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THE EFFECT OF MACROECONOMIC UNCERTAINTY ON AGGREGATE CONSUMPTION

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INDEX

INTRODUCTION

Consumption is an economy's primary demand driver. It is a fundamental component of economic activity and must be balanced in shaping economic growth, influencing policy decisions, and reflecting society's overall well-being. Studying consumption patterns becomes even more critical during economic uncertainty, as consumer behaviour can signal and determine broader economic trends. Understanding how consumption responds to various macroeconomic shocks is essential and fascinating for policymakers, businesses, and financial institutions as they navigate challenges and strive to maintain monetary stability.

Historically, periods of economic uncertainty, such as recessions, financial crises, and geopolitical conflicts, have led to significant changes in consumer behaviour. During these times, consumers often alter their spending patterns by reducing consumption, postponing substantial purchases, or shifting spending toward necessities. These behavioural changes can profoundly affect the economy, exacerbating downturns or, conversely, contributing to recovery. Nevertheless, the global economy has undergone several significant crises in recent decades, each leaving profound and lasting impacts on consumer behaviour and macroeconomic stability. From the Great Recession of 2008 to the Sovereign Debt Crisis in Europe, the Pandemic Recession of 2020, and the current economic slowdown driven by the full-scale war in Ukraine, these periods of uncertainty have not just challenged but demanded a re-evaluation of traditional economic theories and how macroeconomic factors influence consumption patterns.

Existing literature has extensively examined the effects of individual crises on consumption; however, these studies often treat each event in isolation, failing to capture the broader patterns that may emerge when these crises are viewed collectively. This thesis seeks to fill this gap by comprehensively analysing consumption behaviour across multiple crises.

This research presents an updated analysis of aggregate consumption during periods of uncertainty, including the Great Recession, the Sovereign Debt Crisis, the Pandemic Recession, and the current economic slowdown due to the full-scale war in Ukraine. While existing literature often examines these events in isolation, this study examines them together to see how they affect consumption.

By exploring the relationships between macroeconomic factors—such as GDP growth, inflation, unemployment, and interest rates—and consumption as **a primary goal,** this study

aims to enhance our understanding of the dynamics at play during economic downturns. Furthermore, as **a secondary goal** by evaluating the impact of market-based uncertainty measures, such as the Economic Policy Uncertainty (EPU) index, the CRIFS index, and real stock market return volatility, on consumption, this research offers insights into how financial markets and perceived economic risks influence consumer decisions.

The research question of the work is: How do macroeconomic factors and market-based uncertainty measures influence consumption patterns during periods of economic crises, such as the Great Recession, the Sovereign Debt Crisis, the Pandemic Recession, and the current economic slowdown due to the war in Ukraine, within the context of European Union member states?

The central hypothesis of this research is that macroeconomic factors, along with market-based uncertainty measures, have a significant and consistent impact on consumption patterns during periods of economic crises, even considering that the countries that were taken into the dataset are all European Union member states. This means that using the regression analysis with fixed and random effects, the first ones are preferred over the last ones since there are common characteristics such as the joint membership and the euro as a unique currency, and the fixed effects model would be more consistent.

The thesis consists of five chapters. The first chapter deals with the theoretical background of consumption during periods of uncertainty and consumer behaviour, while the second chapter presents the methods implemented in the empirical literature on the research topic. The third one reviews the literature and previous findings. The fourth chapter presents the methodology used in this research, and the fifth presents its conclusions. The Appendix includes details about the STATA code used in the empirical analysis.

THE IMPACT OF A MACROECONOMIC UNCERTAINTY ON CONSUMPTION: THEORY

Understanding how uncertainty affects how people spend money is crucial in finance and economics. This section is about the ideas that explain how economic uncertainty influences people's choices about using their money. When people are uncertain about things like government decisions, changes in markets, and global events, it is essential for those in charge, such as policymakers, economists, and researchers, to grasp the fundamental theories behind how regular individuals spend money when the economy is uncertain.

Expectations

It all starts with forming expectations—the driving force behind consumer behaviour. They understand how macro uncertainty shapes expectations and sets the stage for a nuanced analysis of consumption dynamics. Several key factors, such as personal income, the experience of previous global events, media and information sources, economic indicators, government policies, etc, influence consumers' expectations.

The approach coincides with fundamental economic theories, such as the Permanent Income Hypothesis (PIH) (Friedman M.) and the life-cycle framework (Modigliani F.). Both of them emphasise the significance of expectations. The PIH states that people place their consumption decisions on expected permanent income rather than just current income, and the life-cycle theory divides human life into three stages: youth, middle age, and old age. In each stage, an individual makes decisions regarding their savings and consumption based on their expected lifetime income.

The individuals' financial well-being plays a significant role in shaping their expectations. As shown in the paper by F. Rozsypal and K. Schlafmann (2023), households with different anticipations regarding their future income typically make different choices concerning their present consumption and savings. Also, previous experiences of economic fluctuations of the consumers, often empowered by global events, significantly influence individuals' expectations. According to R. Curtin (2019), consumers tend to pay attention more to the economic conditions they face than national ones. Interestingly, R. Curtin (2018) says that despite the diverse backgrounds of people, media and information sources have the potential to influence individuals to have similar economic expectations.

In his seminal paper "Rational Expectations and the Theory of Price Movements" (1961), he was the first to introduce the theory of rational expectations, which is now the leading theory of human expectations in macroeconomics. According to this theory, individuals form their expectations about future economic conditions based on three main factors: rationality, information, and past experiences. Essentially, it is assumed that humans make decisions that maximise their utility or profits. According to this theory, individuals act in their self-interest and will generally make correct decisions most of the time. This implies that people's expectations about future economic outcomes are, on average, reasonable and unbiased. As a result, the theory challenges the notion that policymakers can effectively manipulate the economy by deliberately influencing these expectations. The theory of reasonable expectations was further expanded by Lucas R., who showed that policymakers cannot consistently create misleading expectations if expectations are rational. Lucas argued that rational forecasters adapt to new information in a way that makes their errors unpredictable. Consequently, policies aimed at manipulating expectations may introduce unnecessary “noise” into the economy but are unlikely to yield consistent improvements in economic performance. This perspective, often called the "policy ineffectiveness proposition," underscores the limited effectiveness of policies that influence expectations in a rational expectations framework. While policymakers may attempt to shape public perceptions to achieve desired outcomes, the inherent unpredictability of rational expectations renders such efforts largely ineffective in the long run, thereby stressing the role of policymakers in shaping public perceptions.

Understanding the concept of consumption smoothing is crucial, as it provides insights into how individuals and households manage their finances during economic turbulence. This knowledge empowers us to confidently make informed decisions and navigate uncertain economic conditions. A sudden change in economic conditions or unexpected events disrupt the smooth operation of market mechanisms when shocks happen. They may introduce inefficiencies, distortions, and uncertainties in the economy, indicating imperfections in the market's ability to allocate resources efficiently. Putting policies in place to even out consumption patterns to solve these issues and maximise consumer welfare is crucial. Despite its imperfections, consumption smoothing has gained significant acceptance in modern macroeconomics. The consumption smoothing concept is based on the idea that individuals desire to keep their living standards stable even during economic turbulence by, for instance, adapting spending habits in response to changing economic conditions. Consumption may decrease due to reduced income due to job loss, fewer hours or productivity, and negative

returns from assets. However, the consumption smoothing approach can help individuals and households mitigate the adverse effects of economic shocks and maintain a relatively stable standard of living despite uncertain economic conditions.

Consumption smoothing

When uncertainty is present, people become more cautious and inclined to save money. This behaviour stems from a desire to prepare for unforeseen events. To avoid adverse effects of future income fluctuations and retain a smooth path of consumption, they set aside a prudent reserve, called precautionary savings, by consuming less in the current period and resorting to it if the wrong state is realised in the future as a protective measure. Precautionary savings represent a deviation from the permanent income hypothesis, which suggests that individuals will save in proportion to their expected lifetime income. On the other hand, the presence of uncertainty pushes people to save more than what would be predicted by the permanent income hypothesis as they seek to build a financial buffer against unexpected shocks or downturns. This deviation from the permanent income hypothesis is a crucial aspect of precautionary savings, reflecting the influence of uncertainty on economic behaviour.

Precautionary savings

Precautionary savings are also closely linked with investment decisions in the economy. This connection arises not only from consumers' tendencies to save more but also from the behaviour of firms in response to uncertain economic conditions. Mathematically, the condition for precautionary savings to show up is that the third derivative of utility function to consumption is positive. Instability can make firms hesitant to take long-term investment projects or hiring decisions that are difficult to reverse. Instead, they may postpone these decisions until uncertainties are resolved and the economic outlook becomes more apparent. As implied by firms, this precautionary approach has important implications for financial activities. When businesses introduce these precautionary steps, it can lead to a slowdown in the economic growth of the whole country. Reduced investment can cut productivity gains and limit the expansion of output and employment in the economy. Furthermore, a clear relationship exists between uncertainty in macroeconomic variables and stock returns. Empirical studies consistently demonstrate a positive correlation between increased uncertainty and higher stock returns. This phenomenon is often attributed to the 'uncertainty premium' (Anderson et al. (2009)) whereby investors demand higher returns as compensation for bearing the additional risk associated with uncertain economic conditions.

New Paradigm

A paradigm shift is occurring in the traditional understanding of how macroeconomic uncertainty impacts consumption. The expectations of consumers are changing in tandem with this change. As the world progresses, improvements in technology, science, and other fields drive society forward. This dynamic process reflects a continuous adjustment to the evolving environment and pursuit of improved quality of life. People adapt to these changes, embracing new lifestyles and opportunities, which unavoidably influence their consumption habits and preferences. These shifts may appear in various forms, such as changes in spending patterns, preferences for specific products or services, or shifts in consumption priorities. One noteworthy observation, presented by Curtin R. (2019), is that most individuals naturally and automatically form their expectations without the anticipated difficulties and changes predicted by dominant theories. Instead of focusing solely on national economic conditions, consumers tend to base their expectations on the financial conditions they encounter.

Moreover, consumption behaviour often deviates significantly from the optimal intertemporal framework. Early bias explains one such deviation, wherein individuals tend to assign greater weight to present consumption over future consumption. This tendency leads to time inconsistency in consumption plans, as individuals may allocate extra funds differently based on the form they receive. For instance, research suggests that individuals are more likely to increase their consumption of certain goods, such as food, when given a discount on purchases compared to when they receive the equivalent amount in cash. Similarly, many individuals may incur debts on credit cards despite having access to lower-cost funds from retirement accounts, illustrating the influence of mental accounting biases on spending and investment behaviour.

Mental accounting, a concept introduced by Nobel laureate Thaler R. (1999), suggests that individuals assign different values to the same amount of money based on subjective criteria, leading to irrational decision-making. To mitigate these biases, individuals should adopt an approach where money is treated as entirely interchangeable across different accounts, whether for everyday living expenses, discretionary spending, or savings and investments. This approach promotes more rational and disciplined financial decision-making, optimising consumption and wealth management behaviours. By understanding and implementing these strategies, individuals can take control of their financial decisions, fostering a sense of responsibility and empowerment.

This part serves as a theoretical foundation, laying the groundwork for subsequent empirical investigations into the real-world manifestations of the relationship between macroeconomic uncertainty and consumption. As individuals face uncertain economic conditions, their expectations evolve, shaping their consumption patterns. Fundamental economic frameworks like the Permanent Income Hypothesis and the life-cycle framework emphasise the role of expectations in consumption decisions. Additionally, rational expectations challenge traditional notions of policymakers' influence on the economy. Consumption smoothing is modifying spending patterns to maintain a constant standard of living in the face of economic volatility. Both individuals and businesses frequently take preventative steps to reduce the possible dangers of unpredictable economic conditions. Examples of these precautions include increasing savings or deferring big investment choices. Mental accounting biases also impact investment and spending behaviour, emphasising the significance of making sound financial decisions. By embracing consumption smoothing strategies and understanding the nuances of consumer behaviour, individuals and policymakers can navigate uncertain economic landscapes more effectively, instilling a sense of reassurance and confidence in their ability to manage economic volatility.

MEASURES OF MACROECONOMIC UNCERTAINTY

Over the past twenty years, the methods employed to measure uncertainty have significantly evolved, a fact that is often a point of contention between the economics and finance professions. This part of the work will discuss the latest and most common ways to measure economic uncertainty, ensuring you are up-to-date with the latest developments in the field.

In past research, stock market volatility has been almost synonymous with economic uncertainty. In the past two decades, there has been an increased emphasis on distinguishing economic uncertainty from stock market volatility and studying its implication for actual economic activity and the volatility of assets' returns. Asset prices are developed as the expected discounted present value of cash flows in equilibrium, and hence, asset volatilities are endogenous functions of agents' beliefs/uncertainty. David A. and Veronesi P. (2022) offer a concise overview of nine distinct measures of economic uncertainty as proposed in the literature. These measures fall into four categories: purely market-based, structural model-based with data on fundamentals and asset prices, text-based, and survey-based.

Market-based approach

The market-based approach involves using financial market data. It leverages the information from asset prices, market volatility, and other financial indicators to infer the degree of uncertainty market participants perceive. This approach offers real-time and forward-looking insights into economic uncertainty as financial markets quickly incorporate new information and expectations. However, it is essential to recognise that market perceptions may not always align perfectly with actual economic conditions, as factors beyond economic fundamentals can influence market dynamics. As examples of market-based measures, the VXO and VIX are described. The VXO measures implied volatility, explicitly focusing on options associated with the S&P 100 index. It provides insights into the anticipated volatility of the top 100 large-cap stocks, offering a more concentrated view than the broader S&P 500. In contrast, the VIX measures implied volatility based on options related to the S&P 500 index, which encompasses 500 of the most widely held U.S. stocks. Investors and analysts use the VIX and VXO to assess market sentiment and the perceived level of risk. Elevated values in either index suggest an expectation of increased market volatility, indicative of higher uncertainty or fear among market participants.

Structural model-based approach

This approach combines information on fundamental economic indicators, such as interest rates, inflation rates, and economic growth, with data on asset prices, considering variables like stock prices and bond yields. Its main goal is to identify the complex relationships among these economic fundamentals and asset prices, providing a comprehensive understanding of how uncertainty in the broader economy is influenced. By incorporating fundamental economic factors and market dynamics, the structural model is a powerful tool for disentangling the various contributors to macroeconomic uncertainty. What sets this approach apart is its capacity to capture the direct effects of economic fundamentals on uncertainty and the indirect effects through financial market channels. For instance, a change in interest rates may impact uncertainty directly and influence asset prices, thereby exerting additional indirect effects on uncertainty. Moreover, the model facilitates scenario analysis, allowing experts to simulate various economic conditions and assess their impact on uncertainty levels. It enables researchers and policymakers to disentangle the multiple factors contributing to uncertainty and provides a tool for scenario analysis and informed decision-making.

Among the other measures, the structural model-based measures (precisely the measures created by Bekaert et al. (2019) and Jurado et al. (2015)) do better than measures constructed using the other approaches. Both Bekaert et al. (2019) model and Jurado et al. (2015) model are structurally built, including a detailed understanding of economic fundamentals and their interaction with asset prices. These models are designed to capture the intricate relationships between key variables of fiscal and monetary policies as long as a financial market, allowing for a more comprehensive evaluation of macroeconomic uncertainty. Moreover, both models are 81% correlated despite approaching different methods.

Text-based approach

Text-based measures involve analysing written information such as news articles, reports, and speeches to understand how uncertain people feel about the economy. Instead of looking at numbers, researchers pay attention to the words used in written content. Typically, these texts contain words related to "uncertainty," "economy," and "policy." This measure is now available in various public databases. Researchers study how often words connected to uncertainty appear and in what context, like discussions about the economy and policies. By doing this, they can figure out how people generally feel and how unsure they are about economic matters. Additionally, it is possible to observe how policy uncertainty spreads

through mass information sources and influences people's decisions. In today's world, resisting false information is very important because we can see the effects of misleading messages on people's thoughts and decisions in the economic environment, politics, and society. Another method for text-based uncertainty measurement involves machine learning techniques employed to train the computer to identify words that impact the VIX. Once the computer is taught, the method is tested out-of-sample to assess the effectiveness of the news-based VIX (NVIX) in predicting the VIX. Additionally, sub-categories of NVIX related to five specific areas: war, government policy, financial intermediation, stock market, and natural disasters – are provided. Interestingly, they discovered that the first two categories, war and government policy, account for 90% of the variation in the VIX. This implies that war-related uncertainties and government policy substantially influence market volatility, as captured by the VIX.

Survey-based approach

The survey-based approach involves gathering information directly from individuals or organisations through surveys, which is crucial in providing a human perspective on economic uncertainty. This approach aims to capture subjective opinions and sentiments regarding future economic conditions. Since these measures offer insights into the human aspect of economic decision-making, they complement traditional quantitative indicators. They are instrumental in capturing the qualitative nuances of uncertainty, such as concerns about policy changes, geopolitical events, or unforeseen challenges. Surveys are the most intuitive way of measuring uncertainty. The two most relevant surveys in this field are the 'Consumer Expectations Survey' conducted by the ECB and the 'Survey of Consumers collected by the University of Michigan. The ECB's survey, which started at the beginning of 2020, aims to strengthen the analytical framework for the ECB's economic and monetary analysis, reinforcing price stability. This survey contributes to a deeper understanding of household financial vulnerabilities and potential stability challenges in certain European countries. On the other hand, the University of Michigan's survey, introduced in 1946, emphasises the significant impact of consumer spending and saving decisions on the trajectory of the national economy. The surveys from the University of Michigan have consistently demonstrated their accuracy as indicators of the future direction of the national economy. They provide valuable insights into consumers' perceptions and behaviours, which are crucial for understanding and predicting macroeconomic trends. An example of a widely used survey-based uncertainty measure is the Economic Policy Uncertainty (EPU) Index, created based on surveys that question future

economic policies and the perceived impact on economic conditions. This index provides a quantitative measure of the uncertainty around economic policy decisions.

The integrated approach, which combines market-based and structural model-based methods, provides a comprehensive understanding of the factors influencing economic uncertainty. This approach leverages the strengths of each type of indicator, providing a more robust and nuanced analysis of the factors shaping accurate consumption growth rates. Market-based indicators like market volatility offer insights derived directly from market behaviour and sentiment. These indicators reflect market participants' collective wisdom and actions, providing valuable real-time information about market expectations and risk perceptions. On the other hand, structural model-based indicators, like the first difference in real interest rates, incorporate economic theory and fundamental relationships between variables. These indicators are derived from economic models characterising the underlying mechanisms driving economic phenomena. Integrating these two approaches provides a comprehensive and reliable understanding of financial uncertainty, reassuring researchers and policymakers and instilling confidence in their decision-making processes.

The past two decades have witnessed a significant evolution in methods to measure economic uncertainty, prompting ongoing discussions in economics and finance. Approaches to measuring uncertainty include market-based, structural model-based, text-based, and survey-based methods. Recognising that each method has its strengths, limitations, and unique perspectives on uncertainty is crucial. By integrating various measures, researchers and policymakers can construct a more holistic understanding of macroeconomic uncertainty, enabling informed decision-making in an environment where uncertainty is not an exception but a constant companion.

LITERATURE SURVEY ON FINDINGS SINCE 2010

The past two decades have seen significant shifts in macroeconomic uncertainty, with an expanding body of research exploring the complex dynamics shaping global economic environments. Scholars and researchers have contributed extensively, shedding light on the multifaceted impacts, underlying drivers, and strategies to mitigate uncertainty in macroeconomic landscapes. However, most of these studies typically focus on the effects of economic uncertainty on consumer behaviour during separate crisis periods. This section will concentrate on synthesising research findings covering various crises such as the Great Recession, Sovereign Debt Crisis, Pandemic Recession, and the current economic slowdown due to the full-scale war in Ukraine, aiming to provide a comprehensive understanding of how uncertainty affects consumption patterns.

Great Recession

The Great Recession was a period of intense economic turmoil that began officially in December 2007 and ended in June 2009. This recession, notable for its depth and duration, witnessed a noteworthy decline in consumer expenditure across various categories.

The study conducted by Petev I. et al. (2011) delves into the nuanced dynamics of consumer spending during this period. The fall in consumption occurred after the financial crisis and the deflation of the housing bubble, not before. Of course, once the consumption decline was in full swing, it prolonged the recession. The national accounts data provided by the Bureau of Economic Analysis (BEA) and micro-level data from the Consumer Expenditure Survey (CEX) and the University of Michigan Surveys of Consumers were used. A significant finding of the research is the uneven impact of the recession across different demographic groups, leading to a reduction in consumption inequality. The authors found that the consumption of the wealthy fell more than that of the less wealthy during the recession. In response to the significant negative shock to their wealth, affluent households may have increased their savings to restore their buffer stock. The breakdown of disposable income into its three components (transfers, wages, and financial income) reveals that per-capita disposable income did not fall as much as consumption fell during the recession, explained entirely by a substantial increase in government transfers to households. In contrast, wages and mainly financial income fell as expected from the nature of the recession. A second explanation for the Great Recession's peculiarity was the increase in uncertainty. The steeper decline in confidence among high-

income households aligns with their findings on the more significant decrease in spending by that group. On the other hand, the slower rate of recovery in the consumer confidence of lower-income households reflects most likely not only their more significant uncertainty but also the durable consequences that this recession has had on the stability and prospects of their employment.

On the other hand, Arestis P. et al. (2021) explore the impact of shocks, financial constraints, and household vulnerability during the Great Recession among European households. While the crisis caused substantial economic and financial harm, its effects were not uniform across individuals and regions, with young, less-educated, and low-income families among the most vulnerable groups. The study identifies two dimensions of households' vulnerability during the crisis: economic and financial hardship. Economic hardship is characterised by difficulties affording essential expenses such as food, utilities, insurance, and medical care. Financial hardship, on the other side, includes problems such as mortgage liabilities, defaulted loan payments, loan refusals, and lack of personal savings or assets. The analysis aims to identify the main determinants of households' vulnerability, which may be associated with declining wages or job loss, leading to challenges in meeting basic needs, accessing credit, or repaying debts. To measure financial hardship, the study considers various balance-sheet problems experienced by households during the crisis, including mortgage payment difficulties, loan defaults or delays, possession of risky financial products like foreign currency mortgage loans, and loan refusals. Economic hardship is assessed by evaluating whether households adopted coping strategies such as cutting food consumption, reducing vacations, health, and education expenditures, or delaying payments on utilities or services. Using data from the LiTS II survey covering 35 countries in Central-Eastern Europe, the Baltic region, South-Eastern Europe, Turkey, the Commonwealth of Independent States, and Mongolia, the researchers employ a bivariate probit regression model to capture the likelihood of households' vulnerability to unexpected shocks, considering both economic and financial difficulties. The analysis reveals that households in Eastern Europe experienced more severe crisis-related shocks, including job losses, wage reductions, and declines in remittances. The findings suggest that elderly individuals with access to precautionary savings and pension income exhibit greater resilience in coping with shocks than younger individuals. Moreover, households affected by adverse job shocks are twice as likely to experience both consumption and financial hardship.

Sovereign Debt Crisis

The sovereign debt crisis from 2009 to 2010 hit several Eurozone countries, like Greece, Portugal, Ireland, Italy, and Spain (so-called GIIPS countries), causing economic disorder. It started with excessive government borrowing, worsened by recession and banking problems, leading to severe measures and financial rescues, with lasting effects on economic growth and social welfare.

The empirical results show that the sovereign tensions that started in Greece towards the end of 2009 initially, and quite rapidly, transmitted to those euro-area countries with weak fiscal and macroeconomic conditions but then later spread to the other euro-area countries less directly hit by the sovereign tensions, bringing about a deterioration in credit market conditions, a contraction in economic activity and an increase in unemployment, next to the bank channel as the prominent propagation channel of the sovereign tensions in the peripheral countries. Neri S. and Ropele T. (2015) contribute to understanding the Eurozone sovereign debt crisis by examining its impact on core countries through the trade and confidence channels. Despite the significance of this crisis, there remains a notable gap in understanding its macroeconomic effects across the Eurozone and the role played by the ECB's monetary policy in stabilisation efforts. To address this gap, the study employs a FAVAR model, a cutting-edge econometric tool for analysing extensive datasets spanning January 2007 through December 2012. The findings highlight how the erosion of business and consumer confidence can exacerbate heightened sovereign risk transmission to the real economy. Throughout the crisis, confidence levels declined across Eurozone countries, influenced by factors such as fiscal consolidation measures, adverse developments in financial markets, and deteriorating economic prospects. These findings underscore the multifaceted nature of the crisis and its profound implications for consumption dynamics and economic stability within the Eurozone.

Meanwhile, Alhumoudi H. (2018) provides insights into the Eurozone sovereign debt crisis, emphasising its causes and repercussions. The reliance on substantial foreign borrowing in wealthier Eurozone countries fuelled credit-driven construction booms and real estate bubbles, ultimately leading to investor bankruptcies amid the crisis. Suggestions have been made for tighter controls within the Eurozone, alongside debt restructuring and severe measures in PIIGS countries, to foster economic growth effectively. The debt crisis manifested differently across Eurozone economies, with Greece experiencing public sector debt concentration due to fiscal mismanagement. At the same time, Spain and Ireland faced private-sector debt accumulation, prompting risky banking practices and a real estate downturn. The aftermath saw governments struggling with mounting debt, revenue shortages, and uncontrollable budget

deficits. The freezing of the capital sector exacerbated borrowing difficulties for governments, households, and organisations, stopping public investment and leading to a reliance on cheap international investment for consumption and spending support. The crisis also underscored accountability, representation, and control issues within the Eurozone, highlighting the need for comprehensive reform measures to address systemic vulnerabilities.

Pandemic COVID-19 Recession

The COVID-19 epidemic, which started in late 2019, has been associated with exceptionally high levels of uncertainty for households because no one expected a pandemic to hit in the 21st century and has contributed to reduced spending.

The study provided by Coibion O. et al. (2021) tells about the impact of macroeconomic uncertainty on household spending, focusing on the COVID-19 pandemic. Using various methods, including survey data analysis and statistical modelling approaches in a new extensive cross-country survey of European households (Consumer Expectations Survey), which was mentioned before, the research provides unique causal evidence of the detrimental effect of macroeconomic uncertainty on household spending behaviour. The study highlights significant variations in the perception of uncertainty among households across different countries, with Belgian and Dutch households exhibiting more pessimistic forecasts than Italian and Spanish households. The research finds that higher uncertainty reduces spending on non-durable goods and services in subsequent months. Additionally, it influences household investment decisions, mainly by reducing the propensity to invest in risky financial assets like mutual funds and cryptocurrencies. Notably, a one percentage point increase in uncertainty decreases the allocation of funds to mutual funds and cryptocurrencies by 2.1 and 0.5 percentage points, respectively. Interestingly, uncertainty does not significantly impact attitudes towards investing in real estate. The study identifies individuals working in riskier sectors and households with portfolios exposed to risky financial assets as the most affected by uncertainty. This underscores the importance of understanding the differential impact of uncertainty across demographic groups and economic sectors. The research findings suggest that macroeconomic uncertainty, rather than concerns about the expected path of the economy, primarily drives declines in household spending.

The research conducted by Baker S. et al. (2020) is of utmost urgency, aiming to assess the short- and medium-term macroeconomic impacts of uncertainties stemming from the COVID-19 pandemic. The initial crucial step involves quantifying uncertainty in a manner

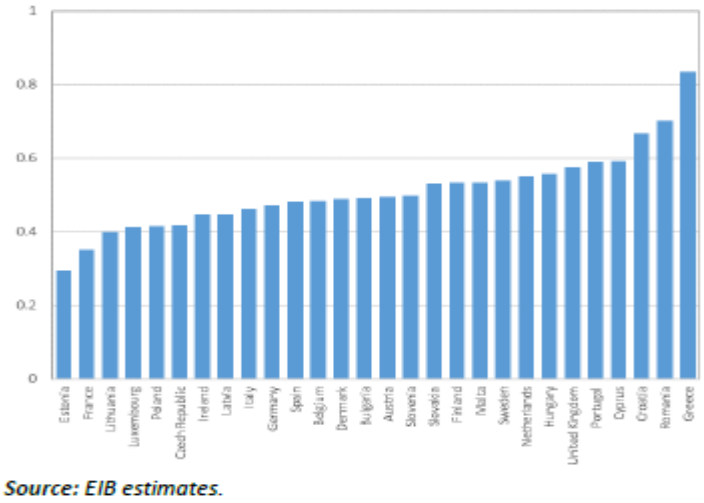
suitable for input into a statistical model of macroeconomic outcomes. Researchers accomplish this by monitoring and analysing the significant increase in uncertainty in near real-time, utilising measures such as stock market volatility, newspaper-based indicators of economic uncertainty, and aggregated survey responses about perceived business-level uncertainty. The VIX, a forward-looking measure available since 1990 and updated daily, experienced a remarkable surge of approximately 500% from January 15, 2020, to March 31, 2020. Another measure, the monthly average of the daily Economic Policy Uncertainty (EPU) index, saw a substantial surge from around 100 in January 2020 to nearly 400 in March 2020, its highest recorded value. Additionally, over 90% of newspaper articles about economic policy uncertainty in March 2020 referenced terms such as "COVID," "Coronavirus," or "pandemic," underscoring the dominant influence of the COVID-19 crisis on public discourse and sentiment. The United States and European countries experienced a notable spike in uncertainty in March 2020, surpassing any previous peaks in their short histories. However, it's essential to acknowledge that these March values may underestimate the proper level of uncertainty, as they primarily reflect survey responses from the first half of the month and fail to capture the rapid deterioration in outlook over the subsequent two weeks. Point estimates from the BBT model indicate a substantial contraction in output, approximately 9% in 2020Q2 relative to 2019Q2, equivalent to a 36% annualised basis contraction. These estimates imply a peak year-on-year output contraction of 11% in 2020Q4, followed by five additional quarters of declining output yearly. Moreover, the COVID-19 crisis is expected to significantly reduce business expenditures on innovation, training, and general management improvements, likely dampening productivity into 2021 and beyond. These investments in intangible forms of capital are particularly vulnerable to uncertainty due to their irreversible nature.

War in Ukraine

The war in Ukraine, which began not in 2022 but in 2014 with the annexation of Crimea and a special military operation in Donbas, has had profound and multifaceted impacts, both domestically and globally. As one of this century's most significant geopolitical conflicts, it has disrupted regional stability, strained international relations, and raised critical questions about security, sovereignty, and humanitarian concerns. Given that the full-scale war in Ukraine persists and has only been ongoing for two years, it is a complex and challenging situation to understand and address.

However, the economic analysis conducted by the European Investment Bank (2022) is particularly significant. The EU economy, which was just starting to recover from the COVID-19 crisis, saw its real GDP barely surpass the 2019 levels by the end of 2021. There were initial expectations for robust growth, compensating for the pandemic-induced slowdown and returning to a typical trajectory by 2023. But the war in Ukraine has led to entrenched higher food, commodity, and energy prices, intensifying uncertainty. While the EU economy is not expected to enter a recession, the once-bright outlook for activity has been substantially revised downwards, and the inflation outlook has become more worrisome. Inflation triggered by the war could reduce private consumption in the European Union by 1.1% in 2022, with a varying impact across countries. The effect will be more pronounced in countries where consumption is more sensitive to energy and food prices and where a relatively large share of the population is at risk of poverty. They used the information from Fig 8 to calculate how inflation affects private consumption. Poorer households tend to save less, and inflation causes them to reduce consumption. Hence, the impact of inflation on consumption, which we calculate as a ratio, depends on the saving rate per country and the household's position in the income distribution (Figure 9).

Savings rate	Impact on consumption
Lower than 5%	100%
Between 6% and 15%	70%
Between 16% and 25%	50%
Between 26% and 50%	30%
Higher than 50%	No impact



Source: EIB estimates.

Fig. 8 Savings rate

Fig. 9 Inflation pass-through rate for the private consumption

Source: European Investment Bank

In Europe, social transfers play a crucial role in poverty reduction, significantly mitigating risks after their distribution. While poverty risks increased during the global financial and sovereign debt crises, they declined with Europe's recovery. Policy measures were instrumental in preventing poverty during the COVID-19 crisis. However, without intervention, rising prices could reverse the progress made in reducing poverty in some countries. The risk

of falling into poverty is higher for women than for men and almost double the EU average for single households with dependent children. Direct transfers and/or changes in tax rates can help households cope with price rises, particularly vulnerable populations in the short term. However, these policies are more challenging to implement in poorer countries with large shares of vulnerable people and less fiscal capacity. The war has hindered economic recovery and introduced new vulnerabilities. The economic slowdown caused by the war is likely to result in revenue shortfalls, putting pressure on government budgets. Although the precise extent of the GDP slowdown remains uncertain, historical data illustrate a correlation between a 1% drop in output and a 1.04% reduction in public revenues on average across the European Union. Notably, countries will be impacted differently, with elasticities ranging from 0.78 in Bulgaria to over 1.1 in the Netherlands, Malta, and Cyprus, indicating that tax revenues will be more susceptible to the economic downturn in these nations.

Mix of crises

The crises we have discussed have profoundly impacted global economies, reshaping financial markets, policy responses, and societal structures. Scholars have delved into understanding the interconnected nature of these crises, exploring their transmission mechanisms and long-term implications for economic stability and resilience. This understanding is crucial and enlightening in navigating the complex landscape of global economics and provides a deeper insight into the challenges we face.

Anton G. (2021) explores the impact of uncertainty on consumer behaviour across various sectors during crises such as financial crises, sovereign debt crises, and the COVID-19 pandemic. The data used is represented by annual consumption data from Eurostat from the European Union. By employing a Bayesian VAR model, the article identifies industries that experience short-term benefits during uncertain periods, such as Health Care or Alcohol & Tobacco, while others, like Hotels & Restaurants or Transportation, are significantly affected as consumers limit leisure expenses. In uncertain periods, consumers have become very reluctant to spend on leisure expenses; they focus more on the necessities than well-being, and the same goes for travelling and transportation. Traditionally, uncertainty measurement has focused on developing macroeconomic uncertainty indices or using proxies like the VIX or VSTOXX indices, which reflect stock market volatility expectations for the United States and the Euro Area, respectively. For this paper, the VSTOXX index is chosen as a proxy for uncertainty due to its inclusion in the real-time market and economic information. While many

studies focus on the negative impact of uncertainty on household consumption, it's essential to consider the other side, where consumers decrease consumption not necessarily due to income decreases but to increase savings. The paper highlights the correlation between stock market implied volatility and uncertainty across crises like the Great Recession, the Sovereign Debt Crisis, and the COVID-19 pandemic. Understanding these dynamics is crucial for policymakers and economists to make informed decisions that can empower them to mitigate the impact of crises on consumer behaviour.

Nam E.-Y. et al. (2021) investigate the impact of time-varying macroeconomic uncertainty on economic decision-making, focusing on consumption behaviour. The study identifies two main economic channels through which economic uncertainty indices influence individuals' consumption uncertainty: labour income uncertainty and financial uncertainty for stockholders. Motivated by these channels, the paper hypothesises that shocks to economic uncertainty indices depress households' future consumption expenditure. To explore this hypothesis, the study considers various widely used economic uncertainty indices, including financial, accurate, and macro uncertainty indices by Jurado et al. (2015), the economic policy uncertainty (EPU) index by Baker et al. (2016), and the economic uncertainty index by Bekaert et al. (2020). Additionally, uncertainties in the financial market, such as the VIX and realised variance of the S&P 500 index, are examined. The research uses micro-level survey data from the Consumer Expenditure Survey to explore the cross-correlation of economic uncertainty indices and their association with households' consumption choices. Despite a low correlation among indices, the analysis reveals that different economic uncertainty indices capture unique components, with accurate and macro uncertainty indices showing longer-lasting adverse effects on household consumption. The findings suggest that households adjust their consumption in response to economic uncertainty shocks, as households highly uncertain about their future consumption are more likely to be concerned about aggregate economic uncertainty. The study indicates that households with high consumption volatility are more sensitive to uncertainty shocks, emphasising the translation of economic uncertainty into households' consumption uncertainty. While individual labour income uncertainty is marginally significant for the economic policy uncertainty index, it may not fully explain households' reactions to economic uncertainty, potentially due to the role of social protection instruments like unemployment insurance in smoothing consumption.

According to economic theory, a high level of uncertainty can depress economic activity through several channels: investment, consumption, employment or risk premia. When

investment, consumption or employment decisions are costly to revert (e.g. due to fixed and adjustment costs), high uncertainty incentivises agents to postpone or cancel their choices until the uncertainty is resolved and more information is available, thus depressing economic activity. Other channels through which uncertainty can dampen economic activity include a higher cost of finance and lower asset prices due to increased risk premia and managerial risk aversion. Compared with a widely used indicator of Policy Uncertainty, the BCS (business and consumer surveys) indicators in Balta N. et al. (2013) research demonstrate a significant negative impact on investment and consumption. High uncertainty levels, particularly since the 2008 crisis, have been associated with weakened economic recovery. Measures of uncertainty, such as stock market volatility and media coverage, rise during recessions and fall during expansions. Regression analysis shows that uncertainty correlates better with investment fluctuations at the country level than individual country industry indicators. During crises, both economic and policy uncertainty indicators negatively affect investment growth, and policy uncertainty also influences the unemployment rate's responsiveness to output changes as employers become more reluctant to hire when the policy environment becomes more uncertain. The approach followed in this focus section needs to be revised to include some of the shortcomings of using VAR models. A drawback of VAR models is that they may omit critical explanatory variables and, therefore, overestimate uncertainty's impact on economic activity. Using fully specified consumption and investment equations will likely significantly reduce the bias due to omitted variables. Another advantage of the current approach is that it estimates uncertainty using country-specific measures of uncertainty, allowing it to match country-specific conditions better. The analysis indicates that uncertainty significantly hampers economic activity in the euro area, affecting consumption and investment spending.

In their study, Christelis D. et al. (2020) explore the relationship between consumption uncertainty and precautionary saving. They discuss the impact of precautionary savings on household behaviour, noting that higher income uncertainty typically leads to increased precautionary saving and reduced current consumption, in line with life cycle models of consumption behaviour. The authors highlight three main approaches to studying precautionary saving: reduced-form estimation, simulation methods, and estimation of Euler equations for consumption. They emphasise the importance of using subjective expectations rather than observed magnitudes to address expectation errors and endogeneity issues. The article investigates the existence of a precautionary saving motive by estimating an Euler equation for consumption using subjective expectations of future consumption obtained from a

questionnaire administered to a representative sample of Dutch households. The survey was administered first to Internet panel participants in June 2014. It was repeated in January 2015 and June 2015 to check for a seasonal response pattern and to increase the sample size used in the analysis. It finds that various estimation methods, including OLS, robust regression, IV, and Partial Identification (PI), consistently point to a precautionary motive in household saving behaviour. One advantage of their approach is that it does not assume that income risk is the only source of consumption risk, allowing for a more comprehensive analysis. The results suggest a positive and economically relevant association between expected consumption risk and consumption growth, aligning with economic theory and intuition.

After reviewing the literature discussed earlier, a key takeaway is that during periods of heightened uncertainty, individuals typically curtail their consumption habits, particularly those with lower incomes who are more vulnerable. This pattern underscores the significant impact of economic and financial crises on household spending behaviour, highlighting the importance of addressing the needs of the most sensitive groups in society during times of upheaval.

THE ECONOMETRIC METHODOLOGY

This section outlines the research design, data collection methods, and statistical techniques to analyse the data and draw meaningful conclusions. By clearly delineating the steps undertaken in the study, the methodology section serves as a roadmap for understanding how the research was conducted and how the results were derived. This transparency enhances the credibility and reproducibility of the study's findings, allowing other researchers to assess the validity and robustness of the analysis.

Panel data, or longitudinal or cross-sectional time series data, is a gateway to exploring dynamic relationships and trends. With its potential for discovery, this approach offers several advantages, making it a powerful tool for empirical research. Some of them are listed below.

Advantages of Panel Data

Identification/Robustness: Enable the identification of specific parameters without making restrictive assumptions. Identify changes over time (state dependence) at the individual level. Correct for time-invariant unobservable effects (unobserved heterogeneity) correlated with the observable regressors. Estimation of instrumental variables can be based upon "internal instruments." No external instruments are required.

Efficiency: Dimensions of the data are typically large. Panel data estimation exploits variation across individuals (between variations) and over time (within variation). The fact that the same individuals are observed repeatedly increases efficiency compared to repeated cross-section data.

While panel data analysis offers many other advantages, it is essential to acknowledge its limitations and challenges. This awareness is critical to being prepared and informed in your research.

Disadvantages of Panel Data

Practical: Because it is hard to assume that different observations of the same individuals are independent, panel data estimation is somewhat more involved than based on cross-sectional data, particularly in dynamic and limited dependent variable models. Many panel data sets are incomplete (unbalanced) because the individuals are only sometimes interviewed the same number of times. This leads to an unbalanced panel in which the number

of time series observations differs across individuals. In a balanced panel, each individual has the same number of observations.

Fundamental: Panel effects: individuals change reporting in successive panel waves. Panel conditioning: individuals change behaviour since they are in the panel.

Overall, utilising panel data proves to be highly beneficial for this research. It allows for a comprehensive analysis within the European context over the proposed period, thereby enhancing the robustness and depth of the findings.

Variables and equation

This research employs panel data analysis, and the equation focuses on examining the European case, encompassing the Eurozone since 1999.

$$cons_{it} = \beta_1 gdp_{it} + \beta_2 d\_inrt_{it} + \beta_3 \mathrm{X}_{it} + \varepsilon_{it} \quad (1)$$

where $cons_{it}$ – the real consumption growth rate in country *i* at time *t*, capturing the fluctuation in consumption levels, reflecting positive or negative growth based on the indicator's sign; gdp_{it} – the real GDP growth rate in country *i* at time *t*, representing the country's overall production of goods and services; d_inrt_{it} – the first difference of the real interest rate in country *i* at time *t*, reflecting the impact of inflation on individuals' investment and consumption decisions (when bond rates fail to exceed the inflation level, investments yield no additional income to bolster future consumption); X_{it} is the set of uncertainty measures controls and ε_{it} – overall error term. Equation (1) is the primary one for further analysis without fixed or random effects.

To account for country-fixed effects (u_i), we modify the model:

$$cons_{it} = \alpha_i + \beta_1 GDP_{it} + \beta_2 d\_inrt_{it} + \beta_3 \mathrm{X}_{it} + u_i + \varepsilon_{it}, \quad (2)$$

where u_i – within-country error term and ε_{it} – overall error term.

To account for the country (u_i) and time (δ_t) fixed effects, we modify the model:

$$cons_{it} = \alpha_i + \beta_1 GDP_{it} + \beta_2 d\_inrt_{it} + \beta_3 \mathrm{X}_{it} + \delta_t + u_i + \varepsilon_{it}, \quad (3)$$

where δ_t - the unknown coefficient for the time regressors, u_i – within-country error term and ε_{it} – overall error term.

Next, we introduce random effects (u_i):

$$cons_{it} = a_i + \beta_1 GDP_{it} + \beta_2 d\_inrt_{it} + \beta_3 \mathrm{X}_{it} + \gamma u_i + \varepsilon_{it}, \quad (4)$$

where γu_i – unobservable country-specific effects and ε_{it} – overall error term.

The last one we present is the time-fixed (δ_t) and random effects (u_i) model:

$$cons_{it} = a_i + \beta_1 GDP_{it} + \beta_2\, d\_inrt_{it} + \beta_3\, \mathrm{X}_{it} + \gamma u_i + \delta_t + \varepsilon_{it}, \quad (5)$$

where γu_i – unobservable country-specific effects, δ_t - the unknown coefficient for the time regressors and ε_{it} – overall error term.

Check for correlation and multicollinearity.

Examining the correlation among variables is a crucial step in regression analysis. Correlation measures the strength of the linear relationship between two variables, providing insights into their interdependence. Ideally, independent variables should exhibit some correlation with the dependent variable to yield meaningful results.

However, multicollinearity, or high correlation among independent variables, can pose challenges in regression analysis. While multicollinearity does not violate the assumptions of multiple linear regression, it can affect the accuracy and reliability of coefficient estimates. Estimating β_j becomes more complicated when independent variables are highly correlated, as it becomes challenging to discern the unique effect of each variable on the dependent variable. It's important to clarify that multicollinearity itself is not a problem per se; somewhat, it complicates the interpretation of regression results. It's acceptable for independent variables to exhibit some degree of correlation as long as they are not perfectly correlated. Allowing for some correlation among independent variables is essential for conducting robust econometric analysis and deriving meaningful insights from regression models.

Working with time series data introduces additional considerations, particularly regarding the assumption of serial correlation in the errors. The Gauss-Markov Theorem, which underpins ordinary least squares (OLS) estimation, necessitates that errors be homoscedastic and serially uncorrelated for OLS estimates to be BLUE (Best Linear Unbiased Estimators). In serial correlation, OLS estimates may no longer be BLUE, and standard errors and test statistics derived from OLS may be invalid, even asymptotically. Serial correlation causes the standard errors of the coefficients to be smaller than they are and higher R-squared. This underscores the importance of ensuring errors are uncorrelated with the regressors in all periods. Models with lagged dependent variables, for example, may violate this assumption.

Heteroskedasticity

Ensuring homoscedasticity is crucial for the Ordinary Least Squares (OLS) estimators to be the best linear unbiased estimators (BLUE). When detected, heteroskedasticity violates

the Gauss-Markov assumption of constant error variance across observations, leading to inefficient and biased parameter estimates.

The White and Breusch-Pagan tests commonly detect heteroskedasticity in regression models. The White test is more general and can detect heteroskedasticity and serial correlation, while the Breusch-Pagan test focuses explicitly on detecting heteroskedasticity.

Fixed and random effects

Exogeneity, one of the Gauss-Markov assumptions, states that the regressors should not be correlated with the error term. To test for homogeneity, researchers often employ fixed and random effects models.

Fixed-effects models help detect a constant unobserved effect in the error term correlated with the regressors. By including fixed effects, researchers can control for unobserved heterogeneity specific to each individual or entity in the dataset. This helps mitigate the bias that may arise from omitting variables that are constant over time but vary across entities.

On the other hand, random effects models are better suited for situations where the error term is not correlated with the variables. Random effects models allow for unobserved heterogeneity that is uncorrelated with the regressors by assuming that these unobserved effects are uncorrelated with the observed variables. If random effects are present, then the random effects estimator is preferred for several reasons:

1. The random effects estimator considers the random sampling process by which the data were obtained.
2. The random effects estimator permits estimating the effects of individually time-invariant variables. In the fixed effects model, the intercept absorbs these variables

Hausman test

The choice between fixed and random effects models depends on the underlying assumptions about the relationship between the individual characteristics and the regressors. Whenever there is a clear idea that the personal attributes of each entity or group affect the regressors, use fixed effects. For example, macroeconomic data was collected for most countries over time. There might be a good reason to believe that countries' economic performance may be affected by their internal characteristics: type of government, political

environment, cultural characteristics, public policies, etc. This is the idea that was mentioned in the central hypothesis of this research. Otherwise, random effects models are suitable when there is no reason to believe that individual characteristics affect the regressors and are uncorrelated with them. In such cases, the random effects model allows for estimating overall effects across entities while also considering unobserved heterogeneity that is not correlated with the variables of interest.

The Hausman test is a statistical test used to determine whether the random or fixed effects models are more appropriate for a given dataset. The null hypothesis of the Hausman test is that the individual characteristics (random effects) are not correlated with the regressors, implying that the random effects model is consistent and efficient. Conversely, the alternative hypothesis is that the individual characteristics are associated with the regressors, suggesting that the fixed effects model is more appropriate. Suppose the p-value of the Hausman test is less than a chosen significance level (0.05). In that case, there is evidence to reject the null hypothesis, indicating that the fixed effects model is preferred due to correlated individual effects. But one thing to remember is that when $T \Rightarrow \infty$, RE⇒FE. This convergence occurs because, in large samples or with many periods, the unobserved individual effects in the random effects model become less influential, approaching the assumptions of the fixed effects model. Hausman test is not robust to heteroskedasticity and autocorrelation. If these assumptions are violated, the results may be unreliable.

EMPIRICAL ASSESSMENT OF THE IMPACT OF MACROECONOMIC UNCERTAINTY ON AGGREGATE CONSUMPTION

This section presents the empirical implications of the previously discussed theoretical parts. As previously mentioned, the applied analysis focuses on the Eurozone countries, which currently counts 20 members: Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain. The analysis covers the period from the introduction of the euro as a currency to the end of 2023. Consequently, the dataset needs to be more balanced, reflecting the sequential accession of countries to the Eurozone over nearly 25 years. The primary data sources utilised in this analysis are Eurostat, the World Bank, and other official websites and organisations.

Descriptive statistics are presented to begin the data discussion. Figure 1 presents the dynamics of the countries' GDP growth rates.

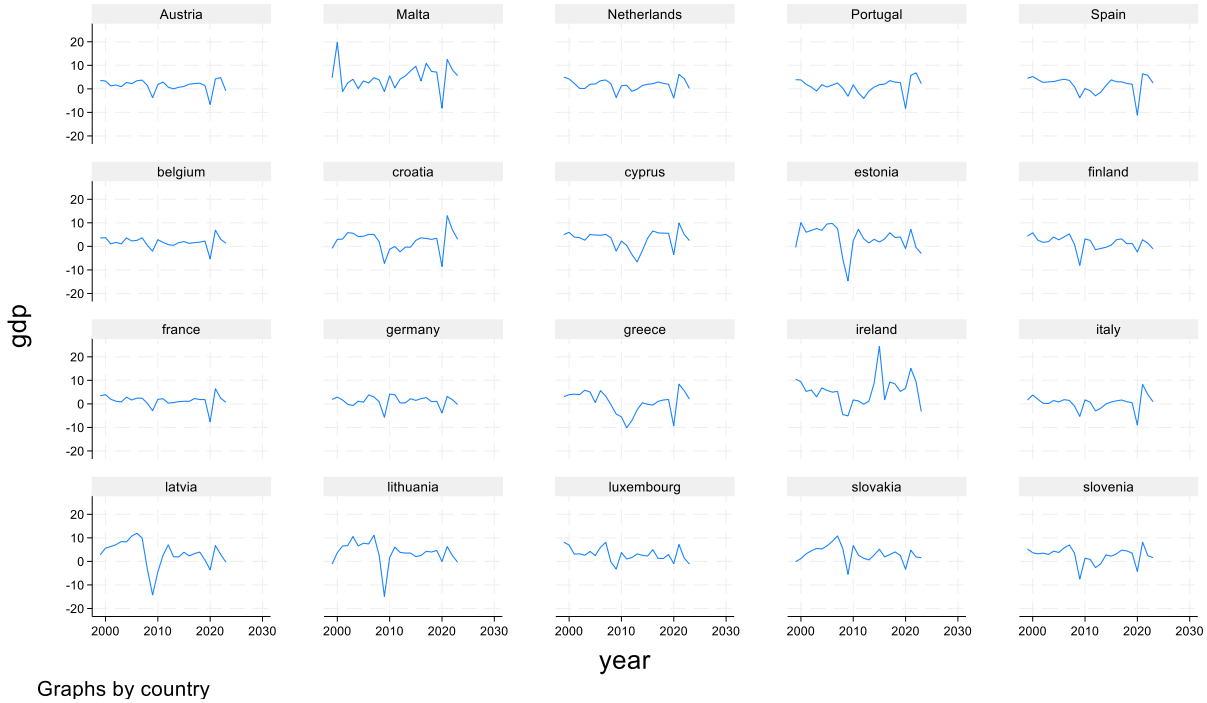


Figure 1: The GDP growth rate in the Eurozone in 1999-2023

Source: own elaboration based on the World Bank data

The graphs highlight the diversity in economic performance among Eurozone countries. Some countries like Ireland and the Baltic states show higher volatility in their GDP

growth rates. Core Eurozone economies such as Germany, France, and the Netherlands display more stability. At the same time, the most vulnerable countries (Greece, Spain, and Portugal) show significant negative growth periods followed by recovery in each presented crisis episode. The members, like Croatia, Slovakia and Slovenia, and small economies, like Malta or Luxembourg, have varied performances, with some stability observed. Also, it is possible to observe a fall in the GDP growth rate after the beginning of the war in Ukraine. It can be related to the decrease in output, an increase in the prices of materials provided by Ukraine (or Russia), etc.

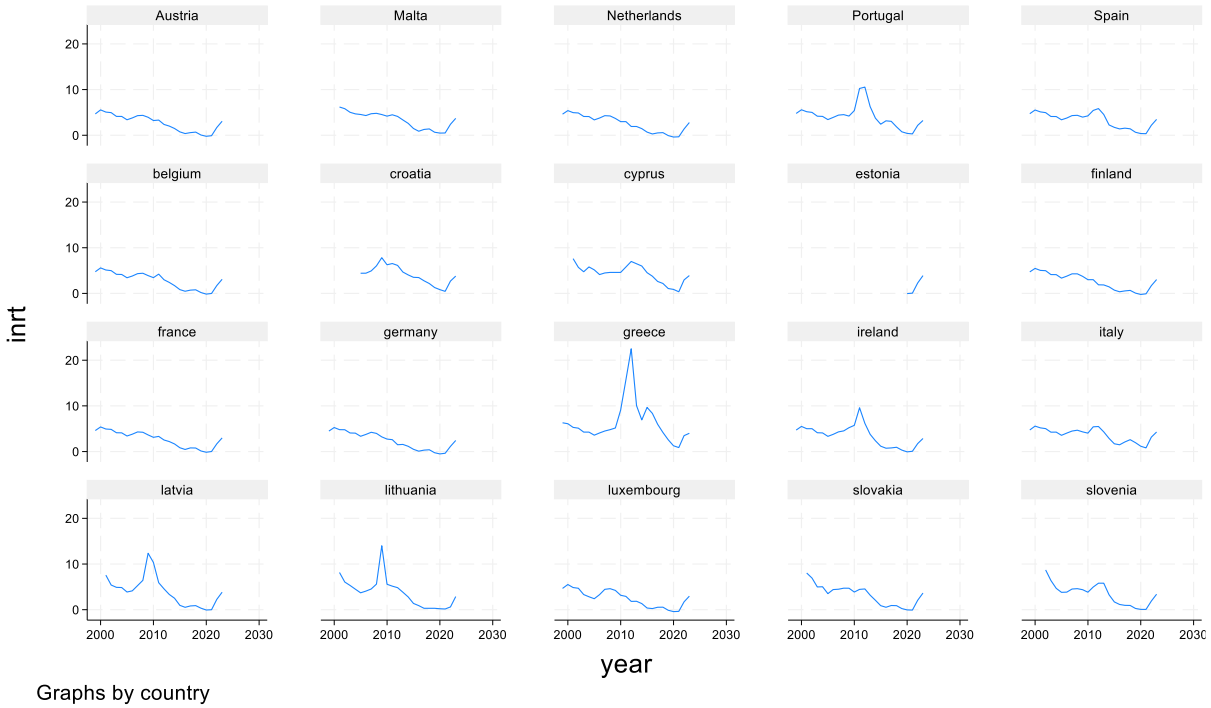


Figure 2: The central government 10-year residual maturity bond yields in the Eurozone in 1999-2023

Source: own elaboration based on the Eurostat data

The analysis of central government 10-year residual maturity bond yields across Eurozone countries reveals a clear impact of major economic events on investor perceptions and bond yields. Countries like Germany, France, and the Netherlands maintain low and stable yields, reflecting strong economic fundamentals. In contrast, countries severely affected by the Eurozone crisis, such as Greece, Portugal, Ireland and Spain, exhibit significant volatility with high peaks during the crisis period, followed by stabilisation. The same is true for the Baltic countries, but it is difficult to judge the situation of Estonia since there is no data for the government bond yields till 2020 (data is not applicable). Newer Eurozone members and smaller countries show varying volatility and stabilisation in bond yields.

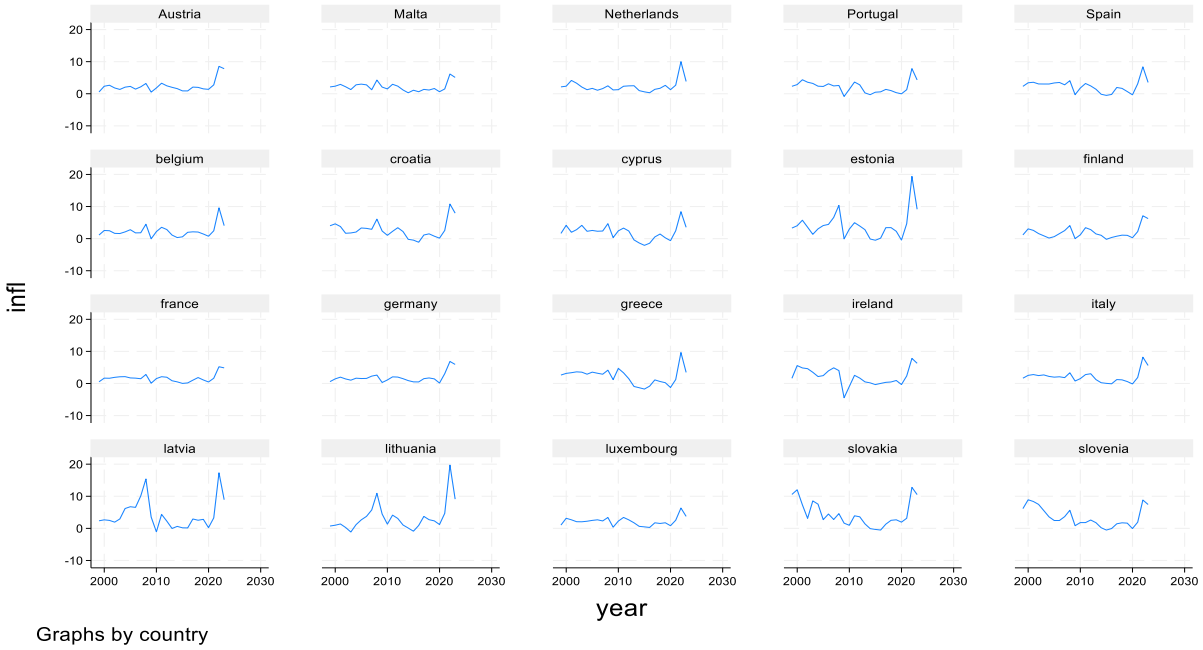


Figure 3: The inflation dynamics in the Eurozone in 1999-2023

Source: own elaboration based on the World Bank data

The dynamics of inflation confirm the previous indicators that were described. Overall, economic crises like the global financial crisis and the Eurozone debt crisis significantly impacted inflation rates, causing inflation spikes. The same is true for the period of the COVID-19 pandemic. It caused a sharp rise across all countries, reflecting the broad impact of supply chain disruptions, fiscal policies, and economic recovery measures. Followed by the invasion of Russia into Ukraine's territory, the inflation all around Europe was pushed even higher than during the financial crisis of 2007/09. The main driver of the increase in price level is the sanctions on Russia, such as reducing gas supplies to Europe. As a result, natural gas prices reached unprecedented levels.

Since the price level target in the European Union (~ 2%) is the same. Still, the government bond yield of each country is different. The first difference in the real interest rate was calculated to introduce the effect of inflation on the consumption growth rate. Equation 6 represents the formula for the first difference of the real interest rates:

$$r\_inrt_{\ it} = inrt_{it} - infl_{it} \quad (6)$$

where $r\_inrt_{\ it}$ - real interest rate of the bond of country *i* at time *t*, $inrt_{it}$ - nominal interest rate of the bond of country *i* at time *t* and $infl_{it}$ – the inflation rate of country *i* at time *t*.

The consumption growth rate was calculated by the author based on data from Eurostat and the Stata software. A detailed explanation of the commands that were used can be found at the end of the paper in Appendix A (see Appendix A). Equation 7 is the formula for the calculation of the growth rate of consumption implied in the Stata command:

$$cons_{it} = ((con_{it} - con_{i,t-1})/con_{i,t-1}) * 100\% \quad (7)$$

where $cons_{it}$ – the consumption growth rate of country *i* at time *t*, con_{it} - the final consumption of country *i* at time *t* and $con_{i,t-1}$ - the final consumption of country *i* at time *t-1*.

Fig 4 below presents the dynamics of the consumption growth rate in the Eurozone in 1999-2023.

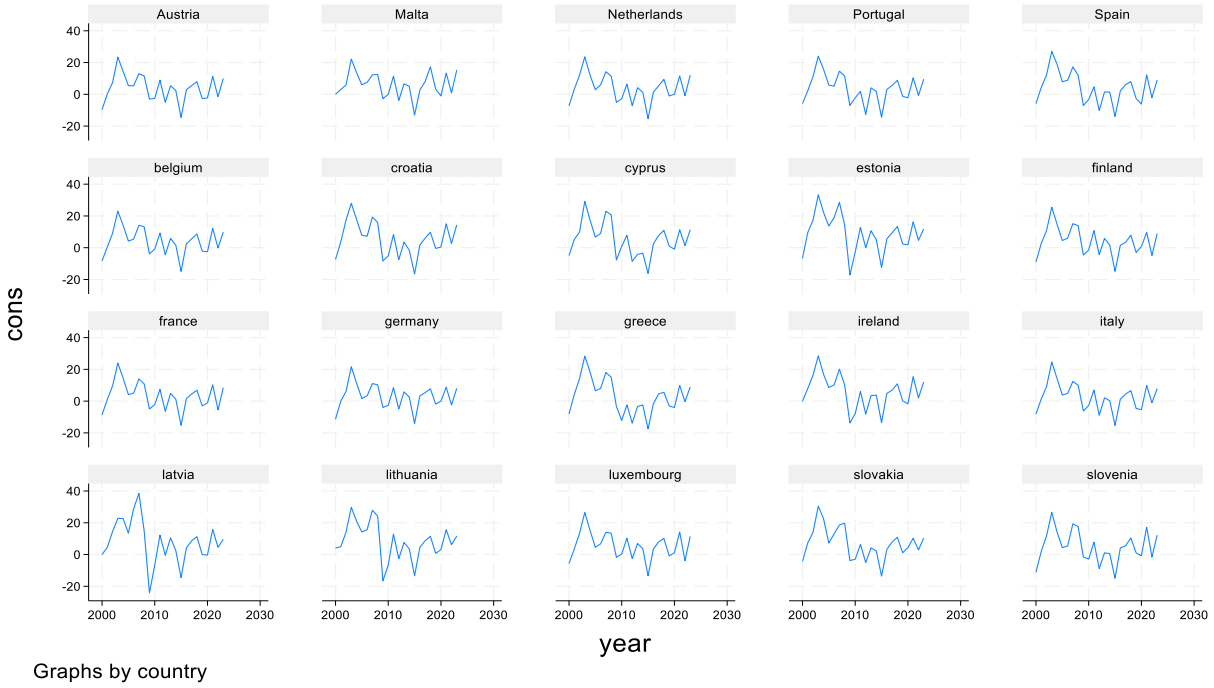


Figure 4: The consumption growth rate in the Eurozone in 1999-2023

Source: own elaboration based on the World Bank data

Countries with strong economic fundamentals (Germany and France) demonstrate greater resilience and faster recovery in consumption growth rates considering previous crises. Greece and Spain show prolonged periods of negative or low consumption growth. Austerity measures and structural economic issues contribute to slower and more uneven recovery in these countries. Croatia and Cyprus also demonstrate high volatility in consumption dynamics. All three Baltic countries maintained unstable consumption growth patterns after joining the Eurozone. The COVID-19 pandemic's impact is universally negative across all countries, with

sharp declines in consumption growth rates. The subsequent recovery trends vary, reflecting the effectiveness of pandemic-related policies.

The patterns of the presented macroeconomic indicators reflect the sophisticated economic landscape of the Eurozone, which is influenced by global financial conditions and specific national circumstances.

Market-based uncertainty measures

In the first part of analysing the uncertainty measures that could potentially have an impact on the variable of interest (consumption growth rate), we begin with three market-based uncertainty measures such as the real stock market return volatility (*mrkrt*), reflecting how unstable the stock market performance is, European policy-related economic uncertainty (*epu*), which offers insights into the level of uncertainty prevailing in the European market, providing a crucial context for understanding consumption behaviour and economic dynamics and the Country Level Index of Financial Stress (*clifs*), which includes six, mainly market-based, financial stress measures that capture three financial market segments: equity markets, bond markets and foreign exchange markets. First, the dynamics and correlation matrix of all the measures mentioned will be presented below.

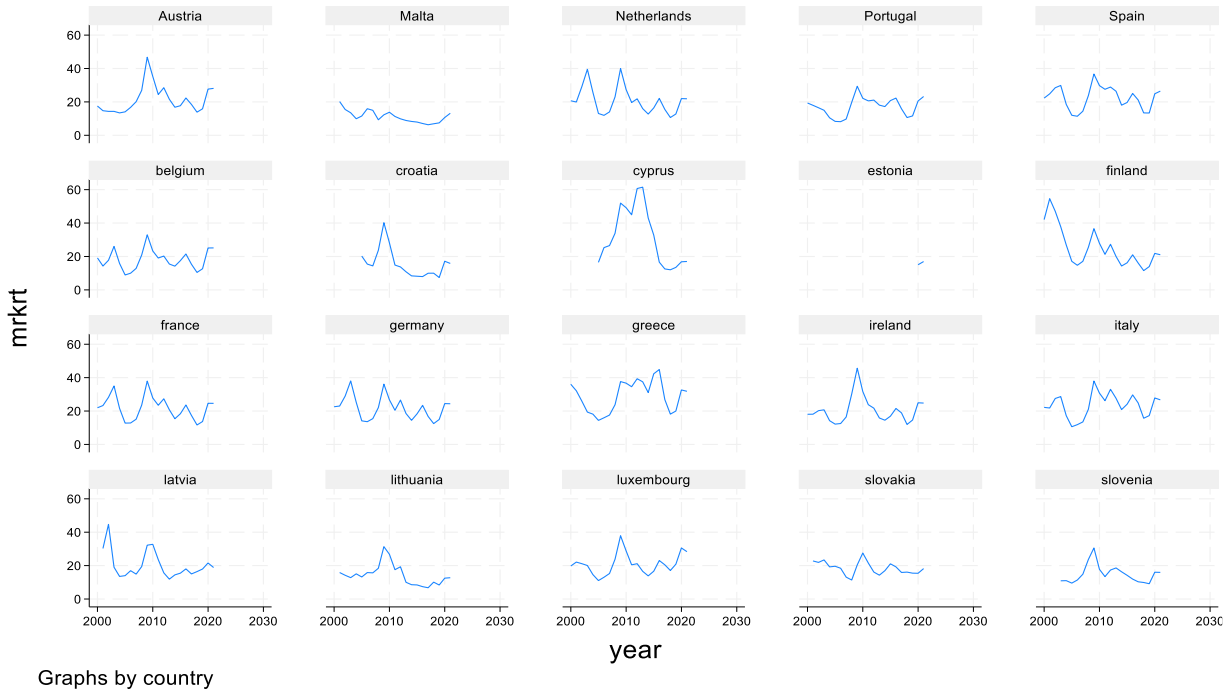


Figure 5: The real market return volatility in the Eurozone in 1999-2022

Source: own elaboration based on the World Bank data

The most noticeable characteristic among all countries is that the 2008 financial crisis and the Eurozone sovereign debt crisis are the most significant events impacting market return volatility with its increase across all countries. It is still possible to observe Cyprus's high volatility during the period analysed. Cypris is a relatively small country that relies heavily on tourism and financial services, which can explain the constant fluctuations in stock returns.

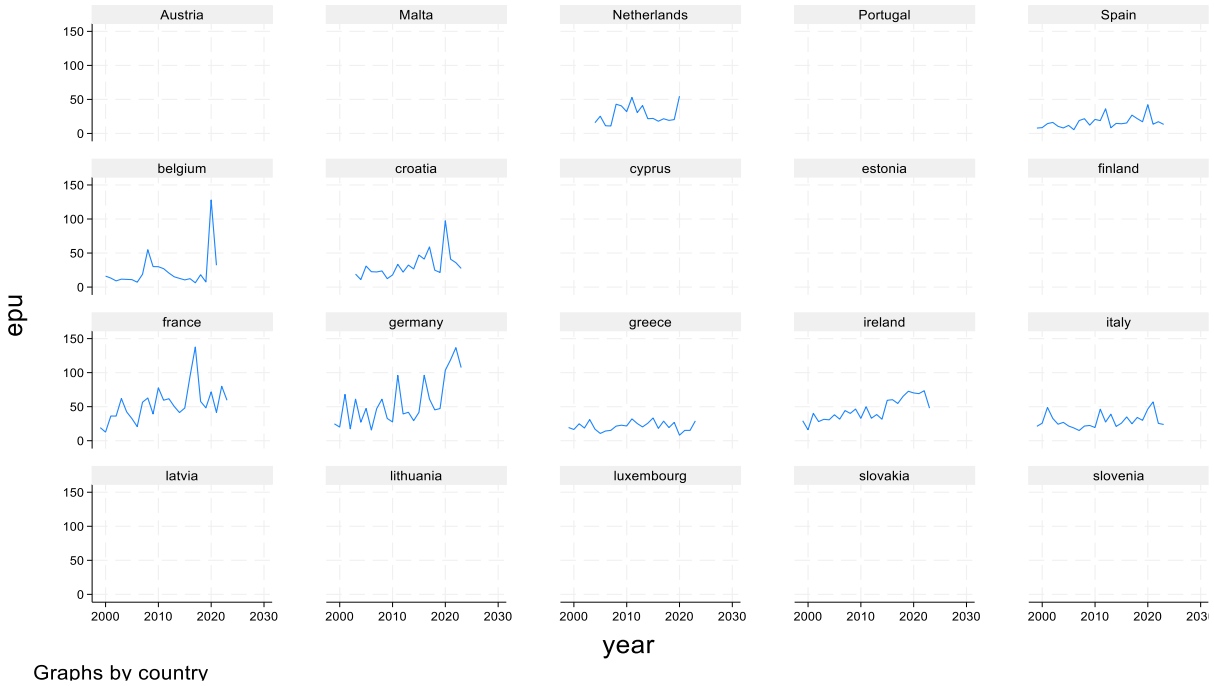


Figure 6: The Economic Policy Uncertainty Index in the Eurozone in 1999-2023

Source: own elaboration based on the EPU data

Unfortunately, the data for the EPU index is available only for nine countries (Netherlands, Spain, Belgium, Croatia, France, Germany, Greece, Ireland and Italy). It is interesting to notice that in most developed countries (like Belgium, France, and Germany), the number of times keywords such as “policy” and “uncertainty” are repeated is much higher and more vulnerable. This can be related to the importance of the countries in the European Union and Eurozone. Mentioning Croatia, it is possible to see that the increase in the index score happened in 2020 together with the COVID-19 pandemic and the active phase of the implication of reforms to enter the euro area finally.

Fig. 7 presents the dynamics of the Country-Level Index of Financial Stress for all Eurozone countries from 1999 to 2023.

In most graphs, two peaks are spotted: the financial crisis of 2007/09, which had a medium continuation during the Sovereign Crisis in several countries like Portugal and Spain, and the COVID-19 pandemic. Ireland was one of the most unstable and stressed countries in

the Eurozone till the end of the crisis in 2007/09 since this is the leading financial centre for American and most European firms. Thanks to a high density of service firms, the country is compassionate and vulnerable to economic instability.

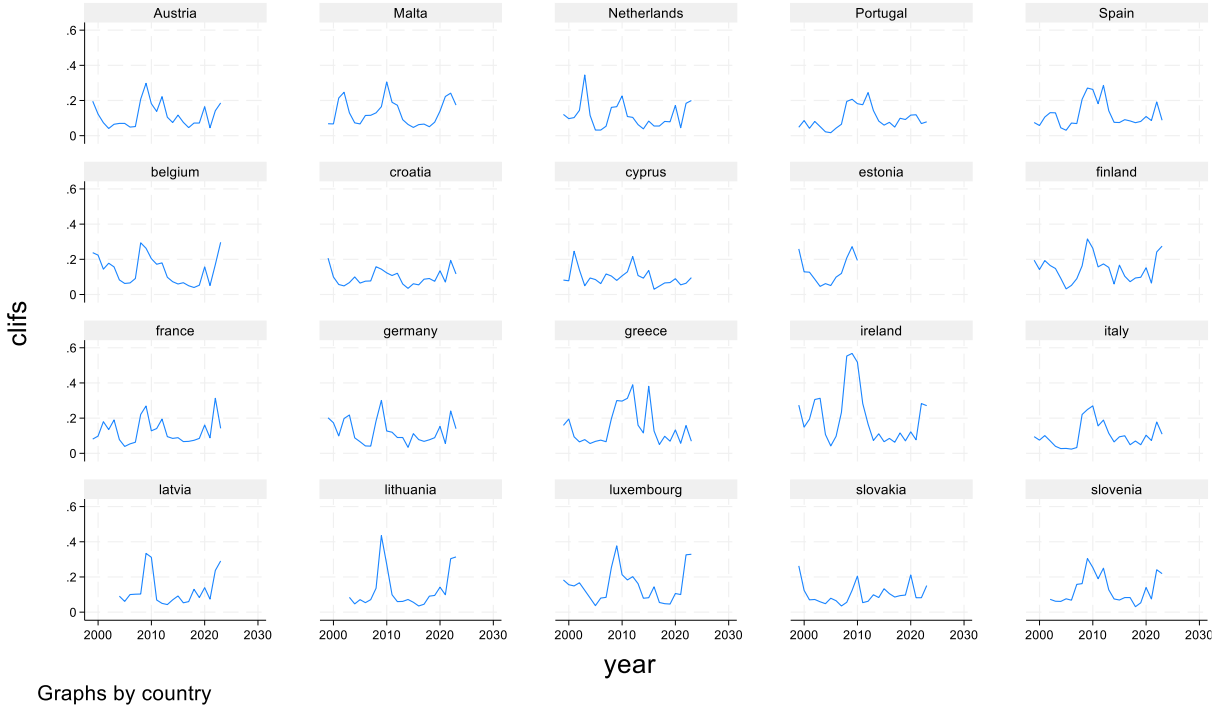


Figure 7: The Country Level Index of Financial Stress in the Eurozone in 1999-2023

Source: own elaboration based on the CLIFS data

We can see that all three variables depict the main periods of economic volatility that were described in the theoretical part of this research, such as the Great Financial Crisis, the Sovereign debt crisis and the Covid-19 pandemic, with a smooth extension at the beginning of 2022, with the War in Ukraine. Considering this, these indicators should be a good fit for our model to explain a specific part of consumption changes since something is left for the behaviour economics and human factor per se. So, we present the correlation matrix in Table 1 to see the links among variables and eliminate the possibility of multicollinearity in further regressions.

Table 1: Correlation matrix of market-based uncertainty measures

	mrkrt	*epu*	*clifs*
mrkrt	1.000		
epu	0.025	1.000	
clifs	0.602	0.057	1.000

Source: own elaboration

It is possible to observe that the actual stock market return volatility (*mrkrt*) is highly correlated with the Country Level Index of Financial Stress (*clifs*), approximately 60%. However, the Economic Policy Uncertainty Index (*epu*) does not quite correlate with the other two indicators, with less than a 10% correlation coefficient.

In this applied part, the log specification was not used because the growth rate and the interest rates were used, and both of them can be negative, so it is impossible to take a logarithm from negative (or close to zero) numbers. Table 2 presents the main results of the regressions with country-fixed effects.

Before running the regression, we ensure that all assumptions for the proper estimation of coefficients are met. The integration of the variables was checked with the Harris-Tzavalis unit-root test and the Fisher-type unit-root test. The results show that the variables are stationary (the unbalanced ones with the first lag). After the preliminary analysis, the heteroskedasticity and serial correlation were detected with the Breusch-Pagan LM test for serial correlation and the modified Wald test for groupwise heteroskedasticity, respectively, so robust standard errors were used.

Table 2: Consumption Growth Rate, panel regression, country fixed effects models in 1999-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
gdp	0.944***	0.805***	0.670*	0.818***	0.522	0.750***	0.509	0.509
	(0.221)	(0.229)	(0.351)	(0.233)	(0.361)	(0.221)	(0.328)	(0.320)
d_inrt	0.116	-0.549***	0.135	0.084	-0.321	-0.544**	0.106	-0.320
	(0.15)	(0.189)	(0.207)	(0.156)	(0.185)	(0.194)	(0.183)	(0.197)
mrkrt		-0.058			-0.179	-0.030		-0.163
		(0.079)			(0.157)	(0.094)		(0.209)
epu			0.001		0.011		0.007	0.012
			(0.028)		(0.026)		(0.029)	(0.027)
ln_clifs				-1.505		-0.904	-2.198	-0.323
				(0.876)		(1.095)	(1.310)	(1.829)
Constant	2.959***	4.166**	2.508	-0.282	6.153	1.544	-2.388	5.090
	(0.473)	(1.923)	(1.434)	(1.856)	(4.203)	(4.019)	(3.527)	(9.036)
Obs	440	397	201	434	187	393	201	187
# groups	20	20	9	19	9	19	9	9
R-sq	0.148	0.192	0.081	0.151	0.112	0.186	0.094	0.113

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

From the preliminary observation of the results of all presented in Table 2 regressions, the explanation power (R-squared) is low, less than 20%. From Column 2 to Column 8, the uncertainty measures were added separately and together, respectively. In the complete specification with all three indexes, all the variables are not statistically significant, so we

cannot explain any consumption dynamic with the presented indicators. The same is true for the specification with a mix of two out of three measures. Moreover, the EPU index (*epu*) is never significant; even more so, the coefficients are mostly zero or close to it. So, we may exclude it from the main specification. The same is true for the current stock market return volatility (*mrkrt*) and the CLIFS variable (*ln_clifs*), except that the coefficients differ from zero but are still unnecessary. The difference across countries explains the variance in consumption growth of less than 10% across all specifications.

Table 3 presents the main results of the regressions with country-random effects models.

Table 3: Consumption Growth Rate, panel regression, random effects models in 1999-2023

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
gdp	0.952*** (0.226)	0.814*** (0.232)	0.664** (0.297)	0.852*** (0.218)	0.532* (0.298)	0.764*** (0.217)	0.576** (0.240)	0.526* (0.276)
d_inrt	0.100 (0.149)	-0.56*** (0.181)	0.129 (0.169)	0.094 (0.158)	-0.354** (153)	-0.529** (0.189)	0.138 (0.139)	-0.342* (0.185)
mrkrt		-0.065 (0.061)			-0.136 (0.124)	-0.050 (0.064)		-0.117 (0.163)
epu			-0.003 (0.017)		0.000 (0.018)		0.003 (0.017)	0.002 (0.020)
ln_clifs				-1.46** (0.740)		-0.774 (0.824)	-1.765 (1.252)	-0.421 (1.640)
Constant	2.938*** (0.325)	4.28*** (1.498)	2.677*** (0.945)	-0.256 (1.651)	5.592 (3.480)	2.229 (2.732)	-1.374 (3.391)	4.199 (7.541)
Obs	440	397	201	434	187	393	201	187
# groups	20	20	9	19	9	19	9	9
R-sq	0.148	0.192	0.081	0.151	0.114	0.186	0.095	0.115

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

In these settings, random effects were used. We can see that the results are similar to Table 2: the real stock market return volatility (*mrkrt*) and the EPU index are never significant (*epu*), while the last uncertainty measure is significant in the separate specification (Column 12); the complete specification contains insignificant variables, and the explanatory power (R-squared) is low, less than 20% on average. However, the Hausman test showed that random effects are preferred over fixed effects, which is controversial to our H1 (see Introduction to the research), even though the Breusch-Pagan Lagrangian multiplier shows that random effects are unnecessary.

Table 4 presents the main results of the regressions with country- and time-fixed effects models.

Table 4: Consumption Growth Rate, panel regression, country and time fixed effects models in 1999-2023

	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
gdp	0.559*** (0.144)	0.566*** (0.163)	0.429 (0.2410)	0.590*** (0.164)	0.361 (0.225)	0.600*** (0.176)	0.408 (0.226)	0.373 (0.211)
d_inrt	-0.436*** (0.124)	-0.467*** (0.180)	-0.249 (0.249)	-0.454*** (0.140)	-0.213 (0.205)	-0.479** (0.190)	-0.245 (0.253)	-0.220 (0.207)
mrkrt		-0.024 (0.032)			-0.194* (0.088)	-0.032 (0.036)		-0.209* (0.100)
epu			0.001 (0.003)		0.001 (0.003)		0.002 (0.003)	0.001 (0.003)
ln_clifs				0.228 (0.414)		0.421 (0.509)	-0.437 (0.556)	0.424 (0.609)
Constant	-9.731*** (1.149)	-9.311*** (1.780)	-9.284*** (1.748)	-9.434*** (1.296)	-4.621 (3.175)	-8.420*** (2.294)	-10.115*** (2.428)	-3.441 (4.459)
Obs	440	397	201	434	187	393	201	187
# groups	20	20	9	19	9	19	9	9
R-sq	0.93	0.934	0.953	0.932	0.69	0.934	0.952	0.961

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

In Table 4, we can see the rapid increase in the explanatory power (R-squared) using the time-fixed effects model; the same is true for the variance of the consumption growth rate explained by the differences among countries – the rho coefficient is higher than in most of the presented specifications. Moreover, the time-fixed effects are needed based on the results of the F-test for the time-fixed effects for all specifications. Meanwhile, we may observe empirical results similar to those of the previous two tables. The EPU index (*epu*) shows no signs of significance, and the coefficients are positive and close to zero. The same is true for the CLIFS variable (*ln_clifs*); the only thing is that the coefficients differ from zero. The real stock market return volatility (*mrkrt*) is significant at 10%-level importance in the specification with the EPU index (*epu*) (Column 21). At the same time, we can also observe the same significance level of the same variable in the complete specification (Column 24). Still, it is the only significant variable in that setting. Another difference from the previous tables is Column 20, where the Country Level Index for Financial Stress (*clifs*) lost statistical significance. The importance of the first difference in the real interest rate of the 10-year government bond (*d_inrt*) was obtained at a 1% level.

Table 5 presents the main results of the regressions with random and time-fixed effects models.

Table 5: Consumption Growth Rate, panel regression, random effects and time fixed effects models in 1999-2023

	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
gdp	0.598*** (0.146)	0.628*** (0.170)	0.489** (0.190)	0.632*** (0.164)	0.402** (0.167)	0.630*** (0.181)	0.487*** (0.179)	0.330** (0.185)
d_inrt	-0.446*** (0.125)	-0.461** (0.181)	-0.229 (0.235)	-0.450*** (0.145)	-0.199 (0.190)	-0.465** (0.193)	-0.225 (0.251)	-0.217 (0.209)
mrkrt		-0.35 (0.029)			-0.149*** (0.053)	-0.038 (0.032)		-0.174** (0.076)
epu			-0.005* (0.003)		-0.006 (0.005)		-0.005 (0.003)	-0.005 (0.004)
ln_clifs				0.170 (0.353)		0.274 (0.411)	-0.173 (0.723)	0.429 (0.668)
Constant	-10.218*** (1.069)	-9.751*** (1.657)	-9.553*** (1.542)	-10.029*** (1.189)	-5.649** (2.462)	-8.99*** (2.004)	-9.905*** (2.819)	-4.177 (4.230)
Obs.	440	397	201	434	187	393	201	187
# groups	20	20	9	19	9	19	9	9
R-sq	0.931	0.934	0.953	0.933	0.961	0.935	0.954	0.962

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

The results differ slightly from the previous three tables in the specifications with random and time-fixed effects models. The explanatory power (R-squared) is also as high as in the last table because of the usage of time-fixed effects. Here, we can take notice of the significance of the EPU index (*epu*) for the first time (Column 27), even though this result is not robust and only at a 10%-level. Conversely, the logarithm of the CLIFS variable (*ln_clifs*) is insignificant in all specifications. The full specification (Column 32) is valuable for two significant variables: the GDP growth rate (*gdp*) and the real stock market return volatility (*mrkrt*) with a 5%-level significance. Moreover, the second one is also significant at 1%-level in the mixed specification with the EPU index (*epu*) (Column 29).

So, in the end, the preferred specification is the one where two out of two variables are significant: the GDP growth rate (*gdp*) and the first difference of the real interest rate of the 10-year government bond (*d_inrt*) with a significance level of 1% in both cases and different sings of the coefficients, meaning with the growth of the GDP the consumption will also grow, while if the real interest rate increases (increase in the real interest rate → increase in the borrowing costs) will decrease the consumption growth rate. This reveals the effect of inflation and the consequence of the diminishing purchasing power of the consumers when inflation goes up. These two results are robust through all specifications presented in the tables above.

The only market-based uncertainty measure that shows at least some statistical significance is the current stock market return volatility (*mrkrt*). It demonstrates the negative coefficients in the regressions. This means the increase in this independent variable can be responsible for a specific decrease in the consumption growth rate. As already stated, the

empirical analysis shows that the random effects are preferred to the fixed ones, meaning no particular characteristics remain constant across observations. This result is controversial since the common characteristic is still the European Union and the euro as a common currency, and the fixed effects model would be more consistent in these settings. Still, it also can be the case that the monetary and fiscal policies that impact consumption have some autonomy within countries, which is why they can give us mixed results.

Macroeconomic uncertainty measures

Since the market-based uncertainty measures did not show substantial results, five additional macroeconomic uncertainty measures were introduced. Below are more details on the new variables.

Inflation uncertainty measure

As already stated before, the inflationary target of the ECB is equal to . The first difference of the actual stock interest rate of return of the 10-year government bonds also showed us that the negative inflation effect strongly influences the consumption growth rate. Two inflation uncertainty measures will be constructed below to catch this effect. With Equation 8, we will calculate the headline CPI inflation of the countries of the Eurozone in 1999-2023:

$$100\% * \left(\log\left(P_{t,i}\right) - \log\left(P_{i,t-12}\right)\right) = \pi_{i,t} \quad (8)$$

where $P_{i,t}$ – prices in month *t* in country *i*, $P_{i,t-12}$ - prices in month *t-12* in country *i* and $\pi_{i,t}$ – the inflation rate at month *t* in country *i*.

We will calculate the difference between the monthly inflation rate and its historical mean for the various countries, the so-called "gap" (see Equation 9):

$$\pi_{gap_{i,t}} = \pi_{i,t} - \pi_i^* \quad (9)$$

where $\pi_{gap_{i,t}}$ – the deviation from the historical mean of the inflation rate of country *i* at month *t* and π_i^* - the historical mean of the country *i* in 1999-2023. In Equation 10, we calculate the uncertainty measure based on the sum of the squared deviations from the mean during a certain year:

$$\pi_{u_{i,t}} = \sum_{j=1}^{12} \pi_{gap_{t,i}}^2 \quad (10)$$

where $\pi_{u_{i,t}}$ - inflation uncertainty measure. In Fig 8, the graph of the calculated measures for each country is presented.

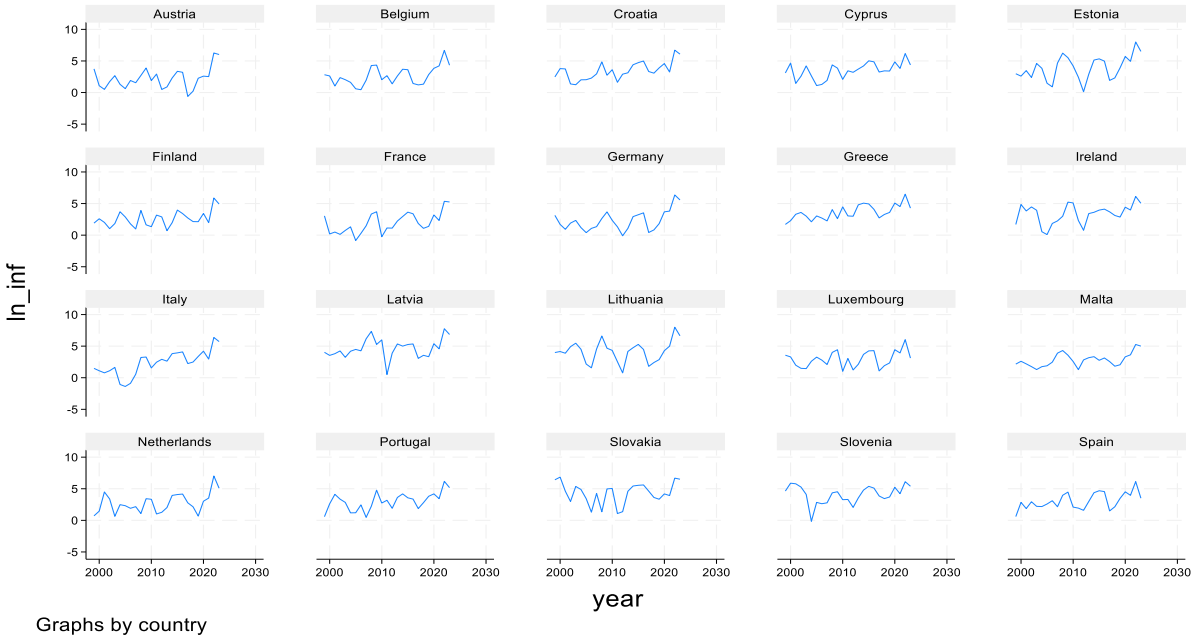


Figure 8: The inflation uncertainty measure in the Eurozone in 1999-2023

Source: own elaboration

Analysing the logarithm of the inflation uncertainty measure, we can observe high volatility in two out of three Baltic countries (Estonia and Lithuania). Slovakia and Slovenia have had constant high uncertainty since the early 2010s, which can be explained partly by the recovery from the Financial crisis and partly by the structural reforms, especially in the labour market, to fight high unemployment rates. Italy depicts the constant increase in inflation uncertainty starting from the beginning of the financial crisis 2007. Overall, we can see such a trend in all countries, but from the COVID period, which continued with the Russian invasion of Ukrainian territory.

Industrial uncertainty measure

With Equation 11, we calculate the headline output change to the previous period of the countries of the Eurozone in 1999-2023:

$$100\% * \left(\log\left(Y_{i,t}\right) - \log\left(Y_{i,t-1}\right)\right) = g_{i,t} \quad (11)$$

where $Y_{i,t}$ – the output (mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply) volume at time *t* in country *i*, $Y_{i,t-1}$ - the output (mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply) volume at time *t-1* in country *i* and $g_{i,t}$ – the change in the output at month *t* in country *i*. In Equation 12, we

calculate the so-called “gap” between the current output change and the mean during 1999-2023:

$$g_{gap_{i,t}} = g_{i,t} - g_i^* \quad (12)$$

where $g_{gap_{i,t}}$ – the deviation from the historical output change at month *t* in country *i* and g_i^* - historical average change in industrial output in 1999-2023 in country *i*. Equation 13 gives us the industrial uncertainty measure based on the sum of the squared deviations from the historical mean of the output change:

$$g_{u_{i,t}} = \sum_{j=1}^{12} g_{gap_{t,i}}^2 \quad (13)$$

where $g_{u_{i,t}}$ - the uncertainty measure based on the industrial output volume. In Fig 9 the graph of the calculated measure for each country is presented.

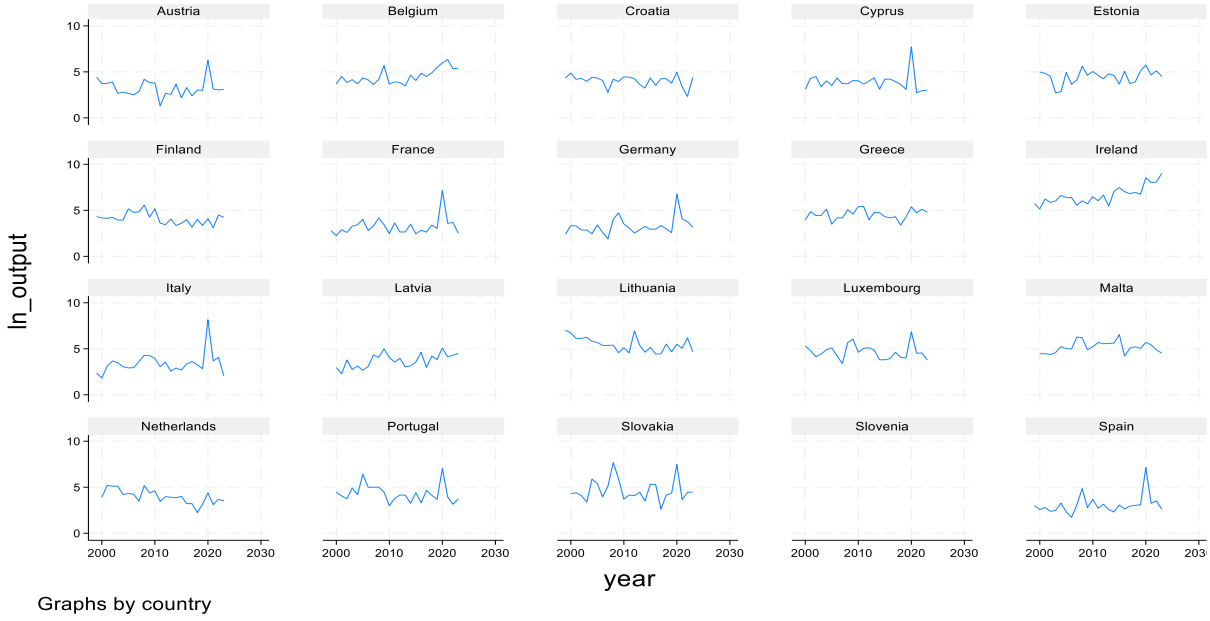


Figure 9: The industrial uncertainty measure in the Eurozone in 1999-2023

Source: own elaboration

Fig 9 shows standard features, such as increased output uncertainty in 2020 during the COVID-19 pandemic. Due to unpredictable production conditions caused by the virus and policy measures to face its spreading, major supply disruptions occurred over this period. Unfortunately, the data for Slovenia is unavailable.

Interest rate uncertainty measure

With Equation 14, we calculated the spread of each country in the Eurozone in 1999-2023 relative to the yield of the German bonds since they are considered the safest in the Eurozone:

$$spread_{i,t} = i_{t,i} - i_{t,DE} \quad (14)$$

where $spread_{i,t}$ – the risk premium of the investor from investing into a 10-year government bond yield at month *t* in country *i*, $i_{i,t}$ – a 10-year government bond yield at month *t* in country *i* and $i_{t,DE}$ - a 10-year government bond yield at month *t* in Germany. Equation 15 shows the way of calculating the interest rate uncertainty measure:

$$i_{u_{i,t}} = \sum_{j=1}^{12} spread_{t,i}^2 \quad (15)$$

where $i_{u_{i,t}}$- interest rate uncertainty measure. In Fig 10 the graph of the calculated measure for each country is presented.

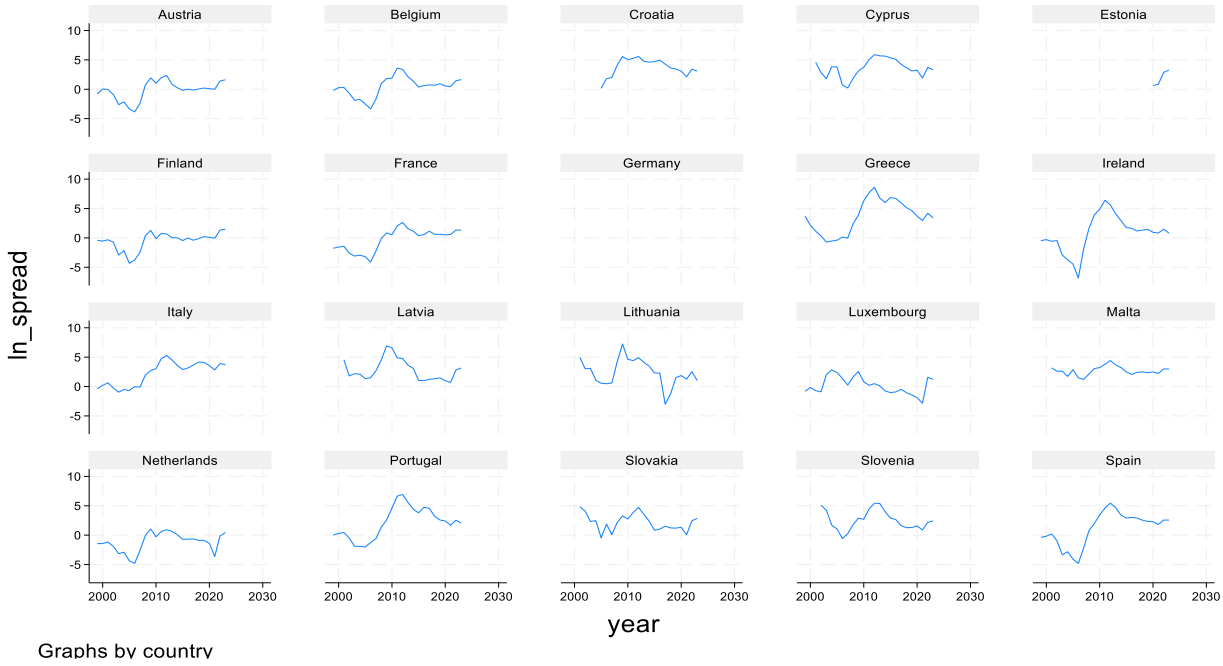


Figure 10: The interest rate uncertainty measure in the Eurozone in 1999-2023

Source: own elaboration

In Fig 10, some countries have limited data (like Croatia, Estonia, etc). We took Germany as a reference in the computational part, so this country has yet to spread. It is considered a risk-free country, so there is no "risk premium" for its bonds. Certain countries in the Eurozone showed negative numbers in the uncertainty measure during the financial crisis of 2007/08, meaning an increase in confidence in the economies. More specifically, such countries are Austria, Belgium, Finland, France, Ireland, Netherlands, Spain and Italy, so basically, these are all advanced countries of Europe. Then, there was a sudden increase in the spread of bonds due to the Sovereign Debt Crisis of 2012/14. It hit a lot of peripheral countries such as Portugal, Spain, Ireland, Italy and Greece.

Unemployment uncertainty measure

With Equation 16, we calculate the difference between the unemployment of the country *i* at month *t* ($l_{i,t}$) and the historical mean of the unemployment rate in a country *i* in 1999-2023:

$$l_{gap_{i,t}} = l_{i,t} - l_i^* \tag{16}$$

where $l_{gap_{i,t}}$- the deviation from the mean unemployment rate and l_i^* - historical average unemployment in 1999-2023 in country *i*. In Equation 17, we can see the maths for the unemployment uncertainty measure:

$$l_{u_{i,t}} = \sum_{j=1}^{12} l_{gap_{t,i}}^2 \tag{17}$$

where $l_{u_{i,t}}$ - the uncertainty measure based on the unemployment rate. In Fig 11, the graph of the calculated measures for each country is presented.

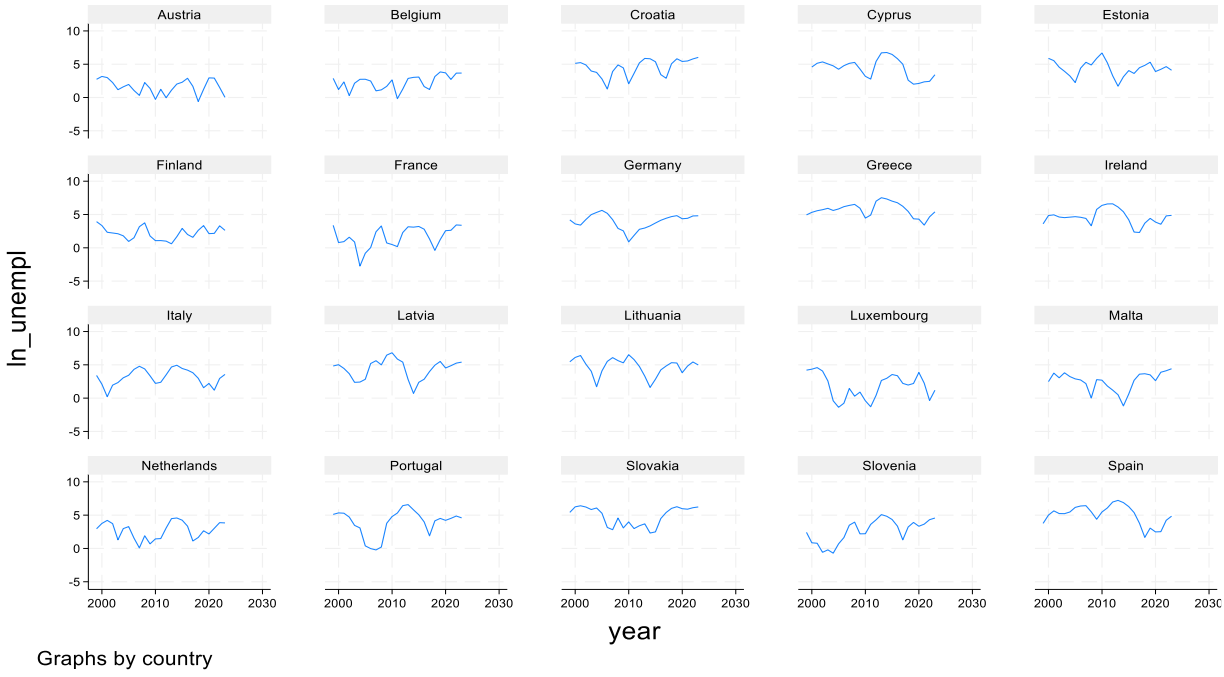


Figure 11: The unemployment uncertainty measure in the Eurozone in 1999-2023

Source: own elaboration

We can observe in Fig 11 the common trend among countries fighting the constantly increasing unemployment rate. This is one of the main goals of fiscal and monetary policies, not only for the European Union but also for each country separately. But still, many countries have suffered from this problem for years, especially those damaged by the Sovereign Debt Crisis, specifically Spain, Portugal and Greece. Also, after the COVID-19 pandemic, there have been small spikes in all countries due to the closure of enterprises and the cut-downs in the number of employees at SMEs. These all increased the uncertainty in the labour market

significantly. Since introducing a few more new uncertainty measures, they were checked for correlation with the previous ones and between themselves (see Table 6) to eliminate the possible future multicollinearity problem.

Table 6: Correlation matrix of market-based and macroeconomic uncertainty measures

	mrkrt	*epu*	*clifs*	*inf*	*spread*	*output*	*unempl*
mrkrt	1.000						
epu	0.027	1.000					
clifs	0.593	0.0976	1.000				
inf	0.282	0.046	0.311	1.000			
spread	0.302	-0.033	0.313	0.071	1.000		
output	0.039	0.314	0.033	0.201	-0.029	1.000	
unempl	0.254	-0.170	0.206	0.329	0.404	-0.060	1.000

Source: own elaboration

As shown in Table 6, all the correlations are less than 30%, making multicollinearity issues unlikely in our regression analysis. Also, there are a few hostile relations, such as between the EPU index (*epu*) and the interest rate uncertainty measure (*spread*) and the unemployment uncertainty measure (*unempl*). Moreover, the industrial (*output*) negatively correlated with the interest rate (*spread*) and the unemployment (*unempl*) uncertainty measures. But these correlations are virtually zero. We further present our panel regression results using robust standard errors.

In Table 7, we can see the empirical results of the country-fixed effects models in different specifications. As in the first part of the research, the GDP growth rate (*gdp*) is significant in all specifications, meaning the result is robust. Meanwhile, contrary to the previous part with the market-based uncertainty measures, the first difference in the real interest rate of the government bonds (*d_inrt*) is never significant. The same applies to the logarithm of the industrial (*ln_output*) and the unemployment (*ln_unempl*) uncertainty measures. The empirical results for the interest rate uncertainty measure (*ln_spread*) are robust, showing a significance of 1% at all specifications. The inflation stress measure (ln_inf) shows no importance only in the complete specification (see Column 7). But still, the explanatory power of the models with fixed effects is relatively low, at most 20% on average. The variation in consumption growth across countries accounts for less than 10% of the total variance in all specifications.

Table 7: Consumption Growth Rate, panel regression, country fixed effects models in 1999-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gdp	0.893*** (.0218)	0.620** (0.228)	0.934*** (0.268)	0.927*** (0.225)	0.613** (0.224)	0.608** (0.226)	0.588** (0.263)
d_inrt	0.069 (0.135)	0.048 (0.136)	0.090 (0.160)	0.109 (0.147)	0.028 (0.131)	0.267 (0.130)	0.001 (0.135)
ln_inf	-0.945*** (0.273)				-0.472* (0.260)	-0.443* (0.253)	-0.435 (0.252)
ln_spread		-1.735*** (0.235)			-1.643*** (0.232)	-1.638*** (0.231)	-1.680*** (0.243)
ln_output			0.307 (0.608)				0.142 (0.518)
ln_unempl				-0.431 (0.361)		-0.200 (0.319)	0.142 (0.340)
Constant	6.051*** (1.218)	6.368*** (0.804)	1.654 (3.053)	4.491*** (1.473)	7.758*** (1.225)	8.345*** (1.642)	7.368* (3.641)
Obs	440	416	419	440	416	416	395
# groups	20	19	19	20	19	19	18
R-sq	0.148	0.188	0.143	0.147	0.183	0.177	0.18

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

Table 8: Consumption Growth Rate, panel regression, random effects models in 1999-2023

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
gdp	0.944*** (0.225)	0.811*** (0.247)	0.923*** (0.236)	0.950*** (0.227)	0.811*** (0.246)	0.804*** (0.245)	0.770*** (0.255)
d_inrt	0.082 (0.140)	0.075 (0.145)	0.065 (0.145)	0.0997 (0.148)	0.075 (0.143)	0.071 (0.145)	0.035 (0.139)
ln_inf	-0.469* (0.280)				-0.001 (0.276)	-0.087 (0.261)	-0.117 (0.287)
ln_spread		-0.949*** (0.219)			-0.949*** (0.216)	-1.016*** (0.230)	-1.073*** (0.226)
ln_output			0.126 (0.390)				0.237 (0.512)
ln_unempl				-0.159 (0.232)		0.301 (0.239)	0.406* (0.221)
Constant	4.438*** (1.012)	4.749*** (0.764)	2.435 (1.895)	3.496*** (0.917)	4.751*** (1.160)	4.114*** (1.306)	2.901 (2.654)
Obs	440	416	419	440	416	416	395
# groups	20	19	19	20	19	19	18
R-sq	0.155	0.209	0.144	0.149	0.209	0.212	0.215

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

Table 8 shows the coefficient of the regressions with random effects. The exact specifications of the random effects models are the same. The empirical results are similar. The difference is the almost complete loss of statistical significance in the logarithm of the inflation

uncertainty measure (*ln_inf*), except for the specification with only this variable (see Column 8). Also, we can observe the first significance of the unemployment stress level at the 10% significance level in the full model (see Column 14), but the result is not robust.

The Hausman tests were introduced to compare two models with fixed and random effects. The fixed effects model was preferred over the random one in four out of seven specifications (see Columns 2, 5, 6, 7). Additionally, the F-test results for time-fixed effects across all specifications indicate they are necessary. So, Table 9 shows the models with country- and time-fixed effects.

Table 9: Consumption Growth Rate, panel regression, country- and time-fixed effects models in 1999-2023

	(15)	(16)	(17)	(18)	(19)	(20)	(21)
gdp	0.558*** (0.144)	0.525*** (0.142)	0.563*** (0.145)	0.566*** (0.152)	0.522*** (0.141)	0.532*** (0.148)	0.538*** (0.150)
d_inrt	-0.435*** (0.123)	-0.424*** (0.121)	-0.435*** (0.125)	-0.435*** (0.125)	-0.421*** (0.121)	-0.418*** (0.122)	-0.417*** (0.122)
ln_inf	0.062 (0.225)				0.203 (0.228)	0.188 (0.227)	0.171 (0.234)
ln_spread		-0.410** (0.151)			-0.440**** (0.134)	-0.447*** (0.128)	-0.437*** (0.128)
ln_output			-0.066 (0.165)				-0.076 (0.157)
ln_unempl				0.083 (0.108)		0.137 (0.094)	0.139 (0.103)
Constant	-9.890*** (1.347)	-9.040**** (1.188)	-9.510*** (1.396)	-10.086*** (1.454)	-9.541*** (1.348)	-10.082*** (1.632)	-9.817*** (1.865)
Obs	440	416	419	440	416	416	395
# groups	20	19	19	20	19	19	18
R-sq	0.931	0.927	0.930	0.931	0.930	0.932	0.932

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

Table 9 shows a significant increase in explanatory power (R-squared) when using the time-fixed effects model. Similarly, the variance in the consumption growth rate explained by differences among countries is more significant, as indicated by a higher rho coefficient than most of the presented specifications. Still, we can see that the industrial (*ln_output*) and the unemployment (*ln_unempl*) uncertainty measures are not statistically significant. Following the previous results, the inflation stress level (*ln_inf*) shows no solid significance through all specifications. At the same time, the GDP growth rate (*gdp*) and the first difference in the actual stock market interest rate (*d_inrt*) are as robust as before. Meanwhile, the logarithm of the interest rate (*ln_spread*) uncertainty measure is statistically different from zero; the result is vital in all specifications.

Table 10: Consumption Growth Rate, panel regression, random and time-fixed effects models in 1999-2023

	(22)	(23)	(24)	(25)	(26)	(27)	(28)
gdp	0.599*** (0.144)	0.579*** (0.147)	0.594*** (0.148)	0.607*** (0.151)	0.574*** (0.143)	0.578*** (0.149)	0.588*** (0.147)
d_inrt	-0.444*** (0.132)	-0.447*** (0.126)	-0.446*** (0.126)	-0.444*** (0.127)	-0.441*** (0.133)	-0.439*** (0.135)	-0.436*** (0.134)
ln_inf	0.445* (0.231)				0.597*** (0.230)	0.537** (0.241)	0.533** (0.264)
ln_spread		-0.160 (0.129)			-0.231** (0.098)	-0.272*** (0.092)	-0.268*** (0.094)
ln_output			0.067 (0.169)				-0.051 (0.193)
ln_unempl				0.117 (0.098)		0.141** (0.071)	0.146** (0.070)
Constant	-11.414*** (1.085)	-9.844*** (1.092)	-10.425*** (1.331)	-10.635*** (1.267)	-11.450*** (1.046)	-11.841*** (1.170)	-11.707*** (1.278)
Obs	440	416	419	440	416	416	395
# groups	20	19	19	20	19	19	18
R-sq	0.934	0.932	0.931	0.932	0.937	0.937	0.937

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

Table 10 presents the empirical results with random and time-fixed effects. In these settings, the only variable not needed is the industrial stress level (*ln_output*). In Column 27, we can observe the significance of the coefficients of all included variables and a high explanatory power. The variables *ln_spread*, and *ln_unempl* are not statistically different from zero in their separate specifications (see Columns 23 and 25, respectively).

Overall, the results point to the two most relevant macro uncertainty measures to account for consumption growth, i.e., inflation (*ln_inf*) and interest rate (*ln_spread*). Their impact is robust throughout almost all the specifications. An increase in interest rate uncertainty is associated with a contraction in consumption growth. The interest rate indicator allows us to account for periods of sizable distress in the Eurozone related to the Great Recession, the sovereign debt crisis, and the pandemic recession. Its negative impact is, therefore, entirely consistent with our expectations. Inflation uncertainty's effects on consumption growth are unstable across specifications but positive in the preferred specifications, allowing for country and time effects. Inflation was subdued over the period investigated, except for the recovery period of the pandemic recession, where inflation increased sizably across all the Eurozone countries. The positive sign found for this indicator needs to be clarified. We further investigate this result in a comprehensive specification where interactions across macro and financial uncertainty measures are allowed.

Robustness checks

As the last part of the research, we conducted some robustness checks of our results. We combined the market-based and macroeconomic uncertainty measures into one regression and different models in the first part. Table 11 shows the country- and time-fixed effects, while Table 12 shows the time-fixed and random effects models. The preliminary check for the necessity of the time-fixed effects should have been addressed since, in all previous results, the F-test's null hypothesis was rejected, meaning we should leave them.

Table 11: Consumption Growth Rate, panel regression, country- and time-fixed effects models in 1999-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gdp	0.294	0.292	0.582***	0.586***	0.569***	0.562***	0.525***
	(0.183)	(0.180)	(0.172)	(0.175)	(0.161)	(0.161)	(0.142)
d_inrt	-0.211	-0.211	-0.458**	-0.460**	-0.448***	-0.448***	-0.424***
	(0.216)	(0.215)	(0.186)	(0.186)	(0.136)	(0.135)	(0.120)
mrkrt	-0.102	-0.102	-0.015	-0.015			
	(0.094)	(0.094)	(0.029)	(0.029)			
epu	0.002	0.004					
	(0.005)	(0.005)					
ln_clifs	0.506	0.509	0.601	0.642	0.531	0.478	
	(0.486)	(0.493)	(0.446)	(0.482)	(0.363)	(0.353)	
ln_inf	0.068	0.070	0.120				
	(0.199)	(0.198)	(0.210)				
ln_spread	-0.962***	-0.9655***	-0.383**	-0.367**	-0.395**	-0.409**	-0.410**
	(0.143)	(0.139)	(0.159)	(0.173)	(0.168)	(0.163)	(0.150)
ln_output	-0.368**	-0.376*	-0.139	-0.140	-0.107		
	(0.153)	(0.160)	(0.181)	(0.178)	(0.157)		
ln_unempl	0.049						
	(0.995)						
Constant	-3.793	-3.595	-7.605	-7.237	-7.796	-8.246	-9.040
Obs	165	165	352	352	389	410	416
# groups	8	8	17	17	17	18	19
R-sq	0.948	0.946	0.932	0.931	0.928	0.929	0.927

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

The complete specification shows that some statistically significant variables have lost their significance, like the GDP growth rate (*gdp*) and the first difference of the real interest rate (*d_inrt*). The interest rate uncertainty measure that the authors calculated is robust and statistically significant at a 5% level; the industrial uncertainty measure, on the other hand, was losing statistical power from the beginning. The rho coefficients, which reflect the variance of the consumption growth rate explained by the differences among countries, were increased to 32% in the final specification (Column 7) with more robust variables.

Table 12: Consumption Growth Rate, panel regression, random and time-fixed effects models in 1999-2023

	(8)	(9)	(10)	(11)	(12)
gdp	0.335* (0.190)	0.623*** (0.173)	0.602*** (0.161)	0.574*** (0.171)	0.578*** (0.149)
d_inrt	-0.219 (0.205)	-0.440** (0.200)	-0.444** (0.190)	-0.459** (0.194)	-0.438*** (0.135)
mrkrt	-0.140*** (0.049)	-0.042 (0.028)	-0.040 (0.026)	-0.039 (0.026)	
epu	-0.000 (0.006)				
ln_clifs	0.379 (0.489)	0.124 (0.380)			
ln_inf	0.166 (0.197)	0.467* (0.265)	0.473* (0.268)	0.465* (0.252)	0.537** (0.241)
ln_spread	-0.335** (0.157)	-0.224** (0.099)	-0.249*** (0.089)	-0.262*** (0.086)	-0.272*** (0.091)
ln_output	-0.182 (0.164)	-0.226 (0.247)	-0.181 (0.209)		
ln_unempl	0.284*** (0.105)	0.155** (0.073)	0.167** (0.072)	0.162** (0.072)	0.141** (0.070)
Constant	-4.922	-9.831	-10.285	-10.806	-11.840
Obs	165	352	356	375	416
# groups	8	17	18	19	19
R-sq	0.970	0.940	0.939	0.939	0.937

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

The results in Table 12 are slightly different from the previous ones. The GDP growth rate (*gdp*), the first difference of the real interest rate (*d_inrt*), the interest rate (*ln_spread*), and the unemployment (*ln_unempl*) uncertainty measures are significant and robust across all specifications. At the same time, the EPU (*epu*) index, the logarithm of the CLIFS (*ln_clifs*) and the industrial stress level (*ln_output*) are not significant in these settings. The real stock market return volatility (*mrkrt*) lost statistical significance, and the coefficient moved closer to zero, so we can neglect it.

Another robustness check presented in this work is the instrumental variable (IV) method. We will use the industrial growth rate as an IV variable for the GDP growth rate variable. The reason for this step is to eliminate the issue of the potential endogeneity bias associated with the endogeneity of GDP growth. By employing this two-stage approach, we aim to get an unbiased estimate of the impact of GDP growth on consumption growth, assuming that the industrial output growth rate is a valid instrument (i.e., it is correlated with GDP growth but uncorrelated with the error term in the consumption growth rate equation). It is a two-step method which will look like:

First stage: $\widehat{gdp_{it}} = \alpha_i + \beta_1 outgr_{it} + \beta_2 X_{it} + \varepsilon_{it}$ (18)

where $\widehat{gdp_{it}}$ – the estimated annual GDP growth rate for country i at time t, $outgr_{it}$ - the annual industrial output growth rate for country i at time t (the instrument), X_{it} - a vector of other exogenous control variables and ε_{it} – the error term.

Second stage: $cons_{it} = \alpha_i + \beta_1 \widehat{gdp_{it}} + \beta_2 X_{it} + \varepsilon_{it}$ (19)

where $cons_{it}$ – the consumption growth rate in country i at time t, $\widehat{gdp_{it}}$ – the estimated annual GDP growth rate for country i at time t, X_{it} - a vector of other exogenous control variables and ε_{it} – the error term.

Table 13 demonstrates the results of the 2SLS with industrial output as an IV variable for the model with country- and time-fixed effects, while Table 14 illustrates the same but with random and time-fixed effects.

Table 13: The IV method for the consumption growth rate, panel regression, country- and time-fixed effects models in 1999-2023

Second stage (Dependent variable: cons)			First stage (Dependent variable: gdp)		
$\widehat{gdp}$	0.333*** (0.112)		outgr	0.328*** (0.059)	
d_inrt	-0.487*** (0.072)		d_inrt	-0.322*** (0.046)	
ln_spread	-0.437*** (0.095)		mrkrt	-0.092** (0.0349)	
			epu	0.018 (0.012)	
			ln_clifs	-0.452 (0.839)	
			ln_inf	0.063 (0.096)	
			ln_spread	-0.556*** (0.094)	
			ln_output	0.116 (0.275)	
			ln_unempl	-0.091 (0.140)	
Constant	-8.106*** (1.181)		Constant	2.913 (3.572)	
Obs	411		Obs	163	
# groups	19		# groups	8	
R-sq	0.919		R-sq	0.768	

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

Table 13 shows that the results from both stages suggest that industrial output growth (*outgr*) is a valid instrument for the GDP growth rate ($\widehat{gdp}$), given its strong predictive power in the first stage. In the second stage, the GDP growth rate ($\widehat{gdp}$) significantly affects consumption growth (cons), confirming that economic growth is a crucial driver of consumption in the Eurozone. The high R-squared values indicate that the overall model fit is vital. All the significant variables in the second stage confirm the results from the previous regressions in Table 11. The only difference is a slightly smaller coefficient of the predicted variables of the GDP growth rate.

Table 14: The IV method for the consumption growth rate, panel regression, random and time-fixed effects models in 1999-2023

Second stage (Dependent variable: cons)			First stage (Dependent variable: gdp)		
$\widehat{gdp}$	0.437*** (0.113)		outgr	0.326*** (0.061)	
d_inrt	-0.524*** (0.094)		d_inrt	-0.335*** (0.051)	
mrkrt	-0.044** (0.021)		mrkrt	-0.086*** (0.030)	
ln_inf	0.556*** (0.135)		epu	0.023** (0.011)	
ln_spread	-0.244*** (0.078)		ln_clifs	-0.465 (0.862)	
			ln_inf	0.192 (0.139)	
			ln_spread	-0.326*** (0.081)	
			ln_output	0.283 (0.207)	
			ln_unempl	0.254** (0.104)	
Constant	-9.797		Constant	1.090 (3.742)	
Obs	370		Obs	163	
# groups	19		# groups	8	
R-sq	0.936		R-sq	0.824	

Source: own elaboration

Note: *p<0.1; **p<0.05; ***p<0.01

The IV approach also effectively addresses potential endogeneity between GDP growth ($\widehat{gdp}$) and consumption growth (cons) in these settings, with instrumented GDP growth ($\widehat{gdp}$) showing a robust positive effect on consumption growth. Key variables such as the first difference of the real interest rate (*d_inrt*), the real stock market return volatility (*mrkrt*), the inflation uncertainty measure (*ln_inf*) and the interest rate stress level (*ln_spread*) consistently

demonstrate significant impacts across stages, underscoring their critical roles in determining economic outcomes in the Eurozone.

In summary, all the variables included in the country and time-fixed effects final model are also significant in the random and time-fixed effects last model. This means that the robustness of the findings across different model specifications is confirmed, indicating that the observed relationships between consumption growth and the included explanatory variables are not sensitive to the choice between fixed effects and random effects models. The significance levels' consistency suggests that these variables' impact on consumption growth is solid and reliable, regardless of the model used.

CONCLUSION

Every person is unique, making individual decisions based on personal judgment. However, during times of crisis, people tend to act in similar ways. Their decisions are guided by three key factors: rationality, the information they possess, and their past experiences. While literature and theory suggest that people may adjust their priorities—such as through early bias or mental accounting—their fundamental drive remains to meet their needs. These needs are shaped by the standard of living to which they are accustomed, and even in uncertain times, individuals are reluctant to compromise their comfort. This is where consumption smoothing becomes relevant, as it has been widely supported in applied research. The theory suggests that people maintain their living standards and build precautionary savings to mitigate the adverse effects of economic turbulence. There are four main methods to detect volatile times: market-based, structural model-based, text-based and survey-based. Each has advantages and disadvantages, so we used the first two approaches in this research.

The literature on consumption during crises examines the subject from multiple angles, resulting in diverse findings explored in this research. For instance, the work on the Great Recession essentially reinforces the consumption smoothing theory. It reveals that younger individuals were particularly vulnerable during this period compared to older individuals, who were better protected by savings and pension income. Research on the Sovereign Debt Crisis focuses on macroeconomic impacts, particularly in the PIIGS countries (Portugal, Italy, Ireland, Greece, and Spain). These studies emphasise the erosion of consumer and investor confidence, the worsening of national debt, and the widening of budget deficits. These macroeconomic challenges severely constrained public spending and household consumption, reinforcing that sovereign debt issues can profoundly impact domestic consumption patterns. The COVID-19 pandemic introduced a new dimension to the study of consumption during crises, differing from previous crises not only because of its health-related origins but also due to the unprecedented uncertainty it brought. This period was marked by a significant decline in the consumption of non-durable goods, a sharp reduction in investments, and a notable increase in precautionary savings as households sought to safeguard against the unknown duration and impact of the pandemic. The ongoing war in Ukraine has further complicated the economic landscape, particularly within the European Union. The sharp rise in inflation and soaring oil prices have raised concerns among EU policymakers, who are already witnessing short-term consequences

such as higher prices and shifts in the labour market. However, the long-term effects of the conflict are challenging to predict, adding another layer of uncertainty to the economic outlook. In response to these economic pressures, poorer households, in particular, are forced to save less and cut back on their consumption. This trend underscores the regressive impact of inflationary shocks. Across various periods of economic volatility, the literature consistently reports common patterns: a decrease in consumption, an increase in precautionary savings, and a reduction in economic activity, particularly in investments, during times of income uncertainty or economic shocks.

Building on the theoretical insights and literature review, the study employed the analysis of the panel data of the Eurozone countries from 1999 to 2023 from official sources (like the World Bank, Eurostat, etc). It was divided into two parts: analysing the market-based and macroeconomic variables. First, from the basic model, we can conclude that the GDP growth rate and the first difference in the real interest rate impact the consumption growth rate; the results are robust through all specifications implied during the analysis. Conversely, the market-based uncertainty measures—namely the Economic Policy Uncertainty (EPU) index, the Composite Leading Indicator for Financial Stress (CLIFS), and real stock market return volatility—were generally found to be statistically insignificant. This lack of significance might be attributed to the short-term nature of these indicators, which capture immediate market sentiments that may not be effectively reflected in the annual data used in this study. Meanwhile, from four calculated uncertainty measures, the ones that demonstrated statistically significant influence on the dependent variable were the inflation and interest rate uncertainty measures. Furthermore, the necessity of incorporating time-fixed effects in the model was confirmed, as the F-test results strongly indicated their importance. Including time-fixed effects accounts for period-specific shocks and events that could otherwise bias the results. This ensures the analysis accurately reflects the temporal dynamics during different economic crises. In the end, the Hausman test confirmed the hypothesis of this research and stated that the fixed effects model was preferred. This underscores the importance of country-specific characteristics. Our analysis shows that aggregate consumption growth is crucially driven by GDP, which has a positive impact, the real interest rate, a negative impact, and interest rate uncertainty. In particular, the impact of the latter variable points to a negative, robust effect of macroeconomic uncertainty on aggregate consumption growth.

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APPENDIX A

THE DO-FILE FROM THE STATA

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*empirical part

clear all

*set mem 200m

cap log close

cap cd "C:\Users\User\Desktop\tesi\stata"

log using "tesi_Shenderova", text replace

use "tesi__shenderova.dta"

*to tell stata that we use panel data and time series operators

encode country, gen(country1)

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*preliminary step

sum

*graphs

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xtline inrt

xtline infl

xtline inf

xtline spread

xtline output

xtline unempl

*create the first differences of the 10-year gov bonds

gen r_inrt = inrt-infl
```

```
*create the growth rate for the consumption
gen lag_con = L.con
gen cons = (con - lag_con) / lag_con * 100
*to check the stationarity of the variables
xtunitroot ht gdp
xtunitroot ht cons
*graphs
xtline cons
*and recheck the stationarity with dfuller command
*to check the stationarity of the variables
xtunitroot fisher mrkrt, lag(1) dfuller
xtunitroot fisher clifs, lag(1) dfuller
xtunitroot fisher epu, lag(1) dfuller
*to calculate the first difference of the real interest rate
gen d_inrt = d.r_inrt
xtunitroot fisher d_inrt, lag(1) dfuller
*country-fixed effects
xtreg cons gdp d_inrt, fe robust
*country and time fixed effects
xtreg cons gdp d_inrt i.year, fe robust
*to check if we need time fixed effects
testparm i.year
*to check if the panels are correlated
ssc install xttest2
```

```
xtreg cons gdp d_inrt i.year, fe robust

xttest2

* to check the heteroskedasticity

ssc install xttest3

xtreg cons gdp d_inrt i.year, fe robust

xttest3

*random effects

xtreg cons gdp d_inrt, re robust

*to check if we need random effects

xttest0

*hausman test

xtreg cons gdp d_inrt, fe

estimates store fixed

xtreg cons gdp d_inrt, re

estimates store random

hausman fixed random

*adding the uncertainty measure 1 (mrkrt)

*graphs

xtline mrkrt

*country-fixed effects

xtreg cons gdp d_inrt mrkrt, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt mrkrt i.year, fe robust

*to check if we need time fixed effects
```

```
testparm i.year

*to check if the panels are correlated

ssc install xttest2

xtreg cons gdp d_inrt mrkrt i.year, fe robust

xttest2

* to check the heteroskedasticity

ssc install xttest3

xtreg cons gdp d_inrt mrkrt i.year, fe robust

xttest3

*random effects

xtreg cons gdp d_inrt mrkrt, re robust

*to check if we need random effects

xttest0

*hausman test

xtreg cons gdp d_inrt mrkrt, fe

estimates store fixed

xtreg cons gdp d_inrt mrkrt, re

estimates store random

hausman fixed random

*to check the correlation among three market-based uncertainty measures

cor mrkrt epu clifs

*adding the uncertainty measure 2 (epu)

*graphs

xtline epu
```

```
*country-fixed effects
xtreg cons gdp d_inrt epu, fe robust
*country and time fixed effects
xtreg cons gdp d_inrt epu i.year, fe robust
*to check if we need time fixed effects
testparm i.year
*to check if the panels are correlated
ssc install xttest2
xtreg cons gdp d_inrt epu i.year, fe robust
xttest2
* to check the heteroskedasticity
ssc install xttest3
xtreg cons gdp d_inrt epu i.year, fe robust
xttest3
*random effects
xtreg cons gdp d_inrt epu, re robust
*to check if we need random effects
xttest0
*hausman test
xtreg cons gdp d_inrt epu, fe
estimates store fixed
xtreg cons gdp d_inrt epu, re
estimates store random
hausman fixed random
```

```
*adding the uncertainty measure 3 (clifs)

*graphs

xtline clifs

*country-fixed effects

xtreg cons gdp d_inrt clifs, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt clifs i.year, fe robust

*to check if we need time fixed effects

testparm i.year

*to check if the panels are correlated

ssc install xttest2

xtreg cons gdp d_inrt clifs i.year, fe robust

xttest2

* to check the heteroskedasticity

ssc install xttest3

xtreg cons gdp d_inrt clifs i.year, fe robust

xttest3

*random effects

xtreg cons gdp d_inrt clifs, re robust

*to check if we need random effects

xttest0

*hausman test

xtreg cons gdp d_inrt clifs, fe

estimates store fixed
```

```
xtreg cons gdp d_inrt clifs, re

estimates store random

hausman fixed random

*adding the uncertainty measure 1 (mrkrt) and measure 2 (epu)

*country-fixed effects

xtreg cons gdp d_inrt mrkrt epu, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt mrkrt epu i.year, fe robust

*to check if we need time fixed effects

testparm i.year

*to check if the panels are correlated

ssc install xttest2

xtreg cons gdp d_inrt mrkrt epu  i.year, fe robust

xttest2

* to check the heteroskedasticity

ssc install xttest3

xtreg cons gdp d_inrt mrkrt epu  i.year, fe robust

xttest3

*random effects

xtreg cons gdp d_inrt mrkrt epu, re robust

*to check if we need random effects

xttest0

*hausman test

xtreg cons gdp d_inrt mrkrt epu, fe
```

```
estimates store fixed

xtreg cons gdp d_inrt mrkrt epu, re

estimates store random

hausman fixed random

*adding the uncertainty measure 1 (mrkrt) amd measure 3 (clifs)

*country-fixed effects

xtreg cons gdp d_inrt mrkrt clifs, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt mrkrt clifs i.year, fe robust

*to check if we need time fixed effects

testparm i.year

*to check if the panels are correlated

ssc install xttest2

xtreg cons gdp d_inrt mrkrt clifs i.year, fe robust

xttest2

* to check the heteroskedasticity

ssc install xttest3

xtreg cons gdp d_inrt mrkrt clifs i.year, fe robust

xttest3

*random effects

xtreg cons gdp d_inrt mrkrt clifs, re robust

*to check if we need random effects

xttest0

*hausman test
```

```
xtreg cons gdp d_inrt mrkrt clifs, fe

estimates store fixed

xtreg cons gdp d_inrt mrkrt clifs, re

estimates store random

hausman fixed random

*adding the uncertainty measure 2 (epu) and measure 3 (clifs)

*country-fixed effects

xtreg cons gdp d_inrt epu clifs, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt epu clifs i.year, fe robust

*to check if we need time fixed effects

testparm i.year

*to check if the panels are correlated

ssc install xttest2

xtreg cons gdp d_inrt epu clifs i.year, fe robust

xttest2

* to check the heteroskedasticity

ssc install xttest3

xtreg cons gdp d_inrt epu clifs i.year, fe robust

xttest3

*random effects

xtreg cons gdp d_inrt epu clifs, re robust

*to check if we need random effects

xttest0
```

```
*hausman test
xtreg cons gdp d_inrt epu clifs, fe
estimates store fixed
xtreg cons gdp d_inrt epu clifs, re
estimates store random
hausman fixed random
*adding the uncertainty measure 1 (mrkrt), measure 2 (epu) and measure 3 (clifs)
*country-fixed effects
xtreg cons gdp d_inrt mrkrt epu clifs, fe robust
*country and time fixed effects
xtreg cons gdp d_inrt mrkrt epu clifs i.year, fe robust
*to check if we need time fixed effects
testparm i.year
*to check if the panels are correlated
ssc install xttest2
xtreg cons gdp d_inrt mrkrt epu clifs i.year, fe robust
xttest2
* to check the heteroskedasticity
ssc install xttest3
xtreg cons gdp d_inrt mrkrt epu clifs i.year, fe robust
xttest3
*random effects
xtreg cons gdp d_inrt mrkrt epu clifs, re robust
*to check if we need random effects
```

```
xttest

*hausman test

xtreg cons gdp d_inrt mrkrt epu clifs, fe

estimates store fixed

xtreg cons gdp d_inrt mrkrt epu clifs, re

estimates store random

hausman fixed random

* country and time random effects model

xtreg cons gdp d_inrt i.year, re robust

xtreg cons gdp d_inrt mrkrt i.year, re robust

xtreg cons gdp d_inrt epu i.year, re robust

xtreg cons gdp d_inrt clifs i.year, re robust

xtreg cons gdp d_inrt mrkrt epu i.year, re robust

xtreg cons gdp d_inrt mrkrt clifs i.year, re robust

xtreg cons gdp d_inrt epu clifs i.year, re robust

xtreg cons gdp d_inrt mrkrt epu clifs i.year, re robust

*correlation matrix

cor mrkrt epu clifs inf spread output unempl

*using log

gen ln_clifs = log(clifs)

gen ln_inf = log(inf)

gen ln_spread = log(spread)

gen ln_output = log(output)

gen ln_unempl = log(unempl)
```

```
xtline ln_inf

xtline ln_spread

xtline ln_output

xtline ln_unempl

*to check the stationarity of the variables

xtunitroot fisher ln_clifs, lag(1) dfuller

xtunitroot fisher ln_inf, lag(1) dfuller

xtunitroot fisher ln_spread, lag(3) dfuller

xtunitroot fisher ln_output, lag(1) dfuller

xtunitroot fisher ln_unempl, lag(1) dfuller

*log clifs

*country-fixed effects

xtreg cons gdp d_inrt ln_clifs, fe robust

xtreg cons gdp d_inrt mrkrt ln_clifs, fe robust

xtreg cons gdp d_inrt epu ln_clifs, fe robust

xtreg cons gdp d_inrt mrkrt epu ln_clifs, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt ln_clifs i.year, fe robust

xtreg cons gdp d_inrt mrkrt ln_clifs i.year, fe robust

xtreg cons gdp d_inrt epu ln_clifs i.year, fe robust

xtreg cons gdp d_inrt mrkrt epu ln_clifs i.year, fe robust

*random effects

xtreg cons gdp d_inrt ln_clifs, re robust

xtreg cons gdp d_inrt mrkrt ln_clifs, re robust
```

```
xtreg cons gdp d_inrt epu ln_clifs, re robust

xtreg cons gdp d_inrt mrkrt epu ln_clifs, re robust

* country and time random effects model

xtreg cons gdp d_inrt ln_clifs i.year, re robust

xtreg cons gdp d_inrt mrkrt ln_clifs i.year, re robust

xtreg cons gdp d_inrt epu ln_clifs i.year, re robust

xtreg cons gdp d_inrt mrkrt epu ln_clifs i.year, re robust

*using ln_inf

*country-fixed effects

xtreg cons gdp d_inrt ln_inf, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt ln_inf i.year, fe robust

*to check if we need time fixed effects

testparm i.year

*random effects

xtreg cons gdp d_inrt ln_inf, re robust

*to check if we need random effects

xttest0

*hausman test

xtreg cons gdp d_inrt ln_inf, fe

estimates store fixed

xtreg cons gdp d_inrt ln_inf, re

estimates store random

hausman fixed random
```

```
* country and time random effects model
xtreg cons gdp d_inrt ln_inf i.year, re robust
*using ln_spread
*country-fixed effects
xtreg cons gdp d_inrt ln_spread, fe robust
*country and time fixed effects
xtreg cons gdp d_inrt ln_spread i.year, fe robust
*to check if we need time fixed effects
testparm i.year
*random effects
xtreg cons gdp d_inrt ln_spread, re robust
*to check if we need random effects
xttest0
*hausman test
xtreg cons gdp d_inrt ln_spread, fe
estimates store fixed
xtreg cons gdp d_inrt ln_spread, re
estimates store random
hausman fixed random
* country and time random effects model
xtreg cons gdp d_inrt ln_spread i.year, re robust
*using ln_output
*country-fixed effects
xtreg cons gdp d_inrt ln_output, fe robust
```

```
*country and time fixed effects
xtreg cons gdp d_inrt ln_output i.year, fe robust
*to check if we need time fixed effects
testparm i.year
*random effects
xtreg cons gdp d_inrt ln_output, re robust
*hausman test
xtreg cons gdp d_inrt ln_output, fe
estimates store fixed
xtreg cons gdp d_inrt ln_output, re
estimates store random
hausman fixed random
* country and time random effects model
xtreg cons gdp d_inrt ln_output i.year, re robust
*using ln_unempl
*country-fixed effects
xtreg cons gdp d_inrt ln_unempl, fe robust
*country and time fixed effects
xtreg cons gdp d_inrt ln_unempl i.year, fe robust
*to check if we need time fixed effects
testparm i.year
*random effects
xtreg cons gdp d_inrt ln_unempl, re robust
*to check if we need random effects
```

```
xttest0

*hausman test

xtreg cons gdp d_inrt ln_unempl, fe

estimates store fixed

xtreg cons gdp d_inrt ln_unempl, re

estimates store random

hausman fixed random

* country and time random effects model

xtreg cons gdp d_inrt ln_unempl i.year, re robust

*using ln_inf, ln_spread, ln_unempl, ln_output

*country-fixed effects

xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl ln_output, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl ln_output i.year, fe robust

*to check if we need time fixed effects

testparm i.year

*random effects

xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl ln_output, re robust

*to check if we need random effects

xttest0

*hausman test

xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl ln_output, fe

estimates store fixed

xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl ln_output, re
```

```
estimates store random

hausman fixed random

* country and time random effects model

xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl ln_output i.year, re robust

*using ln_inf and ln_spread

*country-fixed effects

xtreg cons gdp d_inrt ln_inf ln_spread, fe robust

*country and time fixed effects

xtreg cons gdp d_inrt ln_inf ln_spread i.year, fe robust

*to check if we need time fixed effects

testparm i.year

*random effects

xtreg cons gdp d_inrt ln_inf ln_spread, re robust

*to check if we need random effects

xttest0

*hausman test

xtreg cons gdp d_inrt ln_inf ln_spread, fe

estimates store fixed

xtreg cons gdp d_inrt ln_inf ln_spread, re

estimates store random

hausman fixed random

* country and time random effects model

xtreg cons gdp d_inrt ln_inf ln_spread i.year, re robust

*using ln_inf, ln_spread, ln_unempl
```

```
*country-fixed effects
xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl, fe robust
*country and time fixed effects
xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl i.year, fe robust
*to check if we need time fixed effects
testparm i.year
*random effects
xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl, re robust
*to check if we need random effects
xttest0
*hausman test
xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl, fe
estimates store fixed
xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl, re
estimates store random
hausman fixed random
* country and time random effects model
xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl i.year, re robust
*robustness checks
cor cons gdp d_inrt mrkrt epu ln_clifs ln_inf ln_output ln_spread ln_unempl
xtreg cons gdp d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl i.year, fe robust
testparm i.year
xtreg cons gdp d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl i.year, re robust
xtreg cons gdp d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl, fe
```

```
estimates store fixed

xtreg cons gdp d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl, re

estimates store random

hausman fixed random

xtreg cons gdp d_inrt ln_spread i.year, fe robust

xtreg cons gdp d_inrt ln_inf ln_spread ln_unempl i.year, re robust

xtunitroot fisher outgr, lag(1) dfuller

*an IV approach

xtreg gdp outgr d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl i.year, fe robust

xtivreg cons (gdp=outgr) d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl i.year,
fe

xtivreg cons (gdp=outgr) d_inrt mrkrt ln_clifs ln_inf ln_spread ln_output ln_unempl i.year, fe

xtivreg cons (gdp=outgr) d_inrt mrkrt ln_clifs ln_inf ln_spread ln_unempl i.year, fe

xtivreg cons (gdp=outgr) d_inrt mrkrt ln_clifs ln_inf ln_spread i.year, fe

xtivreg cons (gdp=outgr) d_inrt ln_clifs ln_inf ln_spread i.year, fe

xtivreg cons (gdp=outgr) d_inrt ln_inf ln_spread i.year, fe

xtivreg cons (gdp=outgr) d_inrt ln_spread i.year, fe

xtreg gdp outgr d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl i.year, re robust

xtivreg cons (gdp=outgr) d_inrt mrkrt epu ln_clifs ln_inf ln_spread ln_output ln_unempl i.year,
re

xtivreg cons (gdp=outgr) d_inrt mrkrt ln_clifs ln_inf ln_spread ln_output ln_unempl i.year, re

xtivreg cons (gdp=outgr) d_inrt mrkrt ln_clifs ln_inf ln_spread ln_unempl i.year, re

xtivreg cons (gdp=outgr) d_inrt mrkrt ln_inf ln_spread ln_unempl i.year, re

xtivreg cons (gdp=outgr) d_inrt mrkrt ln_inf ln_spread i.year, re
```

Source: own evaluation based on the data collected from the official data sources