:248) asserts that stokvel foster a savings culture in South Africa. Furthermore, Matuku and Kaseke (2014:513), Anderson, Baland and Moene (2009:15) sought to determine if stokvel savings improve the lives of stokvel members and showed that savings enable stokvel members to meet their basic needs by participating in stokvel. Finally, money-saving was observed to be the main economic factor contributing to the formation and growth of stokvel in South Africa (Landman and Mthombeni, 2021:1; Bophela and Khumalo, 2019:35). The following characteristics of stokvel are explained in detail.

1.2 Save and invest

Despite low saving rates in the banking sector, stokvel have significantly participated in informal saving schemes which have now been legalised (Mishi, 2012:8, Irving, 2005). Stokvel provide opportunities to low- and middle-income households to save, invest and accumulate assets (Landman and Mthombi, 2021:3; Matuku and Kaseke, 2014:503). However, Aidoo-Mensah (2018:133), Kumarasinghe and Munasinghe (2016:367) noted that savings could be considered one of the crucial tool´s households utilise to accomplish their financial expectations in order to improve their financial well-being.

Using primary data, Haider (2018:1) examined the likelihood of household savings in relation to their characteristics. The author sought to determine whether households move to the upper level in the hierarchy of saving motives as described in Maslow's Hierarchy of Needs Theory. The results indicated that households with different characteristics save for different motives, and a change in household characteristics causes movement in the hierarchy of saving motives. For example, lower-income households save for lower-level needs, i.e., daily expenses, while high-income households save for higher needs, such as investments. Conversely, Kumarasinghe and Munasinghe (2016:367) examined the most significant savings motive among households in the Kalutara District. Their study

identified the most effective savings motive of households in the Kalutara District as the precautionary savings motive.

1.2.1 Credit

South African banks exclude most low- and middle-income households from access to formal credit finance (Biyase and Fisher, 2017:50; Kajimo-Shakantu and Evans, 2006:23). However, stokvel provide easy access to credit and small loans from their savings to facilitate income-generating ventures of all-inclusive economic activities (Shuaib (2018); Ngcobo and Chisasa, 2018b).

Owusu-Bempah, Bennet, Amoako and Frempong (2013:108) examined the benefits of the informal sector to savings and loan companies. The research found that the informal sector is significant to savings and loan companies as the benefits of doing business with them far out-weighs the associated costs. Zondi (2016; ii) investigated why stokvels prevail as a credit and savings mechanism despite access to commercial financial services. The study found that there are interactions between stokvel groups and commercial banks in the form of monetary flow.

1.2.2 Women empowerment

Around the 1930s, there was an influx of rural-urban migration, particularly among women, as they arrived in the cities and towns to join their husbands who were working in the mines (Matuku and Kaseke, 2014; Camlin, Snow and Hosegood, 2014). However, Schulze (1997) observed in the 19th and early 20th centuries, women carried the burden of maintaining their families without income or where income was irregular. Moreover, Burger and Fourie (2019), and Buijs (2002) noted that most women participated in stokvel because they were unemployed. Those employed and earned lower income supplemented it with being involved in stokvel and regarded themselves as bankable (Nyandoro, 2018:177; Mboweni, 1990). Similarly, Verhoef (2020:109), Van Wyk (2017:13) and Addai (2017) referred to stokvel as the most significant industry in the informal sector and rural and urban areas for black women's survival strategies. Furthermore, the most critical aspect is that women increasingly rely on stokvel to fulfil their responsibilities towards their families (Nyandoro, 2018:177, Matuku and Kaseke, 2014:510). They integrated stokvel through social networks to smooth their income (Mashigo and Schoeman, 2010:2).

Women created opportunities for independent earnings and displayed remarkable entrepreneurial spirit in undertaking informal economic activities as they moved out of the traditional sector to urban centres (Verhoef, 2001a:259). Similarly, in their study, Matuku and Kaseke (2014:510) revealed that stokvel promote women's empowerment. Moreover, Ngcobo and Chisasa (2018b:217) examined the success factors of stokvels and observed that women lead with the participation in stokvels more than men. Contrary to Ngcobo and Chisasa (2018b:217), Nuhu, Donye, Bzugu and Ani (2015:479) contend that in rural areas, rural informal savings have been primarily designed, crafted and implemented with the male heads of households as the intended clients. They failed to recognise that women are active, productive and engaged in different livelihood activities with their own financial needs and constraints.

1.2.3 Limitations

People with low- and middle-income have limited or no access to the banking sector services and form stokvel to save, invest and access credit (Verhoef, 2001a:540). Through an interpretive-narrative-based inquiry research paradigm, Van Wyk (2017:13) discussed the experience of a stokvel. The research findings revealed that to circumvent the lack of access to formal financial services, stokvel help their members by supplementing limited earnings, guaranteeing access to credit when needed, and, recently, by providing start-up capital for entrepreneurial enterprises. In their study, Mashigo and Schoeman (2012:58) "noted compared to formal financial services, informal financial services or social connections embedded in stokvel generally make it possible to incur very low transaction costs, require less documentation for approving claims, no proof of employment, and no traditional collateral to secure loans."

2 Research Methodology

This study used quarterly time series secondary data ranging from 2009Q4 to 2020Q2 collected from the South African Reserve Bank (SARB) and Old Mutual South Africa. The main variables of this study include the proxies for banking sector development and stokvel. The measure of banking sector development used in this study is banking sector efficiency. The measures of stokvel used in this study is a percentage of income. The data on all these variables were taken from the South African Reserve Bank (SARB) and Old Mutual SA (2020).

List of Abbreviations and acronyms

BSE	Banking Sector Efficiency
GDPG	Gross Domestic Product Growth Rate
M3	Money Supply
STOKV	Stokvel

The literature extensively demonstrated, from both empirical and theoretical angles, that stokvel play a significant role in the development of the banking sector efficiency (BSE). Equation 1 below is illustrative.

$$BSE = f(STOKV, GDPG, M3) \quad (1)$$

The following general econometric model represents the impact of STOKV on BSE in South Africa (see equation 2).

$$\Delta BSE_t = \beta_0 + \beta_1 \Delta LnSTOKV_t + \Sigma^n_{j=1} X_{jt} + u_t \quad (2)$$

Where: STOKV = *stokvel*, X_{jt} *is the vector of control variables*

If $\beta_1 \neq 0$ and have significance, meaning there exists a breakpoint and the impact of STOKV on BSE is the difference between the two periods. The minimum stokvel savings is β_0 in the period before the breakpoint is $(\beta_0 + \beta_1)$ in the period after the breakpoint. If $\beta_3 > 0$ and

have significance, this implies the impact of stokvel savings on BSD in the period after the breakpoint is bigger than the effect in the period before the break-point.

2.1 Autoregressive Distributed Lag (ARDL) approach

Following Pesaran, Shin and Smith (2001) long- and short-run estimations econometric approaches postulated by Engle and Granger (1987), Johansen and Juselius (1990), and Johansen (1996), study used the following ARDL framework in equation 3:

$$\Delta LnBSE_t = \alpha_0 + \beta_1 InBSE_{t-1} + \beta_2 STOKV_{t-1} + \beta_3 GDPG_{t-1} + \beta_4 M3_{t-1} + \sum_{k=0}^{m1} \alpha_{1k} \Delta InBSE_{t-k} + \sum_{k=0}^{m2} \alpha_{2k} \Delta STOKV_{t-k} + \sum_{k=0}^{m3} \alpha_{3k} \Delta GDPG_{t-k} + \sum_{k=0}^{m4} \alpha_{4k} \Delta M3_{t-k} + \omega_t \quad (3)$$

where:

Δ = first difference

β1, β2, β3 and β4 = coefficients of the long-run impacts

α1, **α**2, **α**3 and **α**4 = coefficients of the short-run impacts

ω = error

2.2 Error correction method

After confirming that there exists cointegration among the variables in the long-run, the short-run relationship between stokvel and banking sector liquidity was estimated in equation 4 and 5 using the ECM as follows:

$$\Delta LnBSE_t = \alpha_0 + \lambda_1 ECM_{t-1} + \sum_{k=0}^{m1} \alpha_{1k} \Delta BSE_{t-k} + \sum_{k=0}^{m2} \alpha_{2k} \Delta STOKV_{t-k} + \sum_{k=0}^{m3} \alpha_{3k} \Delta GDPG_{t-k} + \sum_{k=0}^{m4} \alpha_{4k} \Delta M3_{t-k} + \omega_t \quad (4)$$

where:

m1, m2, m3 and m4 = optimal lag length of the variables calculated by the ARDL model to choose the lag order using measures such as LR, final prediction error (FPE), Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC) and Hannan-Quinn information criterion (HCQ).

$$\Delta LnBSL_t = \alpha_0 + \beta_1 InBSL_{t-1} + \beta_2 STOKVSAV_{t-1} + \beta_3 GDPG_{t-1} + \beta_4 M3_{t-1} + \sum_{k=0}^{m1} \alpha_{1k} \Delta InBSL_{t-k} + \sum_{k=0}^{m2} \alpha_{2k} \Delta STOKVSAV_{t-k} + \sum_{k=0}^{m3} \alpha_{3k} \Delta GDPG_{t-k} + \sum_{k=0}^{m4} \alpha_{4k} \Delta M3_{t-k} + \omega_t \quad (5)$$

3 Data analysis and findings

3.1 ARDL long-run form

The estimated results of long-run relationship between BSE (dependent variable), STOKV, GDPG and M3 using the ARDL co-integration procedure are presented in Table 1. The model was implemented with automatic lag selection using E-views version 11. The ARDL (1,0,0,4) model was selected based on the least AIC. In the long-run, STOKV and GDGP were found to have a positive and statistically significant relationship with BSE. M3 was observed to have a positive relationship with BSE; however, its influence was statistically insignificant (p>.05). When using STOKV as the dependent variable, BSE and GDPG were found to have a positive relationship with BSE, albeit insignificant. Only M3 had a negative relationship with BSE; however, the relationship was insignificant. In the third model, GDPG was used as the dependent variable. BSE exhibited a positive and statistically significant relationship with GDPG at a 95% confidence level. On the other hand, the relationship between M3 and GDPG was negative and statistically significant. In the final model, M3 was the dependent variable, while STOKV, GDPG, and BSE were the explanatory variables. The coefficients for STOKV and GDPG were positive and statistically insignificant. BSE depicted a negative and statistically insignificant relationship with M3.

Table 1: Long-term estimates

Long-run Result Constant and No Trend – BSE				
Variable	Coefficient	St.Error	t.Statistic	Prob
STOKV	2.258246***	0.178830	12.62788	0.0000
M3	0.064230	0.089269	0.719513	0.4772
GDPG	78.35344***	22.66281	3.457357	0.0016
Long-run Result Unrestricted Constant and Unrestricted Trend – STOKV				
BSE	0.025422	0.019682	1.291617	0.2071
GDPG	1.084721	1.133032	0.957361	0.3466
M3	-0.000583	0.008610	-0.067659	0.9465
Long-run Result Restricted Constant and No Trend – GDPG				
BSE	0.021599**	0.008837	2.444295	0.0213
STOKV	-0.042145***	0.013090	-3.219648	0.0033
M3	0.0036338	0.002722	1.336279	0.1926
Long-run Result- No Constant No Trend – M3				
STOKV	0.145327	1.557366	0.093316	0.9262
GDPG	-20.54444	13.07846	-1.570862	0.1255
BSE	0.607702	0.590862	1.028501	0.3110

Source: Authors' Analysis, data from SARB and Old Mutual SA, 2022

3.2 The error correction model

To tie the short-run behaviour of banking sector to its long-run value, the error correction term (ECT) was used for this purpose (Gujarati & Porter, 2009; Puatwoe & Piabuo, 2017). The analysis in Table 2 shows that ECT is negative and significant for BSE (-0.630729; p<0,05), STOKV (-0.119320; p<0,05), GDPG (-0.333220; p<0,05) and M3 (-0.647007; p<0,05). This shows the speed of automatic adjustment in the system between the short- and long-run equilibrium of approximately 63% for BSE, 12% for STOKV, 33% for GDPG, and 64% for M3 in the following year. All the short-run variables are statistically significant at the 5% significance level. It can be concluded that the variables used in this model have a short-run influence on BSD.

Table 2: Short-run estimates

Dependent Variable	ECM(-1) Coefficient	T-Statistic	Prob
D(BSE)	-0.630729	-2.666167	0.0046
D(STOKV)	-0.119320	2.372494	0.0017
D(GDPG)	-0.333220	-2.693593	0.0000
D(M3)	-0.647007	-3.133825	0.0000

Source: Authors' Analysis, data from SARB and Old Mutual SA, 2022

3.3 Diagnostic tests

The result of the diagnostic tests is presented in Table 3 ensure that the empirical model is correctly specified, the Breusch-Pagan-Godfrey Serial Correlation LM Test, Heteroskedasticity Test: Breusch-Pagan-Godfrey, and JB test were conducted. The results show that the estimated ARDL model is reliable. All the hypotheses of no serial correlation, no heteroskedasticity and normally distributed residuals cannot be rejected. Thus, it can be concluded that the residuals are homoscedastic, not correlated and normally distributed.

Table 3: Diagnostic statistics

Long-run Obs* R-square/F-statistic			
Variable	Breusch-Godfrey Serial Correlation LM Test	Heteroskedasticity Test Breusch-Pagan--Godfrey	Jarque-Bera test of Normality
BSE	1.179580 (prob. 0.32)	2.011007 (prob. 0.08)	0.689704 (prob. 0.71)
STOKV	0.699537 (prob. 0.51)	1.897127 (prob. 0.07)	4.219974 (prob. 0.12)
GDPG	0.121357 (prob. 0.87)	2.005597 (prob. 0.07)	26.11414 (prob. 0.00)
M3	0.337721 (prob. 0.72)	0.414504 (prob. 0.86)	10.78707 (prob. 0.58)
Short-run Obs* R-square/F-statistic			
BSE	0.779363 (prob. 0.47)	0.189223 (prob. 0.96)	4.050110 (prob.0.13)
STOKV	2.263566 (prob. 0.12)	1.684258 (prob. 0.17)	9.828466 (prob. 0.01)
GDPG	2.063025 (prob. 0.14)	2.279755 (prob. 0.07)	26.80355 (prob. 0.00)
M3	2.573734 (prob. 0.09)	0.997862 (prob. 0.43)	0.209767 (prob. 0.90)

Source: Authors' Analysis, data from SARB and Old Mutual SA, 2022

3.4 Stability Tests

The study explores the stability of the regression coefficients of the model using the cumulative sum of recursive residuals (CUSUM), and the cumulative sum of the squares of recursive residuals (CUSUMSQ) tests. The estimated findings are presented in Figures 2 and 3 respectively show that, the blue lines for both CUSUM and CUSUMSQ lie within the critical bounds and are significant at 5%. The figures suggest that the null hypothesis of stable coefficients of the model cannot be rejected at the 5% level of significance for both CUSUM and CUSUMSQ tests as the sum stays within the 95% confidence band. The CUSUM tests indicates coefficients in the equation are stable within the 5% critical lines while CUSUMSQ shows that the residual variance is stable within the 5% level of significance.

CUSUM and CUSUM square

Figure 2: Results of CUSUM and CUSUM SQUARE test using ARDL

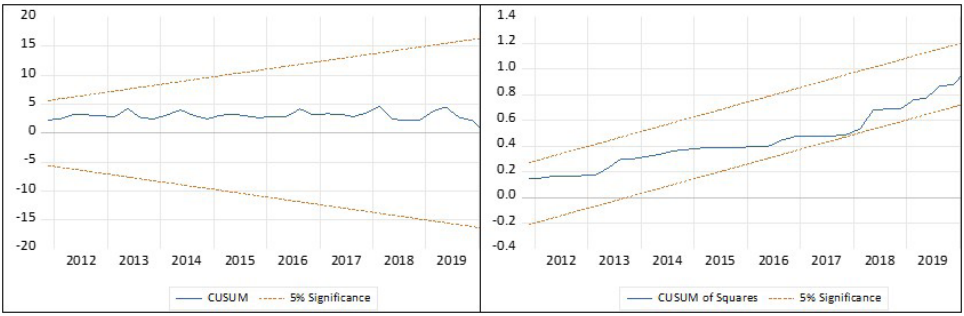
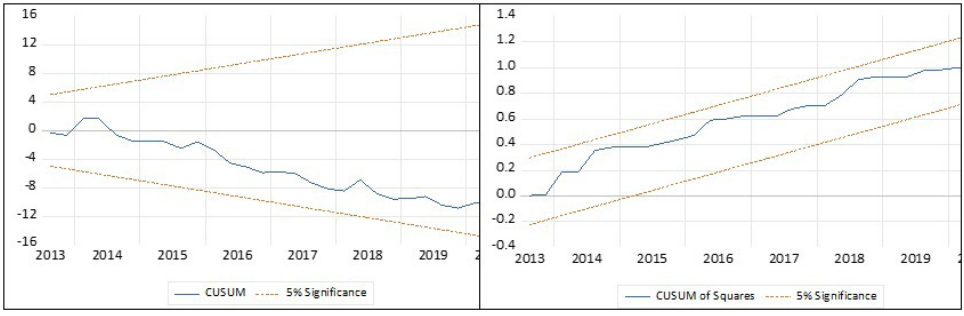


Figure 3: Results of CUSUM and CUSUM SQUARE test using ECM



4 Conclusion

The study examined stokvel and banking sector efficiency using ARDL bound test approach to cointegration using quarterly time series secondary data ranging from 2009Q4 to 2020Q2. The F-statistic value for the ARDL, bounds test result shows evidence of cointegration among dependent variables because the computed asymmetric ARDL F-statistic values exceed the tabulated value of the upper bound at the 5% level of significance. The error correction model [ECT(-1)] also confirmed the prevalence of a causal relationship between STOKV and BSE. The study further tested the model using standard diagnostics tests confirmed that ARDL results are significant and serially correlated. Further, Stability tests were carried out using the CUSUM and CUSUMQ measures of model stability. The results showed that the models were highly stable over the sample period. Thus, it can be said that including stokvels in the banking system does not help with the development of the banking sector.

Acknowledgements

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Classification of European Union Countries in the Context of Tax Burden: Cluster Analysis

JIŘÍ SLEZÁK

Abstract
The tax burden affects a number of areas, including the economic and financial behavior of both legal entities and individuals. The aim of the article is to classify EU countries into groups based on selected tax burden indicators. The sample consists of 27 states of the European Union and the indicators used include direct taxes, indirect taxes, social contributions, taxes on consumption, on labor, on capital and implicit tax rate. In addition, the aim of the article is achieved through correlation and cluster analysis. Through cluster analysis, a total of 4 clusters were created for the period 2009-2021. The countries that joined the EU at the latest belong to the group of countries characterized by a lower tax burden. In contrast, most of the states that joined the EU earlier belong to the group of countries with a higher tax burden. In general, it can be said that countries also cluster on the basis of geographical or political characteristics. Through the cluster analysis, it was proven that there are significant differences between the states in the tax area and harmonization is not taking place, and there is thus further scope for tax harmonization. The contribution of the article is in the current assessment of the tax burden in EU countries and their classification according to similar tax systems for their discussion.

Keywords
Cluster analysis, European Union Countries, Tax burden, Taxes

JEL Codes
H21, H77, C38

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Introduction

Taxes are a factor that affects a whole range of areas, primarily the economic behavior of entities subject to the payment of taxes. They also influence the financial behavior of these entities. Taxes have an impact on the costs or profits of both legal and natural persons (Brezaniova, 2013).

The tax burden is a factor that affects a number of measurable, as well as immeasurable variables, which are constantly evolving and simultaneously influencing each other. These are, for example, the tax rate, tax base, gray economy, government support through tax expenditures, gross domestic product (GDP), or the effect of the GDP growth rate, as well as fiscal imbalance and debt service, the level of the business environment, the

state of economic development, but also for example geographic location (Mihokova, Andrejovska & Martinkova, 2016).

In the European Union (EU), tax harmonization is a priority for individual governments, which is taking place to a certain extent at the level of indirect taxes, but this is not the case for direct taxes. There are significant differences in tax rates between countries, which can cause capital outflows (Contell, Climent-Serrano & Labatut-Serer, 2018). At the same time, however, some countries are characterized by similar tax systems. According to Banović, Blažić & Drezgić (2020), the tax burden on companies affects the decisions regarding the choice of their investments, as a secondary factor emphasizing the advantage of gross domestic product. On the other hand, the tax burden is not the only factor that determines capital movements. Different countries can be characterized by comparative advantages from the point of view of the macroeconomic environment, the infrastructure of public services, and at the same time it should be noted that the tax burden does not always automatically mean the profitability of the capital used (Mihokova, Andrejovska & Martinkova, 2018). However, the inflow of foreign capital is an important factor influencing the development of some economies, especially in Central and Eastern Europe (Andrejovska & Glova, 2022).

The tax systems of individual EU countries are exposed to competition due to the mobile tax base under the weight of globalization. The growth of competition between individual countries is a result of the growth of globalization. Potential competition affects the size and changes in the tax bases of these countries. For that reason, it is appropriate for countries to be characterized by flexibility and modernization of tax systems (Podviezko Perfenova & Pugachev, 2019).

This article contributes to the literature examining the tax burden of EU countries by analyzing, comparing and evaluating groups of EU countries. Awareness of the individual differences, or similarities, in the tax system of EU countries enables the deepening of tax harmonization.

The aim of the article is to classify EU countries into groups based on selected tax burden indicators. The content of the presented article is as follows. The introduction is followed by the theoretical background, in which the results of various authors dealing with the tax burden of the EU, individual European countries, and other countries are identified. The methodology part describes the data and methods used, which are then applied in the empirical part, within which the individual EU states are combined into similar clusters. The discussion and conclusion sections summarize the main findings of the article, including a description of limitations and future research.

1 Literature review

Reed & Rogers (2006) examined the relationship between changes in the tax burden and changes in tax policy over the period 1987–2000. These authors found that revenues induced by non-tax policy changes are an important determinant of changes in the

tax burden and also estimate that about 50% of the total changes in the tax burden are caused by changes in non-tax policy factors. Bustos-Contell et al. (2017) examined the historical development for the period 2006–2014 and the development of convergence or divergence of the tax burden for 15 EU member states, based on changes in the effective tax rate. Through cluster analysis, they found that if a country is prosperous, effective tax rates tend to converge. Otherwise, the effective tax rates differ, due to differences in the tax policies of the Member States and offshoring is encouraged. Braunerhjelm, Eklund & Thulin (2021) argue that the administrative tax burden has an effect on business support. According to their research, the influence of the tax administrative burden changes during the business life cycle. Negativity manifests itself in the beginnings of business. Similarly, in Roman et al. (2023), who analyzed the relationship between taxes paid by small and medium-sized enterprises and their performance for the period 2008 and 2021 in 27 member countries of the European Union. These authors argue that the taxes that small and medium-sized enterprises have to pay are considered obstacles that limit the improvement of performance, taking into account the specifics of the country's economy.

Through a cluster analysis that included countries in the EU27 for the period 1995–2012, Šimková (2015) came to the conclusion that the newly acceding countries with regard to their tax burden (countries that joined the EU in 2004 and 2007) are in the group of countries with low tax burden and identified clusters of countries based on their historical development, geographical and demographic characteristics. Similar conclusions were made in Korecko, Bacik & Voznakova (2019), when a similar development in tax systems in terms of their geographical location was revealed through cluster analysis. At the same time, significant differences in the tax burden and income tax rates were found in the countries.

According to Podviezko, Perfenova & Pugachev (2019), the convergence process of new EU members is strengthened with the increasing tax competitiveness of these countries. Banovic, Blazic & Drezgic (2020) examined the impact of corporate income taxation on attracting FDI flows in EU member countries in the period from 1998–2017 for 28 EU member countries. These authors argue that tax policy significantly affects the FDI flows of companies in the new EU member states (which are characterized by a lower tax burden). Mihokova, Andrejovska & Martinkova (2018) investigated whether the 27 EU countries are competitive in the field of corporate taxation in 2004–2014 and whether the "new member states" are considered more competitive than the states that joined the EU earlier. Through cluster analysis, they found a significant and positive effect of tax competitiveness on the growth of company profits, and at the same time, tax competition between countries is not clearly associated with a decrease in tax rates. Dubrovina et al. (2019) dealt with the analysis of tax revenues and social contributions in EU countries and through correlation analysis found that the ratio of total tax revenues to gross domestic product is correlated in many EU countries. Furthermore, it was found that some EU countries have common features of total income and some groups of countries differ.

Lukacova et al. (2020) analyzed the harmonization of income taxes in the European Union and through cluster analysis it follows that the process of tax harmonization could take place within countries that are geographically and politically close. Llopis & Martí (2016) based on the analysis of the nominal and effective tax rate in the EU countries in the years 2000–2013 claim that the development of corporate income tax is increasingly distant

and countries do not tend to harmonize this tax. Elschner, Heckemeyer & Spengel (2011) looked at the tax burden of corporate tax in the EU. According to their analysis from 1998–2009, based on effective average tax rates, there is no harmonization of the tax burden of individual countries. Liapis, Rovolis & Galanos (2014) in their study dealing with the tax regimes of the EU states, based on the analysis of the countries from 1995–2009, that there are some differences between the tax regimes of the EU countries and that the EU has not introduced any policy that will lead to tax harmonization. A similar conclusion was made, for example, by Andrejovská & Hudáková (2016).

Rudy (2021) examined changes in the tax burden in election and post-election years in 121 countries, including EU countries, between 1991 and 2019. It was found that in developed countries, government spending was higher in election years than in other periods, and governments were motivated to increase rather than reduce the tax burden. Krajňák (2022) dealt with changes in personal income taxation in the Czech Republic in 2022 and, on the basis of regression and correlation analysis, found that the tax burden from 2022 in the case of applying the basic tax reliefs for taxpayers have decreased, and at the same time, the tax burden increases slightly for taxpayers who, in addition to tax reliefs, also apply for tax relief for children. Furthermore, Krajňák (2020) found that the income tax between 1993–2018 was progressive in most cases (the exception was the period 2008–2012). Tanchev (2021) analyzed the effect of a proportional income tax without a tax-free minimum on inequality in Bulgaria in the period 2008-2019. The results of this study show that an increase in gross average income and net average income leads to an increase in inequality. After taxing income with a proportional income tax, inequality does not decrease, but further deepens. In countries such as Belgium, Estonia, Ireland, Malta, the Netherlands, Portugal, Romania, Spain and the United Kingdom, the tax burden does not affect how business entities perceive their business environment. According to Vintilă, Onofrei & Ţibulcă (2018), this may be due to the fact that the tax policy in these countries is very stable or, on the contrary, very unstable.

According to Konôpková (2021), the biggest tax burden in Slovakia is personal income tax, corporate income tax, and property tax. The lowest tax burden is value added tax. According to Bunescu (2015), countries in northern Europe (Denmark, Finland and Sweden) have the highest tax burden. Vlachy (2017), based on an analysis of the tax burden on variable incomes for private sector employees in the countries of the Visegrád Four, claims that the system in the Czech Republic is inefficient and lacks horizontal and vertical fairness. Higher income risk in all countries except Hungary using a flat tax result in less progression (existence of a minimum wage).

Bona-Sanchez, Perez-Aleman & Santana-Martin (2023) investigated the relationship between media coverage and corporate tax burden in non-financial Spanish listed firms for the period 2003-2016, with the result that media coverage reduces the tax burden of legal entities. In Belgium, according to Buyl & Roggeman (2019), it was found that tax incentives for SMEs are not at a high level to compensate for the tax advantages of large and internationally operating companies, or that domestic SMEs face a higher effective tax burden compared to large domestic and large multinational enterprises.

Authors from outside the European Union also deal with the tax burden. Lykova (2015)

claims that in Russia the tax burden on various bases is sufficiently different compared to European countries. For example, the corporate and labor tax burden is lower than in European countries, but the difference between statutory and implicit corporate tax rates is not very large. On the other hand, the tax burden on consumption is very close to the highest in Europe. Based on a regression analysis, Paientko & Oparin (2020) claim that the reduction of the tax burden in Ukraine has a significant positive impact on the level of fiscal freedom, while it has no effect on the level of economic freedom.

Lu et al. (2023) looked at the impact of corporate tax reduction on investment efficiency in China in 2015–2021. These authors argue that reducing the tax burden can improve the efficiency of corporate investment by reducing corporate tax avoidance, especially for non-state enterprises, low corporate governance and low marketization. Niyazmetov (2023) estimates that for the period 2000–2019 the optimal tax burden in Uzbekistan reaches 19%, at the same time it was found that in the period 2010–2020 the government of Uzbekistan failed to collect on average half of the potential tax revenue. In Georgia, according to Kbiladze (2016), the tax burden is uneven according to the types of businesses and their activities, even though according to the tax code, businesses regardless of their size and type of activity pay the same interest rate. In Turkey, according to Nacar & Karaback (2022), it was found that for the period 2006–2019 the effective tax burden on labor is higher than the effective tax burden on capital and consumption, and at the same time that taxes on capital fluctuate according to changes in tax laws. Grubert & Altshuler (2016) looked at the tax burden of legal and natural persons in the USA and propose several variants that lead to a reduction of the tax burden of corporate tax. The most robust proposed option represents a reduction in the corporate tax rate and further taxation of dividends and capital gains as ordinary income.

2 Research methods

The aim of the article is to classify EU countries into groups based on selected tax burden indicators. In order to combine individual countries into several similar clusters, the article is based on two hypotheses based on a literature review:

- Hypothesis 1: European Union countries differ in tax burden indicators.
- Hypothesis 2: The countries of the European Union are characterized by similar levels of tax burden indicators.

The article draws on the literature that deals with tax burden in the countries of the European Union. The empirical part uses data and selected indicators (see table 1) from Eurostat. The empirical analysis was carried out for the period 2009–2021. The year 2021 is the last year for which all values of the selected indicators are available.

The selected set consists of 27 countries of the European Union, namely: Austria; Belgium; Bulgaria; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italians; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Romania; Spain; Slovakia; Slovenia; Sweden.

Tax burden is measured as the ratio of taxes to gross domestic product Dubrovina et al. (2019).

Table 1: Definition of Variables

Indicators	Definition	Unit	Source
Total Taxes (TTB)	They are defined as taxes on production and imports, taxes on income and wealth, taxes on capital and mandatory real social contributions	Index (0–100%)	Eurostat
Direct taxes (DT)	They are defined as income and property taxes and capital taxes (personal income tax, corporate income tax, inheritance tax, gift tax and others)	Index (0–100%)	Eurostat
Indirect taxes (INT)	They are defined as taxes related to production and imports (VAT, import duties, excise duties and others)	Index (0–100%)	Eurostat
Social contributions (SC)	They represent social contributions of employers, social contributions of employees and social contributions of the self-employed and the unemployed	Index (0–100%)	Eurostat
Taxes on consumption (TC)	They are defined as taxes imposed on transactions between final consumers and producers and on final consumption goods	Index (0–100%)	Eurostat
Taxes on labor (TL)	They include taxes related to wages and transfer income of unemployed persons and mostly deducted at source, paid by employers and employees, including mandatory social contributions	Index (0–100%)	Eurostat
Taxes on capital (TCL)	They include taxes on business income in a broad sense - profit tax and taxes that could be considered a necessary condition for entry into production (real estate tax, motor vehicle tax). Capital is defined as physical capital, intangible assets, financial investments and savings	Index (0–100%)	Eurostat
Implicit tax rates on labor (ITRL)	Measure the actual or effective average tax burden levied on labor	Index (0–100%)	Eurostat
Implicit tax rates consumption (ITRC)	Measure the actual or effective average tax burden levied on consumption	Index (0–100%)	Eurostat

Source: European Commission (2023); European Commission (2023a)

The evaluation of selected indicators in EU countries for the period 2009–2021 is carried out using correlation analysis and cluster analysis.

Correlation analysis is used to assess the degree of relationship between the selected indices, see the formula (1):

$$r = \frac{\sum_{i=1}^{n}(x_i - x)\,(y_i - y)}{\sqrt{\sum_{i=1}^{n}(x_i - x)^2 \;\sum_{i=1}^{n}(y_i - y)^2}} \tag{1}$$

where: r represents Pearson's correlation coefficient, x_i a y_i represent the values of x and y for the ith individual (Mukaka, 2012). The significance level is chosen at 5%.

An F-test is used to determine whether the selected criteria are statistically significant at the 5% significance level.

Cluster analysis refers to the field of multivariate statistics that involves grouping objects based on some degree of proximity defined between those objects. Cluster analysis focuses on the classification of objects based on their proximity with respect to measurement variables (Brusco et al. 2012). Clustering methods are mostly divided into two categories. These are hierarchical clustering and non-hierarchical clustering methods.

Hierarchical clustering methods have two different classes. These are agglomerative and divisive approaches. On the basis of hierarchical analysis, individual objects are gradually combined until finally a single cluster containing all cases is created. This clustering method leads to the same number of solutions as the number of objects and at the same time it is not necessary to know the exact number of final clusters. For non-hierarchical methods of cluster analysis, the classification of objects into a predetermined number of clusters is typical. This method starts by dividing the objects into the required number of clusters, calculating the centroids of the cluster and moving the objects to their closest cluster centroid, until all objects are closer to their own cluster centroid (Clatworthy et al., 2010; Trebuňova & Halčinova, 2013).

By means of hierarchical cluster analysis (Ward´s method), a dendrogram is created in graphic form that shows how individual clusters are related to each other and on the basis of which the final number of clusters can be derived. The final number of clusters is performed by the middle K-means algorithm based on the squared Euclidean distances. K-means is used to refine preliminary results based on hierarchical analysis (Franke, Reisinger & Hoppe, 2009).

K-means obtains clusters considering the distances between i-points and cluster centers (Gülağız & Şahin, 2017). The basis of K-means is that the cluster centers are used as the basis for the cluster, comparing the data objects with each center and dividing the data objects into clusters according to the closest center. Next, the center of each cluster is calculated as the new cluster center until (2) converges:

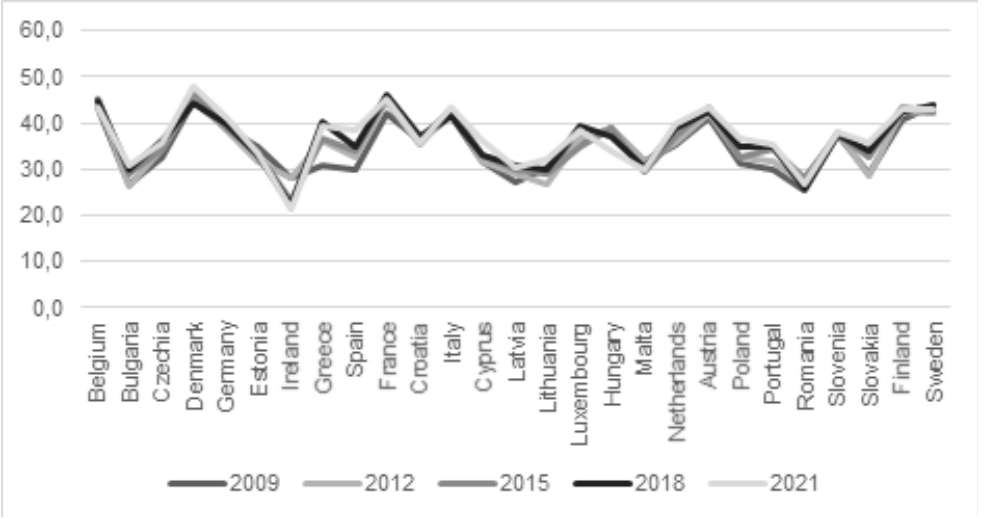
$$E = \sum^{K}_{k=1} \sum_{i \in Cl} [x - \mu_i]^2 \tag{2}$$

where E is the sum of the distance differences between the data objects (x) and the center of the cluster (μ_i), to which it belongs (Ding et al., 2021).

3 Solutions and Results

Figures 1-4 show the development of tax burdens in EU countries in the years 2009–2021.

Figure 1: Tax burden in EU countries

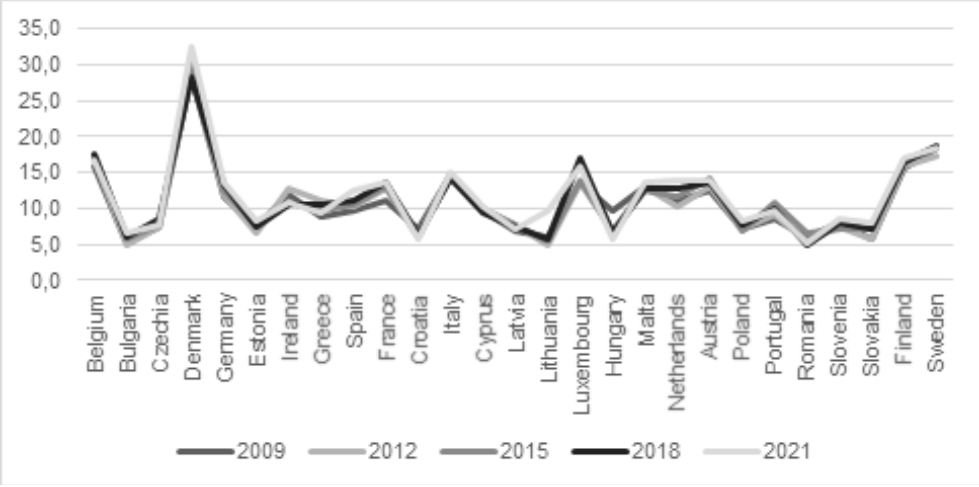


Source: European Commission, own processing (2023)

The average value of the total tax burden in EU countries increased by 2.4% between 2009–2021. The range of variation has increased by around 7.2%, which may indicate that the differences between EU countries have increased over the years. The average value of the total tax burden in 2009 was 38%, in 2012 it was 39.3%, in 2015 it was 39.7%, in 2018 it was 40% and in 2021 it was 40.7%. The countries that do not reach the average value are mainly from Eastern Europe. These are, for example, Romania, Bulgaria, Latvia or Lithuania. Other countries are Malta in the south of Europe and Ireland in the west. On the contrary, the countries that reach higher than average levels are mainly the countries in the north and west of the European Union (the exception is Ireland, which differs from most of the countries of Western Europe because it reaches very low values. These are, for example, Denmark, France and Finland.

The average value of the tax burden of direct taxes in EU countries increased by 1.5% between 2009–2021. The range of variation has increased by around 4%, which may indicate that the differences between EU countries have also increased over the years. The average value of direct tax burden in 2009 was 12.1%, in 2012 it was 12.6%, in 2015 it was 12.9%, in 2018 it was 13.2% and in 2021 it was 13.6%. The countries that do not reach the average value are mainly from Eastern Europe. Countries with low values are, for example, Romania, Hungary, Croatia or Bulgaria. On the contrary, the states that achieve higher than average levels are mainly states in the north and west of the European Union. These are, for example, Sweden, Finland or Belgium. In most countries, a higher proportion of the tax burden on natural persons prevails than on legal persons (the exception is Cyprus). The biggest difference between the tax burden of individuals and legal entities is in Denmark, Italy, Finland and Sweden).

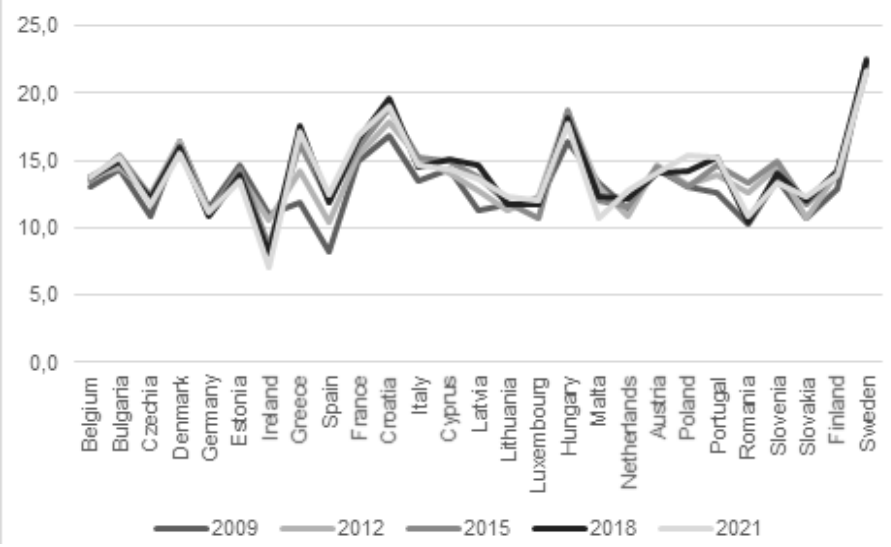
Figure 2: Tax burden of direct taxes in EU countries



Source: European Commission, own processing (2023)

The average value of the tax burden of indirect taxes in EU countries increased by 0.6% between 2009–2021. The range of variation increased again, but only by about 0.3%. The average tax burden of indirect taxes in 2009 was 12.8%, in 2012 it was 13.5%, in 2015 it was 13.7%, in 2018 it was 13.7% and in 2021 it was 13.8%. States, usually reach an average value. However, Ireland achieves low values, and on the contrary, Croatia, Sweden and Hungary achieve very high values. In all states, a higher proportion of the tax burden of VAT prevails compared to consumption tax. The biggest difference between the tax burden of VAT and consumption taxes is in Estonia.

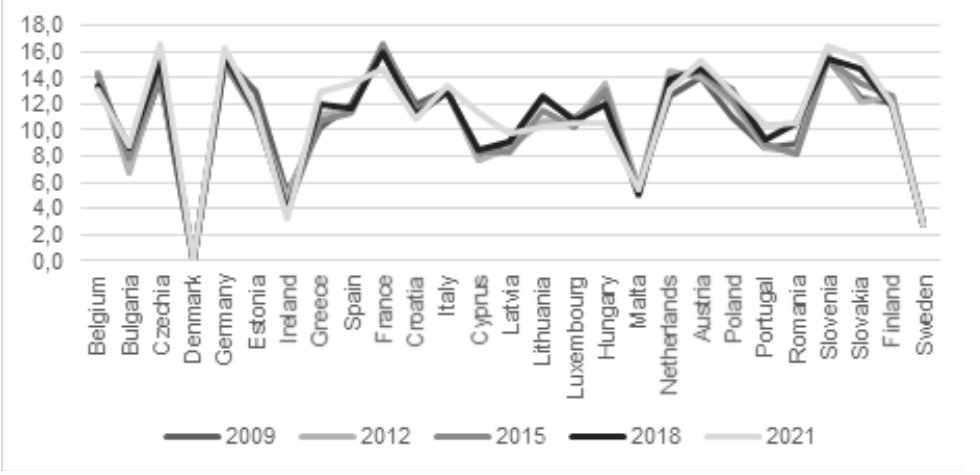
Figure 3: Tax burden of indirect taxes in EU countries



Source: European Commission, own processing (2023)

The average value of the social security tax burden in EU countries was the only one to decrease by 0.1% between 2009-2021. The range of variation increased slightly again, by approx. 0.3%. The average tax burden of indirect taxes in 2009 was 14.8%, in 2012 it was 14.6%, in 2015 it was 14.5%, in 2018 it was 14.6% and in 2021 it was 14.5%. Countries that usually achieve rather lower values are primarily Denmark and Sweden, as well as Ireland, Malta, Cyprus and Latvia. On the contrary, the Czech Republic, France, Germany, Slovenia, and Slovakia achieve higher values.

Figure 4: Tax burden of social security in EU countries



Source: European Commission, own processing (2023)

4.1 Correlation analysis

A correlation analysis was performed to identify the correlation between selected indicators that characterize the tax system. The results of the correlation analysis in individual years can be seen in Table 2.

Table 2: Correlation analysis

Indicators	TTB	DT	INT	SC	TL	TC	TCL	ITRL	ITRC
TTB	1	,703	,502	,189	,911	,191	,567	,698	,298
DT	,703	1	,217	-,439	,644	-,072	,569	,307	,358
INT	,502	,217	1	-,226	,330	,664	,054	,231	,457
SC	,189	-,439	-,226	1	,253	-,072	,037	,452	-,343
TL	,911	,644	,330	,253	1	-,033	,353	,800	,224
TC	,191	-,072	,664	-,072	-,033	1	-,301	-,097	,521
TCL	,567	,569	,054	,037	,353	-,301	1	,262	-,132
ITRL	,698	,307	,231	,452	,800	-,097	,262	1	,049
ITRC	,298	,358	,457	-,343	,224	,521	-,132	,049	1

Source: Own processing

Through correlation analysis, a strong and statistically significant positive correlation was found between the total tax burden and the majority of tax indicators. Another statistically significant positive correlation was found for direct taxes and taxes on labor and capital and indirect taxes and taxes on consumption. Then there is the labor tax and the implicit labor rate and the consumption tax and the implicit consumption rate. These correlations are inferable.

4.2 Evaluation of the similarities of EU countries using cluster analysis

First, it was determined whether all the selected criteria are considered statistically significant differentiations. Based on the results (Table 3), it can be claimed that only one indicator was statistically insignificant. On the contrary, Labor Tax, Tax Burden and Social Insurance are of greatest importance within the framework of differentiation according to the F-Test.

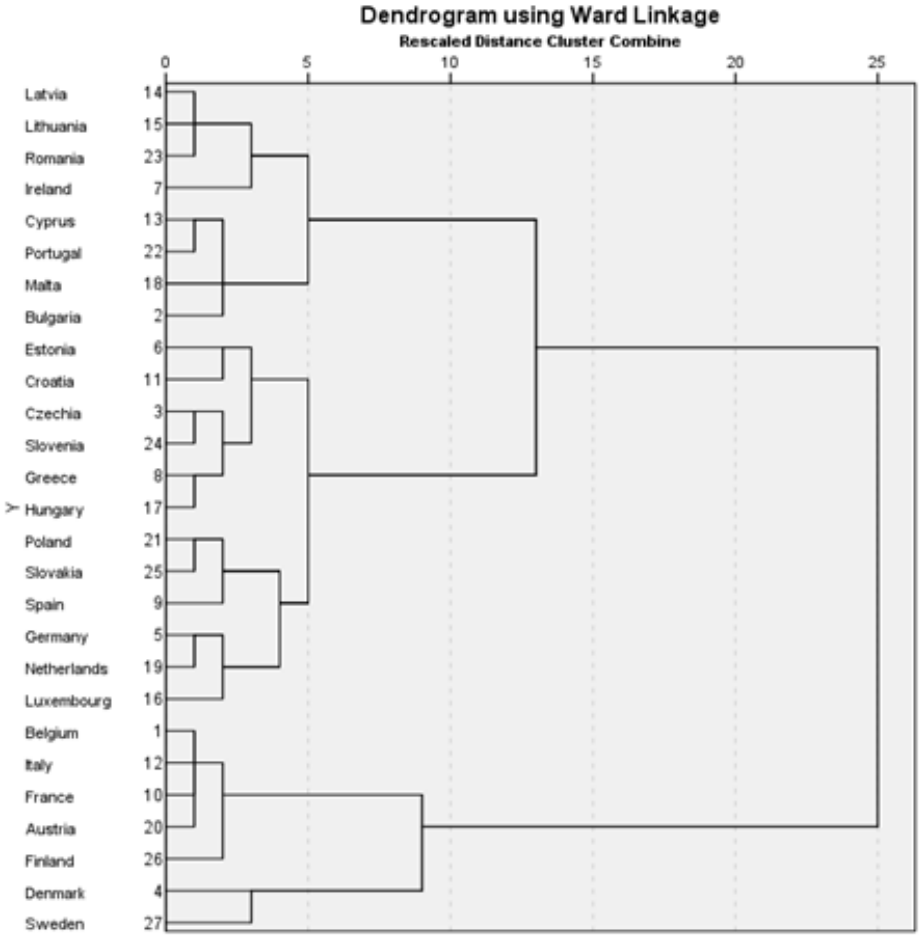
Table 3: One-way Anova

Indicators	F	Sig.
TTB	43,898	0,001
DT	18,583	0,001
INT	3,922	0,021
SC	35,009	0,001
TL	51,675	0,001
TC	0,624	0,607
TCL	2,394	0,094
ITRL	17,751	0,001
ITRC	3,670	0,027

Source: Own processing

As most of the indicators in the model were found to be statistically significant. Hierarchical cluster analysis was first used to create clusters of EU countries. The indicators direct taxes, indirect taxes, social contributions, taxes on consumption, on labor, on capital and implicit tax rate were used as inputs for hierarchical cluster analysis. Through cluster analysis, all 27 EU states were divided into groups characterized by similar behavior. The result of the hierarchical clustering process is shown in a dendrogram (Figure 5), according to which it can be assumed that the probable number of clusters will be between 2–6.

Figure 5: Dendrogram



Source: Own processing

The final number of clusters was finally selected as four through non-hierarchical clustering (K-means).

Cluster 1 includes 6 countries (Belgium, Germany, France, Italy, Austria and Finland). These are primarily Western European countries (Belgium, Germany and France), but also southern (Italy), central (Austria) and northern (Finland). It is therefore a very heterogeneous group. All countries are also Eurozone countries and joined the EU before 2004. These are states that are characterized by a very high overall tax burden. The tax burden of direct and indirect taxes and social insurance is equally represented. States are characterized by high taxes on labor and the associated high implicit tax rate on labor. The implicit rate on labor exceeds the implicit rate on consumption just as taxes

on labor exceed taxes on consumption and capital. France has the highest overall tax burden, while Germany has the lowest. The highest share of direct taxes is in Belgium and the lowest in Germany. The highest share of indirect taxes is in France and the lowest again in Germany. France achieves the highest values also within the framework of social security, and Finland shows the lowest values. The biggest difference is within the implicit consumption rate, where Finland achieves the highest values and Italy the lowest.

Cluster 2 includes 8 countries (Bulgaria, Ireland, Cyprus, Latvia, Lithuania, Malta and Portugal, Romania). These are mainly the states of Eastern Europe (Bulgaria, Latvia, Lithuania and Romania), Southern (Cyprus, Malta and Portugal) and Western Europe (Ireland). From a geographical point of view, these are rather smaller states. These are the states with the lowest tax burden, where the share of indirect taxes prevails. Most of these countries joined the EU after 2004. These are the states characterized by the lowest overall tax burden. These are the states characterized by a similar tax burden of direct taxes and social insurance and a slightly increased share of indirect taxes, but compared to the other clusters it has the lowest share of the tax burden of indirect taxes. The implicit rate on labor exceeds the implicit rate on consumption just as taxes on labor exceed taxes on consumption and capital. Portugal has the highest total tax burden, the lowest is Ireland. The highest share of direct taxes is in Malta and the lowest is in Bulgaria. The highest share of indirect taxes is in Bulgaria and the lowest in Ireland. Lithuania has the highest values in social security and the lowest values in Ireland. The biggest difference is in implicit rates from work, where Romania has the highest values and Malta the lowest.

Cluster 3 includes 11 countries (Czechia, Estonia, Greece, Spain, Croatia, Luxembourg, Hungary, Netherlands, Poland, Slovenia and Slovakia). This is the largest group of countries, which are mainly from Central Europe (Czechia, Poland and Slovakia), then from the East (Estonia, Croatia, Slovenia), from the South (Greece, and Spain) and West (Luxembourg and the Netherlands). Rather, these are states with a lower tax burden, where the share of indirect taxes and social security prevails. Most of these countries joined the EU after 2004. These are states that are characterized by a lower overall tax burden. These states are characterized by a lower tax burden of direct taxes compared to indirect taxes and social insurance. At the same time, however, the share of social insurance is largely high. The fact that these countries have a high implicit rate for work is also related to the higher share of social insurance. The implicit rate on labor exceeds the implicit rate on consumption just as taxes on labor exceed taxes on consumption and capital. Within that cluster, Hungary has the highest overall tax burden, while Slovakia has the lowest. The highest share of direct taxes is in Luxembourg and the lowest in Croatia. The highest share of indirect taxes is in Croatia and the lowest in Spain. The Czech Republic achieves the highest values in terms of social security, and Luxembourg shows the lowest values. The biggest difference is within the implicit consumption rate, where Estonia achieves the highest values and Spain the lowest.

Cluster 4 includes 2 countries (Denmark and Sweden). These are the states that are characterized by the highest total tax burden, due to the high proportion of the burden of direct and indirect taxes and at the same time the lowest burden of social insurance. These are the states with a high tax burden on labor and the implicit rate on labor, as

well as the highest implicit rate on consumption and also the highest share of taxes on consumption. The implicit rate on labor exceeds the implicit rate on consumption just as taxes on labor exceed taxes on consumption and capital.

The average values of the clusters can be seen in the table 4.

Table 4: Average cluster values

Cluster	TTB	DT	INT	SC	TL	TC	TCL	ITRL	ITRC
1	42,53	14,45	13,90	14,19	22,57	11,46	8,48	40,68	17,64
2	29,45	8,62	12,76	8,07	12,24	11,60	5,61	28,18	17,40
3	35,37	8,81	13,84	12,72	16,82	12,38	6,17	34,52	19,11
4	44,56	24,11	19,05	1,40	24,26	13,18	7,12	36,67	23,15

Source: Own processing

4 Discussion and conclusions

Based on the cluster analysis, a total of 4 clusters were created, see Table 5.

Table 5: Cluster analysis

Cluster	Countries in cluster
1	Belgium, Germany, France, Italy, Austria and Finland
2	Bulgaria, Ireland, Cyprus, Latvia, Lithuania, Malta and Portugal, Romania
3	Czechia, Estonia, Greece, Spain, Croatia, Luxembourg, Hungary, Netherlands, Poland, Slovenia and Slovakia
4	Denmark and Sweden

Source: Own processing

Based on the results of the cluster analysis, differences between countries in terms of their taxation are identified, especially between countries that joined the EU earlier or later. It can be stated that most of the countries in the 2nd and 3rd clusters, i.e., with the lowest tax burden, joined the EU in 2004 and later. A high tax burden can be found in countries in the west and north of Europe. The lower tax burden of these states can make their economic environment much more interesting for foreign investors, thereby increasing their tax revenues. However, as already mentioned, the tax system is not the only factor that affects the movement of capital. Similar results were obtained, for example, in Andrejovská

& Hudáková (2016); Korecko, Bacik & Voznakova (2019) or Mihokova, Andrejovska & Martinkova, (2018).

The article revealed clusters of countries in the EU27 with similar tax systems according to various tax burden indicators. At the same time, gaps and differences in the tax burden were identified.

The results of the correlation analysis showed a strong and statistically significant positive correlation between the total tax burden and most of the tax indicators. Furthermore, the results show that between 2009–2021 there was a slight increase in the tax burden, especially direct taxes. Significant differences in tax indicators within the EU were found. It was found that the countries that joined the EU after 2004 are characterized by a lower tax burden than the countries that joined the EU before 2004. All clusters show the largest implicit labor rate and at the same time the largest labor taxes. Among the clusters in which the countries with the highest tax burden appeared were Sweden and Denmark, and on the contrary, Bulgaria, Ireland, Cyprus, Latvia, Lithuania, Malta, Portugal and Romania were in the cluster with the lowest tax burden.

By means of a cluster analysis, states were found that could cooperate in this area within the framework of tax harmonization, and based on this cooperation, opinions and recommendations for uniform EU tax rules could be included. Fewer proposals from only a few clusters would facilitate the adoption of uniform rules. The countries that have been grouped are characterized by similar historical, political or geographical features (for example, larger countries show a higher tax burden and the opposite is the case in smaller states).

The limit of this research is that not all indicators that describe the tax burden in individual countries were used. Future research could expand the sample set by adding more countries or analyze individual countries more intensively.

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Correlation between Wages and House Prices: an Analysis of Regional Differences in the Czech Republic

OSKAR CRNADAK

Abstract

Background: The real estate market in the Czech Republic exhibits significant differences among regions, especially in terms of the influence of economic factors such as wages on property prices. Wages are one of the key determinants of house prices, but their influence may vary across regions and over time. It is important to further understand the dynamics between wages and house prices at the regional level.

Objective: This study seeks to investigate whether and how the impact of wages on house prices varies among regions and how it changes over time.

Methods: The fixed effects panel regression with interaction terms was used to account for regional and time effects. The model includes lagged house price values to better capture market dynamics over time. Interaction terms between wages and regions allow for the detection of region-specific effects. The Newey-West correction was used to control for heteroskedasticity and autocorrelation.

Results: In some regions, such as Prague, factors other than wages (e.g. lack of supply and high demand) may play a more significant role. The analysis also confirmed that house prices exhibit time inertia, which means that past price developments have an impact on the current market.

Recommendation: It is recommended to focus on promoting affordable housing in regions with high prices and on investment opportunities in emerging regions where wages and house prices are growing more steadily.

Practical relevance: This study provides insights into regional differences in the Czech Republic's housing market. These insights are valuable for regional housing and economic development strategies Policymakers can use this knowledge to better respond to affordable housing challenges.

Originality/value: This study provides an original analysis of the impact of wages on house prices, with an emphasis on regional specificities and time trends, allowing for a deeper understanding of regional dynamics in the housing market in the Czech Republic. This analysis provides useful insights for future research and for practical applications in real estate market and regional policy decision-making.

Keywords
house prices, wages, regional differences, panel regression, Czech Republic, affordable housing

JEL Codes
L33, H59, Q15

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Introduction

Real estate prices in the Czech Republic have shown significant regional differences in recent decades, which are due to a number of economic factors. One of the key determinants, often discussed in connection with trends on the real estate market, are the average wages of the inhabitants of the individual regions. This article addresses the correlation between average wages and property prices across different regions of the Czech Republic, in the context of examining, analyzing, and synthesizing regional differences and their causes.

Property prices are influenced by a wide range of factors. Among the most important price drivers are macroeconomic indicators such as gross domestic product (GDP), unemployment rate, inflation, and especially wages (Ting, 2017). Wages, as one of the main economic indicators, have a direct impact on the purchasing power of the population and the demand for real estate. It can be assumed that these factors are subsequently reflected in market prices. Therefore, regional differences in wage levels can play a crucial role in creating price differentiation in the real estate market.

Regional differences in property prices can also be a signal to investors interested in the profitability of property investments in different locations. They provide useful information for individuals who are considering buying a property to own. Thus, this research provides new empirical evidence on the link between wage trends and property prices in the Czech Republic, while contributing to the understanding of property market dynamics.

The paper aims to explore wage-property price correlations and regional variations within the Czech Republic. For the purposes of this research, the following hypotheses were formulated:

H1: There is a positive correlation between average wages and real estate prices in the individual regions of the Czech Republic.

H2: There is a positive correlation between average wages and property prices depending on the location and level of economic development of the region.

H3: The correlation between wages and house prices is stronger in highly urbanized regions, such as the capital city of Prague, than it is in less developed regions.

This paper focuses on testing these hypotheses and formulating recommendations for policymakers and investors who want to better understand the regional dynamics of the Czech real estate market.

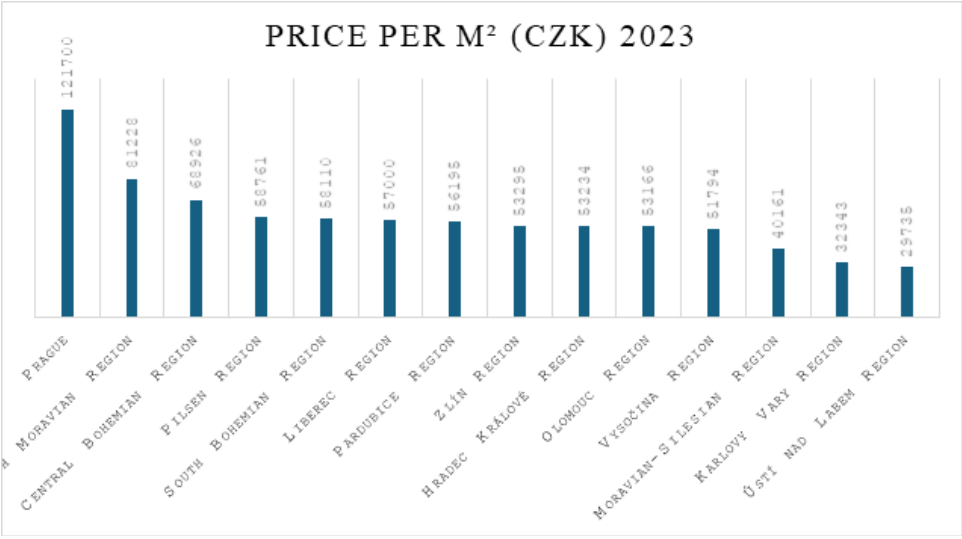
The paper addresses price-setting factors affecting real estate prices through a systematic literature review and is structured as follows: the Introduction provides an introductory view of the issue and justifies the importance of examining the relationship between wages and real estate prices, with a focus on regional differences in the Czech Republic. The Literature Review presents the views and attitudes of world authors on the topic of pricing factors in the real estate market and focuses on identifying the main determinants influencing real estate prices and wage levels in the different regions. The Data and Methodology section presents a methodological approach to the research, including the chronology, analytical methods used, and models applied for investigating the relationship between wages and property prices. It presents the steps and techniques that were used in the processing of the data. The Research findings and discussion section presents the main findings of the research performed, including the correlations found between wages and property prices, and discusses how this relationship varies among the different regions of the Czech Republic. The Conclusion summarizes the key findings and offers an interpretation of the results in a broader context, including possible implications for market participants and policymakers. The author's intention is to present deeper insights into the relationship between wages and property prices and to provide valuable insights into regional market dynamics. These may be useful for future research and practical applications.

1. Literature review

Location is one of the strongest factors influencing property prices. The quality and attractiveness of a location play a major role in determining the type of buyers or tenants a property attracts, which is then reflected in the resulting market value. Location can influence property prices through proximity to the city center, accessibility of transportation, or access to key services and amenities. Amenities, including access to schools, health facilities, or shops, for example, are closely linked to location. Location is considered to be one of the most important factors in determining the price of real estate (Kaynak & Stevenson, 1982; Yusuf & Resosudarmo, 2009; Zabel & Kiel, 2000; Opoku & Abdul-Muhmin, 2010). Moreover, research shows that most buyers consider location a key factor in deciding the price of a home (Raden et al., 2015).

In the Czech Republic, house prices vary significantly by region. Traditionally, prices are highest in Prague, whereas they are almost half as high in most other regions (see Figure 1).

Figure 1: Average prices per m² for flats in the individual regions in 2023



Source: Deloitte Real Index Q4 2023

The differences in average price per square meter among regions in the Czech Republic are obvious at first glance. The highest average price per square meter is found in the Capital City of Prague, while the lowest prices are seen in the Ústí nad Labem Region. This regional variation shows the significant influence of location on the market value of real estate.

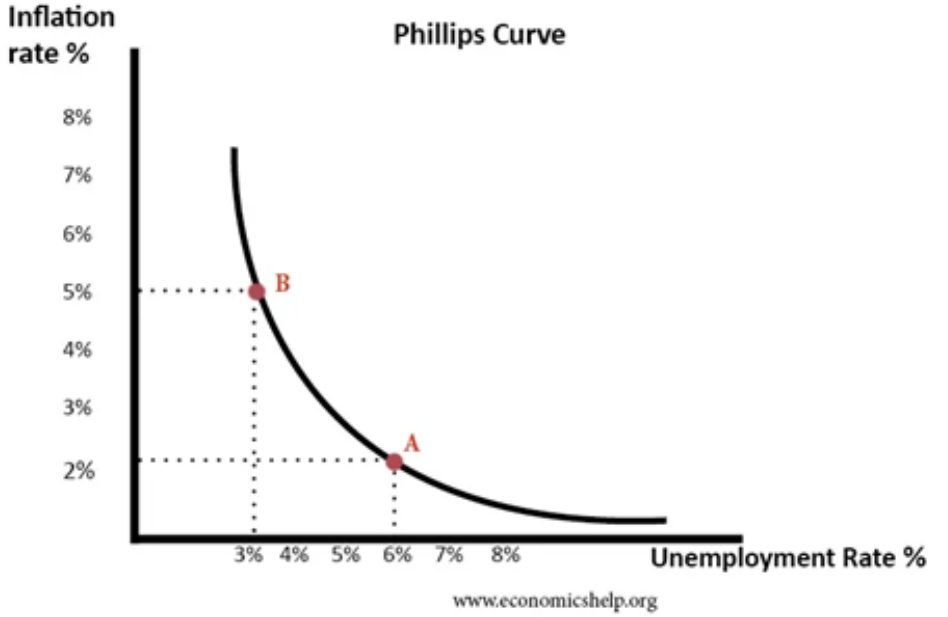
In addition to the attractiveness of the location and the amenities, the quality of public services also plays an important role and can significantly increase the value of residential property and contribute to its price growth. Public services in the context of property prices include a wide range of services provided by the state, municipalities, or other public institutions. These services provide added value to local residents and their availability is a key factor in determining property prices. The main types of public services that affect residential property prices include:

- Transportation infrastructure: includes access to roads, public transportation, and the rail network, facilitating mobility and increasing accessibility.
- Educational facilities: nurseries, primary schools, secondary schools, and universities that attract families and support stable housing demand.
- Healthcare facilities: hospitals, clinics, and pharmacies providing easy access to healthcare. These are seen as a key factor in the quality of life in the area.
- Security services: include local police and fire stations, which increase the sense of security and ensure the protection of residents.
- Social and cultural facilities: parks, libraries, community centers, and other public spaces that contribute to community life and enhance the environment.
- Technical infrastructure: water supply, sewerage, electricity, and high-speed internet access – all essential for comfortable living and a modern lifestyle.

Martz et al. (2006) found that the extent of available public services significantly influences the decision to purchase a property. Following this, a study by Liu et al. (2022) analyzed the effects of public services on property prices using a large sample of 155,845 residential sales transactions in Beijing over the period 2012-2019. The results showed that higher service quality indeed creates a premium in property value. The higher the quality of services, the higher this premium in house price, whereas this premium continuously increased over the reference period. This study also shows that the contribution of the quality of public services to property value is greater for higher-priced or larger houses, relatively newer buildings, or properties farther away from the city center. Amenities include other elements such as cultural attractions, sports centers, shopping facilities, or hospitals, which also contribute to the attractiveness of a location (Huang et al., 2020; Jang & Kang, 2015). The availability of employment opportunities is also an important factor influencing the price of real estate. For example, a study by Vágó et al. (2024) showed that after the opening of a Mercedes factory, property prices in an area increased by 39 percentage points between 2010 and 2017 compared to a hypothetical scenario without this investment. These studies confirm the importance of public services and employment as key factors that significantly affect property values and contribute to their market attractiveness.

House prices are closely linked to the overall state of the economy, so it is important to mention the Phillips curve (Phillips, 1958), which shows a significant negative relationship between wage inflation and the unemployment rate, while also tracking the rate of change in unemployment. This relationship illustrates that with lower unemployment comes higher wage inflation (see Figure 2).

Figure 2: Phillips curve



Source: Phillips Curve Explained - Economics Help

This phenomenon significantly impacts the real estate market through two main mechanisms. The first mechanism is the influence of overall inflation, which raises not only wage costs but also the prices of construction materials. Higher construction costs for new properties consequently drive price growth in the real estate market. The second mechanism involves the effect of rising employment and wage growth, which increases the purchasing power of the population, thereby boosting demand for real estate. This increase in demand leads to further price growth in the real estate market (Baptista et al.,2023). Together, these two mechanisms amplify the impact of wage and price inflation on the real estate market, resulting in further price increases in this sector.

Examining the relationship between regional unemployment rates and housing affordability, measured by the ratio of property prices to average wages, provides an interesting approach to analyzing the economic potential of regions. Unemployment is a key indicator, reflecting not only the economic capabilities of a region but also its potential for future development. In practice, it has been observed that higher unemployment rates are often associated with lower core property prices, as noted by Dráha (2014). Authors Marinković et al. (2024) found that average wages and unemployment rates in Serbia are among the significant determinants of property prices. Similarly, Laurinavičius et al. (2022) conducted research on the impact of macroeconomic factors on property prices in Vilnius from 2006 to 2019. Their findings suggest that rental housing prices, among other factors, are influenced by average wage levels. These studies confirm the importance of employment and wage levels as crucial economic variables affecting the market value of real estate in a regional context.

2. Data and methodology

This study utilized quarterly panel data covering information on property prices (residential units) and wages across regions of the Czech Republic for the period 2015 to 2023. The objective of this analysis was to examine how wage growth affects housing prices in different regions. The time series were normalized with a base index of 2015=100, allowing for relative changes over the reference period to be observed. The data was sourced from the database of the Czech Statistical Office (ČSÚ, 2024), which provides a detailed overview of developments at the regional level. This approach enables a comparative analysis between regions.

To test the relationship between wages and property prices, a panel regression model with fixed effects (Fixed Effects Model) was employed, specifically a fixed effects panel regression with interaction terms between the wage index and regional variables. This model accounts for fixed effects by region and time effects, controlling for unobserved heterogeneity across regions and years. The interaction terms between the wage index (Log_Wage_Index) and regional dummy variables reveal how the relationship between wages and property prices varies across regions. econometric models were created in Gretl software.

Additionally, lagged values of property prices were included in the model to control

for time effects and real estate market dynamics. A robust model with the Newey-West estimator was used, which effectively controls for heteroskedasticity and autocorrelation while retaining the interaction terms. This robust model demonstrates a high R-squared value (0.994), indicating that the model explains a substantial portion of the variability in the data while accounting for both time and regional variability.

The results show that the lagged value of Log_Price_Index has a strong positive and statistically significant association, suggesting the presence of temporal inertia in housing prices. This dynamic is more accurately captured in the model with robust standard errors, providing more stable estimates by accounting for potential temporal and regional influences on the real estate market.

2.1 Model development

A model development approach was selected for analyzing the relationship between the wage index and the price index across different regions, taking into account temporal trends and regional specifics. Below is a detailed description of the methodology. The study utilizes panel data and applies fixed effects for regions and time periods (years, quarters), enabling the model to control for inter-regional variability and temporal factors. The autoregressive component of the model includes the dependency of current values of the price index (Log_Price_Index) on values from previous periods, which better captures the dynamics of price trends. The interaction terms between the wage index and regional variables allow the model to account for varying effects of wages on housing prices across regions, contributing to a more detailed understanding of regional differences. The model uses Newey-West robust standard errors, which are essential for controlling for autocorrelation and heteroskedasticity in residuals, ensuring more accurate and stable estimates.

The model was tested for the presence of autocorrelation, heteroskedasticity, and multicollinearity, yielding the following important findings:

- The Durbin-Watson statistic demonstrated that the model's autoregressive component effectively removed autocorrelation, contributing to the stability and reliability of the results.

- The Breusch-Pagan test confirmed the presence of heteroskedasticity; however, the use of Newey-West standard errors effectively addressed this issue, ensuring the accuracy of estimates.

The proposed model was designed to reflect regional differences in housing price dynamics and to account for temporal inertia in property prices. These adjustments to the model allow for robust and reliable estimates, even in the presence of heteroskedasticity and autocorrelation. Based on these parameters, the model can be considered a valuable tool for analyzing the impact of wages on housing prices across regions, allowing for a deeper understanding of the price dynamics in the real estate market.

$$Log\_Price\_Index_{it} = \alpha + \sum_r \beta r \cdot C(Region)_r + \sum_t yt \cdot C(Year)_r + \delta \cdot Log\_Wage\_Index_{it} + \sum_r \theta r \cdot (Log\_Wage\_Index_{it} \, x \, C(Region)_r) + \lambda \cdot Lag\_Log\_Price\_Index_{it} + \epsilon it$$

Where the following applies:

- Log_Price_Index: Dependent variable representing a logarithm of property prices.
- C(Region): Regional fixed effects for each region (region-specific categories).
- C(Year): Temporal fixed effects for each year.
- Log_Wage_Index: Logarithmic wage index, the main independent variable.
- Log_Wage_Index × C(Region): Interaction terms between the wage index and regions, indicating how wage effects vary across regions.
- Lag_Log_Price_Index: Lagged property price value from the previous period to account for autocorrelation.
- ε_{it}: Model error for individual regions and years.

The above equation describes the relationship between property prices (in logarithmic form) and wages, accounting for regional differences, temporal trends, and lagged effects.

2.2 Research findings and discussion

The following model represents the result of the calculation.

Model 1: Fixed Effects Model

OLS Regression Results						
Dep. Variable:	Log_Price_Index				R-squared:	0.994
Model:	OLS Adj.				R-squared:	0.994
Method:	Least Squares				F-Method	3789.
Prob (F-statistic):	0.00					
Log-Likelihood:	1093.9					
No. Observations:	490					
Df Residuals:	453					
Df Model:	36					
Covariance Type:	HAC					
Durbin-Watson:	2.072	coef	std	err	t P>|t| [0.025	0.975]

Variable	Coefficient	Std. Error	t-Statistic	P-Value
Intercept	0,7666	0,182	4,223	0
C(Region)[T.Hradec Králové Region]	-0,0357	0,165	-0,216	0,829
C(Region)[T.Karlovy Vary Region]	-0,0059	0,239	-0,025	0,98
C(Region)[T.Liberec Region]	-0,2252	0,201	-1,12	0,263
C(Region)[T.Moravian-Silesian Region]	-0,0618	0,211	-0,293	0,77
C(Region)[T.Olomouc Region]	0,3082	0,174	1,771	0,077
C(Region)[T.Pardubický Region]	0,2104	0,159	1,327	0,185
C(Region)[T.Pilsen Region]	0,409	0,155	2,636	0,009
C(Region)[T.Prague]	0,4479	0,17	2,632	0,009

Variable	Coefficient	Std. Error	t-Statistic	P-Value
C(Region)[T.South Bohemia Region]	-0,1686	0,183	-0,922	0,357
C(Region)[T.South Moravian Region]	0,2781	0,172	1,615	0,107
C(Region)[T.Vysočina Region]	-0,0943	0,165	-0,571	0,568
C(Region)[T.Zlín Region]	0,225	0,191	1,181	0,238
C(Region)[T.Ústí nad Labem Region]	-0,8454	0,202	-4,184	0
C(Year)[T.2016]	0,0441	0,005	9,355	0
C(Year)[T.2017]	0,0687	0,007	10,474	0
C(Year)[T.2018]	0,09	0,009	9,991	0
C(Year)[T.2019]	0,1065	0,011	9,64	0
C(Year)[T.2020]	0,1451	0,014	10,56	0
C(Year)[T.2021]	0,2257	0,017	12,988	0
C(Year)[T.2022]	0,2303	0,023	10,195	0
C(Year)[T.2023]	0,1868	0,022	8,56	0
Log_Wage_Index	0,1026	0,04	2,562	0,011
Log_Wage_Index:C(Region)[T.Hradec Králové Region]	0,0086	0,034	0,257	0,797
Log_Wage_Index:C(Region) [T.Karlovy Vary Region]	-0,0028	0,048	-0,058	0,954
Log_Wage_Index:C(Region) [T.Liberec Region]	0,05	0,041	1,212	0,226
Log_Wage_Index:C(Region) [T.Moravian-Silesian Region]	0,0143	0,043	0,33	0,741
Log_Wage_Index:C(Region) [T.Olomouc Region]	-0,0623	0,036	-1,739	0,083
Log_Wage_Index:C(Region) [T.Pardubický Region]	-0,0436	0,032	-1,345	0,179
Log_Wage_Index:C(Region)[T.Pilsen Region]	-0,0832	0,032	-2,615	0,009
Log_Wage_Index:C(Region) [T.Prague]	-0,0898	0,035	-2,552	0,011
Log_Wage_Index:C(Region)[T.South Bohemia Region]	0,0367	0,038	0,978	0,329
Log_Wage_Index:C(Region)[T.South Moravian Region]	-0,0561	0,036	-1,577	0,115
Log_Wage_Index:C(Region) [T.Vysočina Region]	0,022	0,034	0,644	0,52
Log_Wage_Index:C(Region)[T.Zlín Region]	-0,0441	0,039	-1,127	0,26
Log_Wage_Index:C(Region)[T.Ústí nad Labem Region]	0,1803	0,042	4,322	0
Lag_Log_Price_Index	0,7297	0,027	27,24	0

Source: compiled by the author, Gretl

An R-squared value of 0.994 indicates that the model explains approximately 99.4% of the variability in the house price index (dependent variable). This result indicates a very good fit of the model to the data, which is indicative of how well it is able to describe the relationship between wages and house prices. The adjusted R-squared of 0.994 is very similar to the R-squared value, confirming that the model is well suited to the data, even when taking into account the number of predictors. The Durbin-Watson statistic of 2.072 is close to the value of 2. This indicates that there is no significant autocorrelation of residuals in the model. This value means that the model does not have a problem with autocorrelation between errors, which strengthens the credibility of the results. Most of the coefficients are statistically significant with p-values less than 0.05. This result suggests that we can say with high confidence that these variables have a real relationship with housing prices.

3. Interpretation of the results

Table 1 presents the interaction terms of the logarithmic wage index (Log_Wage_Index) with detailed descriptions. It provides an overview of the interaction effects between the wage index and each regional variable, showing how the impact of wages on house prices varies across regions.

Table 1: Log_Wage_Index interaction terms with detailed descriptions

Region	Log_Wage_ Index interaction coefficients	Description	Detailed description
Hradec Králové Region	0.0086	Very small positive effect: wages slightly influence prices in this region.	For every 1% increase in wages, housing prices increase by 0.0086% more than in the baseline region.
Karlovy Vary Region	-0.0028	Very small negative effect; wages have almost no influence on prices.	For every 1% increase in wages, housing prices increase by 0.0028% less than in the baseline region.
Liberec Region	0.0500	Small positive effect; wages slightly influence prices in this region.	For every 1% increase in wages, housing prices increase by 0.0500% more than in the baseline region.
Moravian-Silesian Region	0.0143	Very small positive effect; weak influence of wages on housing prices.	For every 1% increase in wages, housing prices increase by 0.0143% more than in the baseline region.
Olomouc Region	-0.0623	Negative effect; higher wages lead to lower prices in this region.	Housing prices in this region decrease by 0.0623% for every 1% increase in wages.

Pardubice Region	-0.0436	Small negative effect; wages decrease housing prices slightly.	Housing prices in this region decrease by 0.0436% for every 1% increase in wages.
Pilsen Region	-0.0832	Moderate negative effect; wages reduce housing prices in this region.	Housing prices in this region decrease by 0.0832% for every 1% increase in wages.
Prague	-0.0898	Negative effect; wages decrease housing prices in Prague.	For every 1% increase in wages, housing prices decrease by 0.0898% in Prague compared to the baseline region.
South Bohemia Region	0.0367	Small positive effect; weak influence of wages on prices.	For every 1% increase in wages, housing prices increase by 0.0367% more than in the baseline region.
South Moravia Region	-0.0561	Negative effect; wages slightly reduce housing prices.	Housing prices in this region decrease by 0.0561% for every 1% increase in wages.
Vysočina Region	0,0220	Very small positive effect, wages have a weak effect on prices.	For every 1% increase in wages, housing prices increase by 0.0220% more than in the baseline region.
Zlín Region	-0,0441	Moderate negative effect, wages have a small negative impact on prices.	Housing prices in this region decrease by 0.0441% for every 1% increase in wages.
Ústí nad Labem Region	0,1803	Large positive effect, higher wages lead to higher prices in this region.	For every 1% increase in wages, housing prices increase by 0.1803% more than in the baseline region.

Source: compiled by the author, Gretl

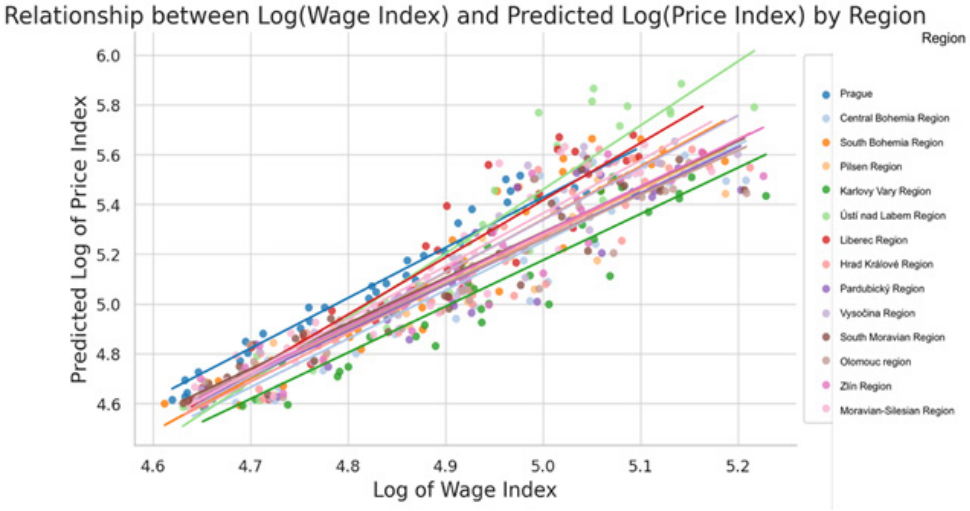
The model suggests that wages generally have a positive impact on housing prices but that this effect varies significantly across regions. For instance, a negative relationship between wages and housing prices appears in some regions, such as Prague. This indicates that other factors, such as limited housing supply, high demand, high cost of living, or specific regional economic conditions, may exert a stronger influence on housing prices in these areas than wages do. These factors may overshadow wage influences, driving up prices independently of local wage levels.

Coefficients for individual years: C(Year) [T.2016] to C(Year) [T.2023]. The coefficients for the C(Year) variables indicate the effect of each year compared to the reference year 2015 (which is not explicitly shown in the model). Each coefficient represents the difference in price index relative to 2015. For example, the coefficient value for C(Year) [T.2020] is 0.1451, meaning that the price index in 2020 was 0.1451 higher than it was in the reference year

2015. Positive coefficient values for the individual years indicate an overall upward trend in housing prices over time. This trend signifies that the housing prices exhibited annual growth. However, this growth may likely be driven by increasing demand, inflation, rising construction costs, or other economic factors over the period. This price increase may also be influenced by specific macroeconomic conditions, such as interest rates or changes in mortgage availability. The trend confirms that housing prices tend to rise each year. The model effectively captures the price dynamics in the Czech Republic's real estate market between 2015 and 2023.

In addition to the main model, a simple linear relationship between wages and property prices was analyzed to identify the direct correlation between these two variables, without accounting for additional factors such as regional specifics or temporal trends. The results of this linear analysis provided insight into the basic relationship between wage growth and changes in property prices. This approach helped confirm the general positive impact of wages on property prices – higher wages often correlate with higher housing prices, suggesting that wage growth contributes to increased housing demand and, consequently, to rising prices in the real estate market. **Thus, the linear relationship provided a simplified view of the issue that supports the initial hypothesis of a positive correlation between wages and property prices.**

Figure 3: Relationship between Log_Wage_Index and Predicted Log_Price_Index by region



Source: Author analysis, Gretl

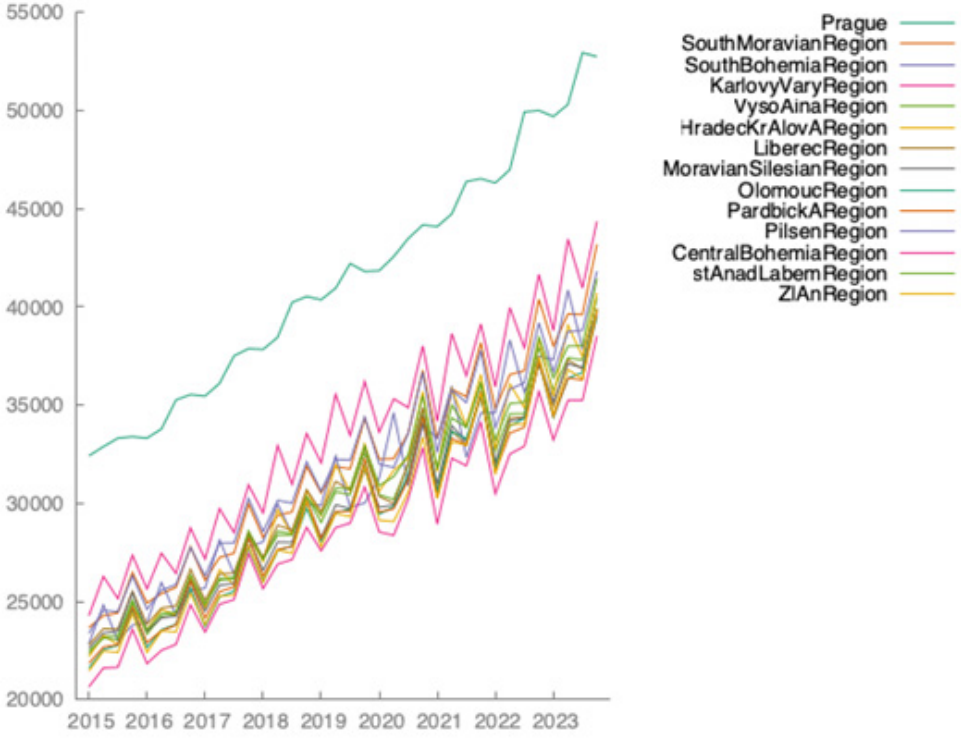
The graph indicates a positive relationship between the logarithmic wage index and the predicted logarithmic price index across different regions. This suggests that higher wages are associated with higher housing prices in all regions. However, this relationship represents only a basic view of the association between wages and property prices, without considering other key factors.

Limitations of the graph: The graph only displays a simple linear relationship between wages and property prices without accounting for regional differences, time effects, or lagged price values. In other words, it shows only the current relationship between wages and prices without incorporating historical trends or time dynamics that could significantly influence the results. Additionally, the graph does not include interaction terms that would help reveal how the relationship between wages and prices varies by specific region or over time.

Difference between Model 1 and Figure 3: Model 1 incorporates regional fixed effects, time effects, and lagged variables, taking into account specific factors for each region and time period. Thus, Model 1 provides a more in-depth analysis that includes historical price changes and the impact of previous periods, while Figure 3 shows only the current relationship between wages and prices, offering a static view. Moreover, Model 1 includes interaction terms between wages and regions, allowing for an analysis of how the impact of wages on property prices varies between regions. Figure 3, however, shows only the average relationship, potentially concealing specific regional differences essential to understanding the full dynamics of the real estate market. In summary, Figure 3 provides a general view of the relationship between wages and property prices, albeit limited to a simplified and static perspective that does not account for the complex dynamics of regional and temporal factors. In contrast, Model 1 offers a more detailed analysis, taking time trends and regional specifics into consideration, which allows for a deeper understanding of the factors influencing the real estate market.

An interesting perspective on wage growth across regions is shown in Figure 4, which highlights a nearly identical trend across all regions except Prague. In Prague, a distinct trend can be observed, suggesting that wages in the capital city have grown at a different rate than in the rest of the country. This specific trend may result from a higher concentration of economic opportunities, above-average demand for jobs, and generally higher living costs, which are common in Prague compared to other regions.

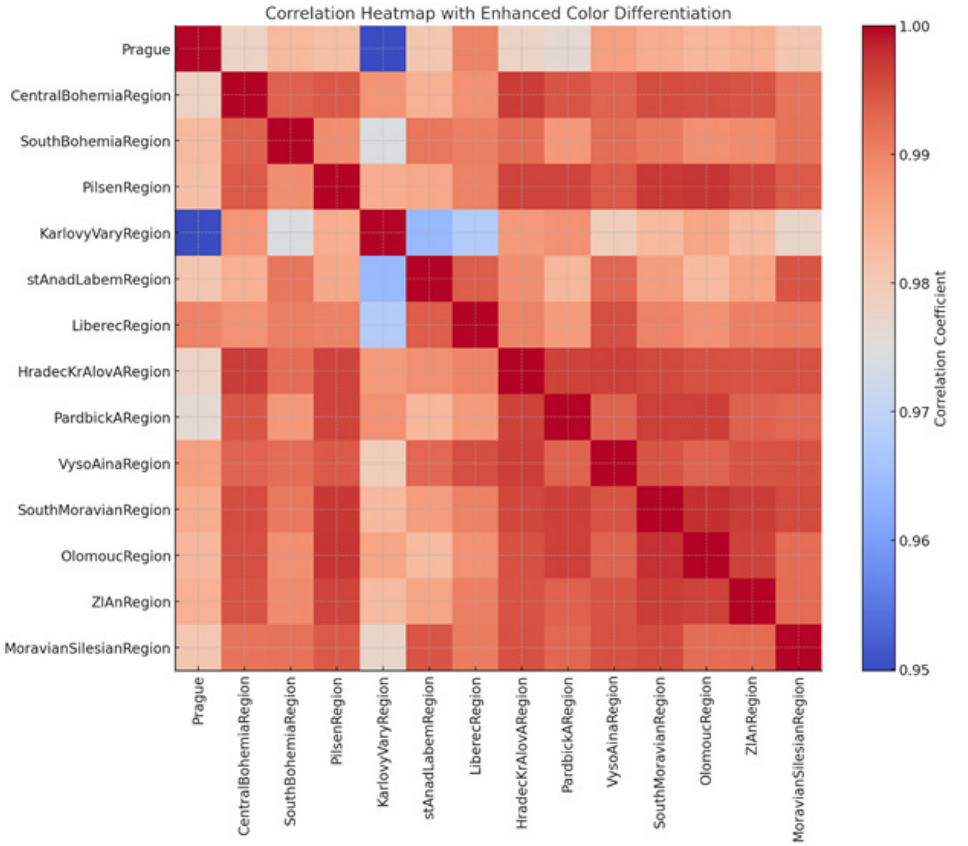
Figure 4: Wage trends by region



Source: Author analysis, Gretl

The unique trend in Prague underscores regional wage differences that may be important when examining the influence of wages on property prices. As the economic and administrative center of the country, Prague exhibits characteristics that may significantly impact wage growth and, in turn, the dynamics of housing prices. This is followed by a correlation matrix.

Figure 5: Correlation matrix between regions



Source: Author analysis, Gretl

The values between regions show very strong positive correlations, depicted in dark red. Most values reach levels close to 1, indicating that the regions display nearly identical behavior in the observed factor, with minimal variability between them. Exceptions include certain values around 0.9, suggesting a slightly lower correlation between certain regions. Still, the relationship remains strong. For this reason, the model could be adjusted to better account for this regional homogeneity and adapt to the small differences that may be relevant to regional analysis. This adjustment would allow for a more accurate interpretation of regional variations, thereby providing a more detailed view of the dynamics of property prices across regions.

Based on the above findings, the following comments can made regarding the hypotheses:

H1: There is a positive correlation between average wages and property prices in various regions of the Czech Republic. The results of the model confirm a strong positive correlation between average wages and property prices. Higher wages are associated with higher property prices, suggesting that wage growth supports housing demand and the ensuing price increases. This hypothesis is supported by the results of the analysis.

H2: The relationship between wages and property prices varies depending on the economic development and location of the region. The interaction terms between the wage index and regional variables indicate that the impact of wages on property prices is not uniform across all regions. For example, a different relationship was found in Prague, where other factors besides wages (e.g., limited supply and high demand) could affect housing prices. This hypothesis is also supported, as the results suggest regional differences in this relationship.

H3: In highly urbanized regions, such as the capital city of Prague, the correlation between wages and property prices is stronger than in less developed regions. Conversely, the results suggest that in Prague, the relationship between wages and property prices is not as pronounced as in other regions. In Prague, other dominant factors may have a greater impact on housing prices than wages. This hypothesis was not validated. The analysis suggests that the wage impact on property prices may be stronger in less urbanized areas than in the capital.

In summary, the analysis supports two of the proposed hypotheses, emphasizing that the impact of wages on property prices is highly region-specific and that additional factors may influence the market in certain areas.

4. Discussion of results

The discussion of the results confirms that the impact of wages on property prices is significant, consistent with numerous prior studies. Similar conclusions are noted by Laurinavičius et al. (2022), who found that an increase of one euro in net monthly wages in Vilnius leads to an increase in rental prices of 0.56 euro cents per square meter per month. This finding supports the notion that wages play a fundamental role in property prices. Other research, such as that by Malpezzi (1999), Capozza et al. (2002), and Meen (2002), also highlights the significant relationship between wages and property prices. Conversely, Gallina's study (2006), which employed a bootstrap method to test this relationship, concluded that a statistically significant relationship between wages and property prices could not be demonstrated. The findings of this study suggest that this relationship may not be universally applicable.

It is essential to consider the model's limitations in order for the results to be interpreted correctly. The model simplifies the relationship between wages and property prices by assuming a linear relationship between these variables. However, nonlinear relationships or complex interactions may exist that the model does not capture. Although the model considers regional and temporal effects, there remains the possibility that other significant factors – such as macroeconomic and microeconomic determinants, demographic changes, or specific housing policies – are not being taken into account. These factors may limit its accuracy.

Despite using the Newey-West correction for standard errors to address heteroskedasticity and autocorrelation, some forms of these problems may not have been fully accounted for. Thus, while this model is a valuable tool for examining the relationship between wages and property prices, the results should be interpreted with an awareness of its limitations and simplifications. Further research could explore nonlinear and more complex models that

might better reflect the intricacies of real estate market relationships. This model focuses exclusively on quantitative factors, such as wages and property prices, and does not include qualitative aspects like buyer preferences, lifestyle changes, or technological innovations, which can also influence property prices. However, this approach was chosen for several critical reasons.

Panel regression with fixed effects allows us to account for temporal and regional heterogeneity, which is essential for this research. This modeling approach enables the impacts of wage on property prices to be identified while controlling for differences across regions and individual years. Interaction terms also play a vital role, offering a deeper understanding of how different regions respond to wage changes. Without these interactions, regional specifics could be overlooked, leading to less accurate results. The inclusion of lagged property price values also ensures that the model accounts for market dynamics, which is essential for properly interpreting long-term trends. Without these temporal effects, conclusions about the influence of wages on property prices could be inaccurate.

While the model has its limitations, its flexibility and robustness in analyzing panel data and regional differences make it a suitable tool for examining the impact of wages on property prices. This approach provides a comprehensive quantitative perspective that, while not incorporating qualitative factors, offers valuable insights into the relationship between wages and prices within the context of the regional real estate market.

Conclusion

This study has focused on analyzing the relationship between wages and property prices in the Czech Republic, with an emphasis on regional differences and temporal trends. Using a panel econometric model with fixed effects and interaction variables, we found that the impact of wages on property prices varies significantly across regions and depends on specific time periods. This suggests that economic factors, such as wages, are not the sole determinants of property prices and that a broader context must be considered.

This research emphasized regional differences, examining how wages affect property prices across various Czech regions. Employing interaction effects allowed us to understand how this relationship varies by region, while the temporal effects in the model captured changes in property prices and wages over the years, bringing us closer to the dynamics of the real estate market. Including lagged property price values helped explain how historical price trends influence the current market state.

The use of panel regression with fixed effects and interaction terms enabled us to account for the specifics of individual regions and periods, contributing to a deeper understanding of the complex relationship between wages and property prices. An interesting finding of this study is that the influence of wages on property prices differs across regions – while in some areas this impact is positive, in others it may be negative.

In conclusion, the relationship between wages and property prices is complex and depends on a range of factors, including not only economic but also regional and temporal

variables. This study provides new insights into the dynamics of property prices in the Czech Republic and highlights the importance of considering regional specifics when analyzing the real estate market.

The objective of this study can be considered achieved. The study successfully analyzed the relationship between wages and property prices in the Czech Republic, with a focus on regional differences and temporal trends. The results of the analysis provide valuable insights into how wages influence property prices across different regions and how this impact changes over time. This research not only confirms hypotheses about the influence of wages on property prices but also provides new insights into regional differences. These findings may serve as a basis for further research or the development of regional strategies in housing and economic development.

Based on the findings of this study, several recommendations can be formulated for policymakers and investors who are interested in better understanding the regional dynamics of the real estate market in the Czech Republic:

- Focus on regional specifics – policymakers and investors are advised to approach the real estate market from a regional perspective, recognizing that the impact of wages on property prices varies across regions. For example, in Prague, factors other than wages – such as limited supply or high demand – may have a significant effect on property prices.

- Support affordable housing in low-wage regions – initiatives aimed at improving housing affordability in regions with lower wage levels could address regional housing disparities and help stabilize local markets.

- Offer investment opportunities in emerging regions with rising wages – investment in regions with rising wages and economic activity may have long-term growth potential, particularly as purchasing power and economic activity in these areas increase.

- Regularly monitor economic indicators – tracking economic indicators, such as wages, unemployment, and other macroeconomic factors, can help anticipate shifts in housing demand. This approach aids with predicting potential changes in property prices across different regions.

- Promote development of transportation infrastructure and services in regions – to support balanced development of the real estate market across the Czech Republic, regional policies could include investments in transportation infrastructure and public amenities in less developed regions. This would enhance the appeal of these areas to new residents and investors alike.

These recommendations can help policymakers and investors better navigate the complex dynamics of the real estate market and respond to regional specifics, with the goal of promoting the development of a sustainable and equitable housing market in the Czech Republic.

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Comparative Analysis of Financial Flows in the Healthcare Systems of Germany, Austria and Czechia: Opportunities for Savings and Assessing the Tax-Like Nature of Health Insurance Contributions

PATRICK MINI

Abstract

Background: Healthcare and pension expenditures represent significant budgetary commitments in OECD countries, with considerable variation in spending levels influenced by factors such as demographic structures, healthcare system models, and the role of private insurance. Germany, Austria, and Czechia exemplify diverse approaches to universal healthcare, reflecting unique socio-economic and policy contexts.

Objective: This study aims to compare the financial flows and spending efficiencies of healthcare systems in Germany, Austria and Czechia to identify opportunities for savings and policy innovations.

Methods: A comparative analysis of secondary data from OECD reports and academic literature was conducted, examining key metrics such as public and private expenditure, health insurance contributions, and administrative costs.

Results: The analysis reveals that while Germany's dual public-private insurance system ensures comprehensive coverage, it faces challenges in integrating care services. Austria's regionally managed system benefits from robust public funding but struggles with administrative complexity. Czechia's centralised financing model supports equitable access but requires improved resource allocation and efficiency. Across all systems, health insurance contributions exhibit tax-like characteristics, with significant implications for public policy and perception.

Recommendations: Policymakers should consider measures such as integrating care services in Germany, streamlining administrative processes in Austria, and refining fund redistribution mechanisms in Czechia. Leveraging digital health technologies and fostering transparency in healthcare financing are critical for achieving systemic savings and equity.

Practical relevance/social implications: This study highlights the importance of tailored financial reforms to address demographic shifts and rising healthcare costs. Its findings provide actionable insights for policymakers aiming to balance equity and efficiency in healthcare financing while ensuring public trust and sustainability.

Originality/value: By dissecting the healthcare financial flows in Germany, Austria, and Czechia, this study offers a nuanced understanding of their systems' dynamics and identifies opportunities for cross-border learning to inform global healthcare policy reform.

Keywords
Healthcare financing, comparative analysis, Germany, Austria, Czechia, health insurance contributions, equity and efficiency

JEL Codes
I18, H51, H71

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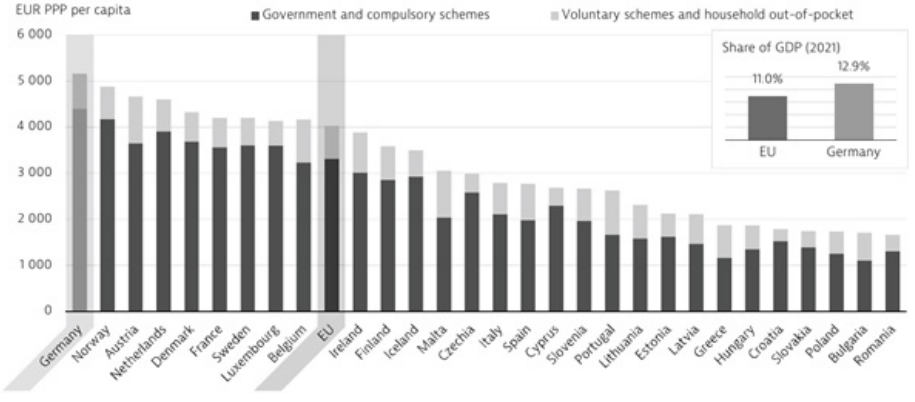
1. Introduction

In OECD countries, pension and healthcare spending represent significant portions of national budgets, with noticeable variations among nations. These differences are influenced by factors such as healthcare system structures and population demographics. Among EU countries, Germany has the highest per capita healthcare expenditure. This spending is primarily funded through government and compulsory schemes, with additional contributions from voluntary schemes and out-of-pocket payments. Germany also allocates a larger share of its GDP to healthcare than the EU average.

Austria ranks slightly below Germany in terms of healthcare spending. Like Germany, it relies mainly on government and compulsory schemes, with voluntary contributions providing supplementary funding. In contrast, Czechia's per capita healthcare expenditure is much lower. Its healthcare system is predominantly funded by government schemes, reflecting a smaller overall investment in healthcare.

In 2021, Germany spent 12.9% of its GDP on healthcare, nearly 2 percentage points higher than the EU average of 11.0%, making it the highest spender in the EU. Austria ranked third in healthcare spending, while the Czech Republic remained below the EU average.

Figure 1: Public spending on health in the EU



Source: OECD, 2023b, p. 9.

Austria and Czechia spend just over 7% and more than 6% of their GDP on healthcare, respectively (OECD, 2023b, p. 9). These differences reflect not only demographic factors but also variations in access to services and the specific characteristics of each country's healthcare and pension systems, including the role of private insurance (OECD, 2023b, p. 9).

Our analysis of the healthcare systems in Germany, Austria, and Czechia has several goals. By comparing how these systems are funded and how efficiently they spend resources, we aim to uncover the strengths and weaknesses of their financial models. This includes identifying areas where costs could be reduced without lowering the quality of care. The perspectives of key stakeholders – patients, healthcare providers, payers, and policymakers – are essential for understanding the practical implications of these financing models (Mertl, 2019).

A central focus of our research is the nature of health insurance contributions in these systems. We will examine whether these contributions function more as taxes or as premiums and analyze how this distinction affects equity, efficiency, and the distribution of healthcare costs. By studying these countries' financial models, we aim to derive lessons that can guide policy reforms and innovations to create more sustainable and fair healthcare systems.

Through this comprehensive approach, we seek to highlight the challenges and successes of each system. Our goal is to enable cross-border learning and contribute to global improvements in healthcare financing (Bradley, Taylor, & Cuellar, 2015).

2. Healthcare Systems Overview

The healthcare systems of Germany, Austria, and the Czech Republic share the common goal of providing universal coverage but differ in how they reflect their socio-economic and historical contexts through policy, tradition, and innovation (Kočišová & Sopko, 2020). Despite their differences, these systems prioritize accessible, high-quality healthcare (Popic & Schneider, 2018).

Healthcare systems are often classified based on how nations finance, organize, and deliver health services. Traditional frameworks focus on three dimensions: financing, service provision, and regulation. These form the basis of three ideal models: the State Healthcare System, where the state manages all aspects; the Societal Healthcare System, led by societal actors; and the Private Healthcare System, driven by market forces (Wendt, Frisina, & Rothgang, 2009, p. 71).

However, critics argue that these models oversimplify the complexity of modern healthcare systems. Similar policy responses across systems suggest these typologies fail to capture the varied roles of actors and their influence in the political process (Beckfield, Olafsdottir, & Sosnaud, 2013; Burau, Kuhlmann, & Lotta, 2023). More recent approaches

consider mixed financing, hybrid governance structures, and diverse service delivery methods, better reflecting today's healthcare realities (Böhm et al., 2013, p. 258).

Germany, Austria, and the Czech Republic share characteristics rooted in the Bismarck Model but adapt them to their specific sociopolitical contexts.

Germany's healthcare system is known for its strong structure and efficiency. It ensures universal health insurance with a comprehensive benefits package for all citizens. The system combines public and private insurance, serving different groups. Decision-making involves federal, state, and corporatist entities, with a distinct separation between outpatient and inpatient care in both organization and funding (Blümel et al., 2020). While this separation poses challenges, Germany's extensive network of providers and hospitals ensures good access to care, short waiting times, and high-quality services (Blümel et al., 2022).

Austria's healthcare system is built on mandatory social insurance and aims to provide equal access to all residents. Its nine federal provinces manage public hospitals, which are central to healthcare delivery. Coverage is nearly universal, funded through employer and employee contri-butions, government revenues, and direct patient payments. This federal structure and reliance on public hospitals define Austria's system (Bachner et al., 2018).

The Czech Republic's healthcare system is notable for its high level of public funding, with 81.5% of healthcare costs covered by public sources – a figure significantly higher than in many other WHO European Region countries (Bryndová et al., 2023, p. 19). For over 30 years, its statutory health insurance system has ensured universal coverage and a comprehensive benefits package (Hejdukov, 2016). The system is managed by seven health insurance funds, with the largest, Všeobecná zdravotní pojišťovna ČR (VZP), handling contributions and resource distribution across 14 regions (Pavlík & Kotherová, 2020). Inclusivity is central, offering coverage for both economically active individuals and those supported by the state. Contributions for state-insured individuals are pooled centrally to ensure fair and equitable access to healthcare for all citizens (Bryndová et al., 2023).

Table 1: Comparison of healthcare systems

Country	Funding Sources	Insurance Model	Coverage Level
Germany	Public and private insurance, general taxation	Dual system (statutory and private)	Comprehensive, near-universal coverage
Austria	Income-dependent contributions, general taxation	Compulsory social insurance framework	Universal coverage with strong public hospital role
Czechia	Public funding, statutory health insurance contributions	Centralised statutory health insurance system	Broad benefits package, universal membership

Source: Own compilation

These three systems illustrate how different nations can interpret the principle of universal healthcare in various ways. Each system has been crafted to align with national values, economic capabilities, and societal needs. In the following analyses, we will delve deeper into the intricacies of each system's structure, examining their funding mechanisms and exploring the balance of contributions between individual citizens and the state. This will provide a clearer picture of how each country strives to fulfil the collective goal of health for all, highlighting the cultural, economic, and political diversity between the Czech Republic, Germany, and Austria.

3. Comparative Analysis of Money Flows

Germany's healthcare system operates through a well-established social health insurance (SHI) model, primarily funded by contributions from employees and employers. These contributions are managed by self-governing sickness funds, which use a risk-adjustment system to distribute funds equitably based on members' healthcare needs. In addition to these contributions, the system benefits from general tax revenues, which play an important role, particularly in financing capital investments for hospital infrastructure and technology upgrades to ensure facilities remain modern and effective (Blümel et al., 2020).

Public employees (Beamte) are covered under the Beihilfe system, where the state subsidizes a significant portion of their healthcare costs. The remainder is typically covered by private health insurance, as they are exempt from mandatory participation in statutory health insurance (GKV). Additionally, statutory health insurance funds can impose supplementary contributions (Zusatzbeiträge) to address financial shortfalls. These contributions are determined annually by each insurer and supplement the standard wage-based contributions (Blümel et al., 2020).

A significant component of the SHI's funding is the federal subsidy, which is financed through general tax revenues. This subsidy supports societal benefits not directly funded by contributions, such as maternity pay or contribution-free co-insurance for children and spouses (Blümel et al., 2020).

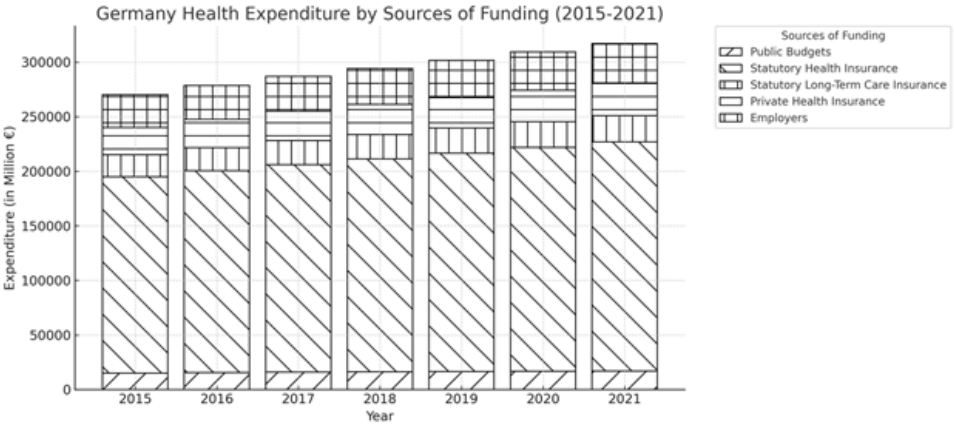
Germany's healthcare system is known for its efficiency, with low administrative costs and a strong focus on value for money. However, it faces challenges, particularly in the separation between ambulatory (outpatient) and inpatient care. This division can result in service duplication and disrupt continuity of care, leading to unnecessary hospital admissions and readmissions that could be avoided with better-integrated care pathways (Blümel et al., 2020).

Another challenge stems from Germany's long-term care insurance, the Pflegeversicherung, established in 1995 as part of the social security system. It operates independently of statutory health insurance and is funded separately, including contributions from pensioners. While SHI focuses on acute medical care, Pflegeversicherung supports individuals with chronic illnesses or disabilities who need help with daily activities. This

separation can cause fragmentation in care coordination and complicate transitions from acute to long-term care, creating inefficiencies and gaps in service delivery. Addressing these issues may require a more integrated approach to health and long-term care financing and delivery (Bahnsen & Wild, 2023).

Public healthcare spending in Germany has increased in recent years, driven by demographic changes and rising healthcare demands, underscoring the growing role of government funding in maintaining the system's sustainability.

Figure 2: Germany health expenditure by sources of funding (2015-2021)

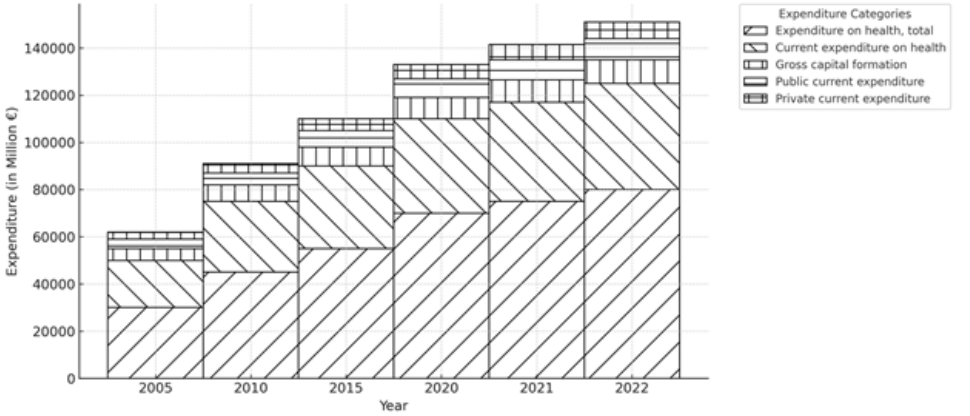


Source: Own compilation based on Federal Statistical Office, Wiesbaden (2023).

The graph shows a clear upward trend in health expenditure by funding source in Germany from 2015 to 2021. Public budgets have experienced the most significant increase, indicating a growing reliance on government financing. Expenditures from statutory health insurance, the largest funding source, have also risen steadily, driven by factors such as increased enrolment, higher costs, or both. Statutory long-term care insurance shows notable jumps, likely due to policy changes or demographic trends. Spending from private health insurance and employers has grown more gradually, reflecting a stable but consistent rise in their contributions. Overall, health expenditures have increased across all funding sources, with public budgets showing the sharpest growth.

Austria's healthcare financing system relies on a dual approach that combines income-based social health insurance contributions with substantial general tax revenues (Hofmacher, 2013). This structure ensures funding remains progressive and aligns with individuals' economic capacities. The funds collected are carefully allocated to maintain high-quality healthcare services. As part of a major health reform implemented on January 1, 2020, the number of insurance carriers was reduced to five central entities to improve administrative efficiency and control costs. However, it remains uncertain whether these changes will sufficiently address concerns about rising healthcare costs and administrative complexity (Bachner et al., 2018; European Observatory on Health Systems and Policies, 2021).

Figure 3: Austria: public and private expenditure on health 2005-2022



Source: Own compilation based on Statistics Austria, 2023.

Public current expenditure on health in Austria constitutes the majority of healthcare spending, reflecting substantial state involvement in financing. Since 2015, there has been a notable upward trend in public expenditure, likely due to the government's response to demographic challenges or initiatives aimed at improving healthcare provision.

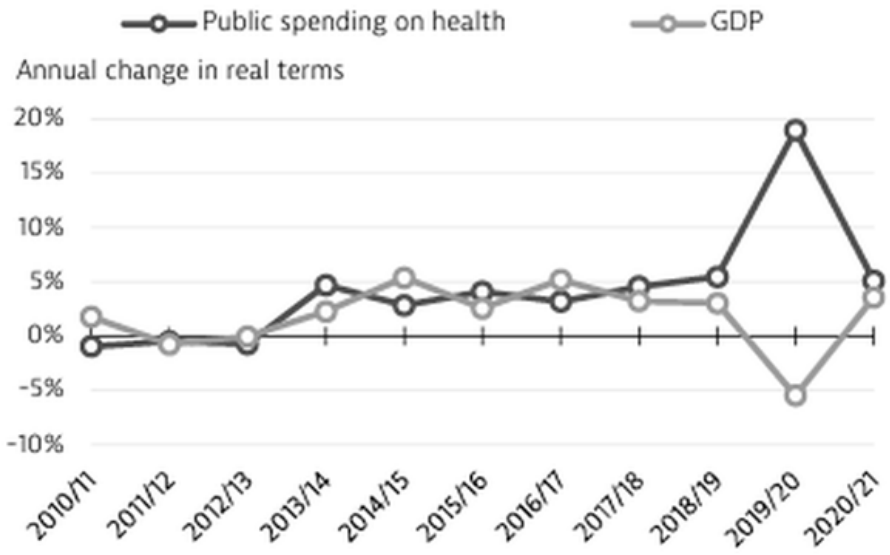
Between 2000 and 2015, healthcare spending in Austria grew at an average annual rate of 3.9%, surpassing the average nominal GDP growth rate of 3.2% during the same period. However, from 2010 to 2015, the growth rate slowed to 3.3%, partly due to the impact of the global financial crisis of 2008/2009 and cost-cutting measures introduced in the 2013 healthcare reform (Bachner et al., 2018, p. 80).

The Czech Republic's healthcare system is primarily funded through public contributions, with the largest health insurance fund, Všeobecná zdravotní pojišťovna ČR (VZP), managing a central account that pools statutory health insurance (SHI) funds (Brock, 2023). In 2020, the state supplemented SHI contributions with budget transfers, accounting for 27% of SHI revenues, underscoring the government's critical role in financing healthcare (Bryndová et al., 2023, p. 56). For economically inactive groups, such as pensioners, unemployed persons, and children, the state covers health insurance contributions. These payments are uniformly determined by national legislation, ensuring equal contributions regardless of health status. This approach shares similarities with the Austrian model (Hejdukova, 2016, p. 7). While it guarantees access to healthcare for non-working groups, it raises concerns about long-term financial sustainability and the need for reforms. By pooling contributions and state support, the Czech system efficiently distributes healthcare costs and ensures access for all members of society (Bryndová et al., 2023).

In recent years, Czechia, like Germany and Austria, has increased public funding for healthcare to address challenges posed by demographic changes. Aging populations in these countries are driving up healthcare costs, pressuring systems to adapt their financing and services to meet evolving needs. This increased reliance on public funding

reflects a shared effort to manage demographic shifts and maintain sustainable healthcare provision.

Figure 4: Public spending on health in Czechia 2010-2021



Source: State of Health in the EU, 2023, p. 17.

The healthcare systems in Germany, Austria, and the Czech Republic are each effective in ensuring access to necessary healthcare services for their citizens. However, they face distinct challenges. Germany needs to improve the integration between different levels of care, Austria aims to streamline bureaucratic processes, and the Czech Republic focuses on managing centralized funding more effectively. These challenges also offer opportunities for continuous improvement, particularly through the adoption of digital health technologies and innovations in administration.

4. Stakeholder Perspectives and Potential Savings

Germany, Austria, and the Czech Republic each have distinct healthcare systems with opportunities for cost savings through targeted reforms and optimizations. In Germany, advanced methods such as Data Envelopment Analysis (DEA) play a crucial role in identifying inefficiencies in resource allocation and finding potential areas for cost reduction. These models have been successfully used to evaluate healthcare system efficiency and develop cost-saving strategies based on changes in population health (Kriksciuniene & Sakalauskas, 2017; Chia & Loh, 2018; Novikova et al., 2023).

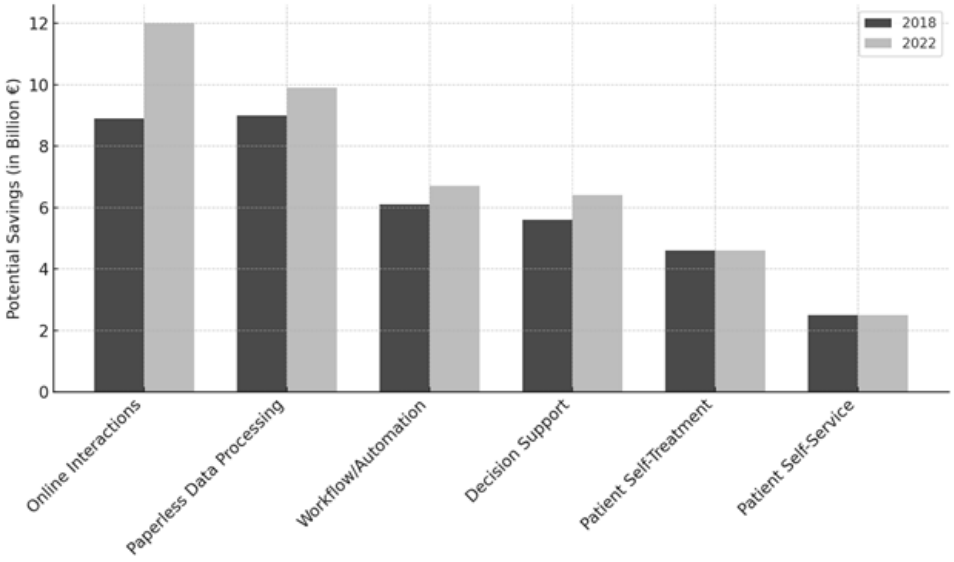
Dynamic forecasting techniques, which incorporate stochastic health models, further enhance predictions of healthcare demand and expenditures. Machine learning and clustering methods, such as combining k-means clustering with LSTM (Long Short-Term Memory) networks, allow for the segmentation of patient populations based on factors like age, comorbidities, and healthcare utilization patterns. These techniques help identify high-cost patient groups, support targeted interventions to lower expenses, improve resource allocation, and enhance healthcare quality (Serrano et al., 2022). Advanced analytics are also invaluable for planning preventive strategies and ensuring healthcare system sustainability.

Germany's statutory health insurance system has undergone significant consolidation, reducing the number of insurers from 1,147 in 1990 to 105 in 2020. This process, driven by competition and legislative reforms, has improved efficiency and service quality. Mergers among health insurers, a common strategy since 2009, have played a key role (Rebeggiani, Roppel, & Schrickel, 2022). Despite these changes, administrative costs for statutory health insurance funds remain low, at just 4.8% of revenues in 2018 compared to 8.6% in the private sector. Recent reforms, such as the Ambulatory Care Enhancement Act introduced in 2023, aim to further reduce costs by shifting inpatient treatments to more cost-effective outpatient care, thereby lowering personnel and hospital expenses (Regierungskommission, 2022).

Digitalization offers substantial potential for healthcare cost savings. The Digital Health Index, which measures the level of digitalization in healthcare systems across EU and OECD countries, highlighted significant disparities in 2018. Estonia, with a score of 81.9 points, ranked highest, while Germany ranked second to last (Bertelsmann Stiftung, 2019). A McKinsey study estimated that adopting digital technologies could save Germany's healthcare system €42 billion annually, approximately 12% of total healthcare and care expenditures, which were recently estimated at €343 billion (McKinsey & Company, 2022).

Among the 26 digital technologies analyzed, a few stand out for their impact. Five technologies alone account for nearly €22 billion in potential savings. Leading this list is the electronic patient record (ePA), which could generate benefits of €7.0 billion, a 9% increase from 2018. Other key technologies include teleconsultations (€5.7 billion), remote monitoring of chronic conditions (€4.3 billion), electronic appointment scheduling (€2.5 billion), and tools for managing chronic diseases (€2.4 billion).

Figure 5: Potential Savings in Germany by Digital Health Technologies (2018 vs. 2022)



Source: Data based on: McKinsey & Company (2022). Own representation.

Among the 26 digital technologies analyzed, certain ones stand out as particularly impactful, similar to the findings in 2018. Five key technologies account for nearly €22 billion, more than half of the total potential savings of €42 billion. Leading the list is the electronic patient record (ePA). McKinsey estimates that its widespread adoption could yield savings of €7.0 billion, a 9% increase compared to 2018. Other significant technologies include teleconsultations (€5.7 billion), remote monitoring for chronic illnesses (€4.3 billion), electronic appointment scheduling (€2.5 billion), and tools for managing chronic diseases (€2.4 billion).

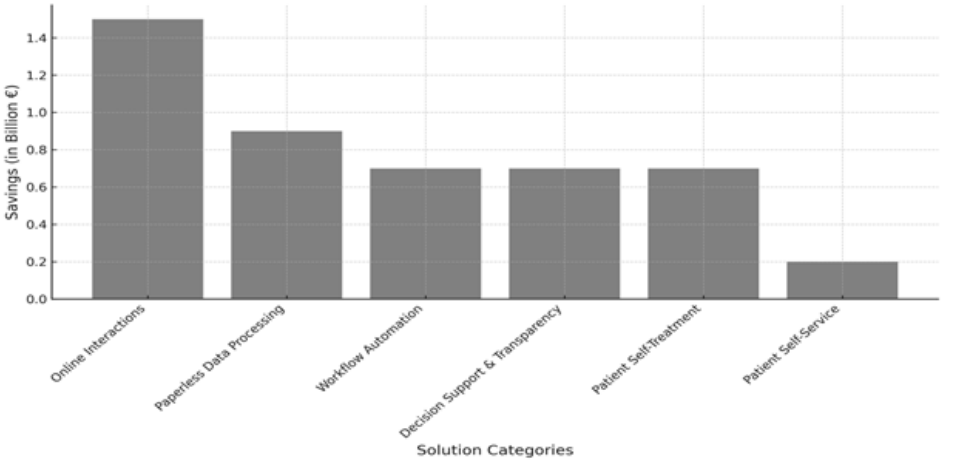
To unlock greater savings through digitalization, the German healthcare system should build on existing initiatives, such as the mandatory introduction of the ePA in 2025, and focus on the nationwide implementation of other high-impact digital technologies with significant cost-saving potential.

Austria's healthcare system also presents opportunities for cost containment, particularly in hospital and outpatient funding. The LKF (Leistungsorientierte Krankenanstalten-Finanzierung) model, which allocates funds based on hospital performance, could be further optimized to reduce operational losses and improve efficiency. Additionally, transitioning outpatient services to a DRG-based (diagnosis-related group) payment system aims to prevent overutilization and pro-mote cost savings (Gasparella et al., 2021).

Clinical Pathways (CPs), which have been more recently adopted, also show potential for moderate savings in areas such as nursing and pharmaceuticals. Beyond financial benefits, CPs contribute to improved patient safety and higher staff satisfaction (Noehammer et al.,

2022). Austria is notably ahead in digitalization compared to Germany, as highlighted in a study by McKinsey (2021), which identified significant cost-saving potential in Austria's healthcare sector, similar to findings in Germany. The study categorizes 26 digital health technologies into six solution areas with varying savings potential:

Figure 6: Potential Savings in Austria by Digital Health Technologies (2018 vs. 2021)



Source: Data based on: McKinsey & Company (2021). Own representation.

Austria's digital healthcare technologies could save a total of €4.7 billion annually. The biggest savings come from online interactions, such as teleconsultations and remote monitoring of chronic illnesses, with an estimated €1.5 billion. Switching to paperless data processing could save €900 million. Workflow automation, like mobile tools for nursing staff and barcode-based medication systems, is expected to save €700 million. Decision-support systems and tools for tracking outcomes offer another €700 million in savings. Patient self-treatment, such as using health apps and digital diagnostic tools, could also save €700 million. Lastly, patient self-service initiatives, such as online appointment booking, add another €200 million in potential savings. These figures show Austria's strong progress in digitalising healthcare and cutting costs (McKinsey, 2021).

Austria should expand teleconsultations and remote monitoring to maximize savings from online interactions. Accelerating paperless data systems and workflow automation, such as mobile tools for staff and barcode medication systems, will improve efficiency and reduce costs. Broader use of decision-support tools and health apps can enhance outcomes and empower patients. Lastly, user-friendly self-service platforms, like online appointment booking, should be prioritized to improve patient experience and streamline services. These steps will strengthen Austria's healthcare system and deliver significant economic benefits.

The table highlights opportunities for cost savings and improvements in Austria's health system compared to EU averages. Administrative expenses have risen instead of meeting

reduction targets, showing potential for efficiency gains. A significant share of health spending goes to impatient care, exceeding the EU average, suggesting a shift toward outpatient and primary care could be beneficial. While avoidable mortality is below the EU average, it remains higher than in top-performing countries, indicating room for improvement in public health initiatives. Access to multidisciplinary primary care centers is limited, underscoring the need to expand these networks. Although spending on prevention increased during the pandemic, maintaining this higher level could help prevent future health issues and reduce costs (OECD/European Observatory on Health Systems and Policies, 2021).

In the Czech Republic, the healthcare system relies heavily on public health insurance contributions managed by health insurance funds (HIFs), with the state funding certain population groups. These funds operate with limited competition but significant potential for cost savings (Tambor, Klich, & Domagała, 2021). Pharmaceutical spending could be better managed through reference pricing and the adoption of generic substitutions, while the shift toward DRG-based payments for hospital services indicates potential for more efficient resource allocation (Bryndová et al., 2023).

A further opportunity for cost savings in the Czech healthcare system lies in improving the efficiency of public procurement processes (Nemec et al., 2020). Increasing competition in tenders could lead to lower prices, as studies show that having more bidders reduces costs. In 2018, about 50% of public tenders in the Czech Republic had only one bidder, limiting competition and driving up prices. Enhancing procurement practices and using Health Technology Assessments could unlock even greater savings. A 10% improvement in procurement efficiency could free up resources equivalent to 0.5% of GDP for healthcare needs.

The Czech system could also learn from Austria and Germany, which have demonstrated that reducing hospitalisation durations can achieve substantial savings. A specific example in the Czech Republic involves transitioning from long-term psychiatric hospitalisations to community-based care for individuals with chronic mental illnesses. This change could save approximately €7,922 per patient annually while maintaining comparable quality of care (Winkler et al., 2018). An actionable recommendation for the Czech Republic is to prioritize the deinstitutionalisation of psychiatric care and enhance community-based services.

Table 2: Potential Savings in the Czech Health System

Area	Current Status and EU Comparison	Potential Savings
Health Expenditure per Capita	EUR 2,994 (26% lower than the EU average of EUR 4,028)	Efficient allocation of resources
Hospital Beds	6.7 beds per 1,000 population, occupancy 67% (EU average: 4.8 beds, 73% occupancy)	Reduction or better utilization of capacity
Avoidable Mortality	25% higher than the EU average	More effective prevention and healthcare interventions
Avoidable Hospital Admissions	7% higher than the EU average	Improved outpatient and preventive care
Prevention Expenditure	8% of total health expenditure (significantly higher than ~3% before the pandemic)	Increased focus on prevention to achieve long-term savings

Source: Own compilation based on OECD/European Observatory on Health Systems and Policies, 2023a.

The table outlines areas where the Czech health system could improve and save costs by comparing its performance to EU averages. While health expenditure per capita is relatively low, more resources are spent on hospital infrastructure and occupancy than the EU average, suggesting room for better capacity utilization. Avoidable mortality and hospital admissions are higher than the EU average, highlighting the need to strengthen prevention and outpatient care. Spending on prevention is already significant but could be further increased to reduce avoidable health issues and achieve long-term savings (OECD/European Observatory on Health Systems and Policies, 2023a).

5. Nature of Health Insurance Contributions

Health insurance contributions in Germany, Austria, and Czechia share common features with taxation. These mandatory payments, enforced by the state, form the financial foundation of the healthcare systems in all three countries. However, there are important differences that distinguish these contributions from regular taxes (Mertl, 2022, p. 48).

In Germany, health insurance contributions are directly linked to individual income and used exclusively for healthcare. Unlike general tax revenues, these funds are managed by selfgoverning organizations called sickness funds rather than the state (Mertl, 2016). This targeted use and independent management set these contributions apart from standard taxes.

Austria follows a similar model. Contributions are income-based and resemble a progressive tax structure, meaning higher earners pay more. This ensures fairness within the system, as those with greater income contribute more toward healthcare costs (Pavlina, 2016; Hejdukov, 2016, p. 10).

In Czechia, health insurance contributions are also mandatory and matched by employers. Like in Germany and Austria, these funds are specifically allocated for healthcare. However, the government plays a more prominent role in the healthcare sector, including owning and managing care providers. This stronger connection between health contributions and the public sector makes these payments appear more like taxes (Mertl, 2016).

How these contributions are perceived – as taxes or distinct healthcare payments – can significantly influence public opinion and policy decisions. If viewed as part of a necessary tax system, healthcare reforms, even those involving higher contributions, may be more acceptable. However, this perception could also lead to dissatisfaction if individuals feel they are paying too much without receiving adequate value in return (Mertl, 2021, p. 306).

Policymakers must carefully balance these factors. Maintaining public trust requires transparency about how contributions are used and ensuring that healthcare quality matches the costs. Exploring alternative funding options, such as adjusting general taxes or introducing new revenue sources, could also help keep the healthcare system fair and effective in the long term (Mertl, 2022, p. 49).

In conclusion, while health insurance contributions in these countries share similarities with taxes – such as being mandatory and often progressive – their exclusive use for healthcare and independent management make them distinct. Policymakers must navigate these differences carefully to manage public perceptions and ensure the long-term sustainability of their healthcare systems.

6. Conclusion

Germany, Austria, and Czechia present diverse healthcare systems, each with unique strengths and opportunities for cost-saving reforms. Germany, as the highest healthcare spender in the EU, has significant potential to optimize its spending. Recommendations include integrating outpatient and inpatient care more effectively to reduce duplication and leveraging digital technologies to achieve substantial savings, such as through the widespread adoption of electronic health rec-ords and telemedicine.

Austria's healthcare system could benefit from further digitalization and streamlined administrative processes, particularly in hospital funding and workflow automation. Expanding teleconsultations and transitioning to paperless data systems are key measures for reducing costs while maintaining high-quality care.

Czechia, despite having lower healthcare expenditure per capita, has room for improvement in efficiency and capacity utilization. Recommendations include reducing hospital bed numbers to align with EU averages, strengthening outpatient care to lower avoidable hospital admissions, and further enhancing preventive care spending to tackle high rates of avoidable mortality. Reforming public procurement practices and transitioning psychiatric care to community-based models could unlock additional savings.

By adopting these measures, the healthcare systems in these three countries can achieve greater efficiency and sustainability while continuing to provide universal access to high-quality care. Collaboration and cross-border learning could further inspire reforms tailored to each system's specific needs.

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