



Sosyal Bilimler
Enstitüsü

T.C.

MARMARA ÜNİVERSİTESİ

SOSYAL BİLİMLER ENSTİTÜSÜ

İKTİSAT ANA BİLİM DALI

İNGİLİZCE İKTİSAT BİLİM DALI

Interest Rate Channel of Monetary Transmission in the Euro Area

Yüksek Lisans Tezi

CANSU BAŞAK AYÇİÇEĞİ

İSTANBUL, 2024

T.C.

MARMARA ÜNİVERSİTESİ

SOSYAL BİLİMLER ENSTİTÜSÜ

İKTİSAT ANA BİLİM DALI

İNGİLİZCE İKTİSAT BİLİM DALI

Interest Rate Channel of Monetary Transmission in the Euro Area

Yüksek Lisans Tezi

CANSU BAŞAK AYÇİÇEĞİ

Tez Savunma Jürisi

Tez Danışmanı: Doç. Dr. SEÇİL YILDIRIM KARAMAN

2. Üye : Doç. Dr. PINAR DENİZ

3. Üye : Dr. ERHAN ULUCEVİZ

İSTANBUL, 2024

ABSTRACT

This paper utilizes a panel dataset comprising 20 Euro Area countries spanning the period from 2004 to 2022 to examine the influence of real long-term interest rates on private investment levels. The study employs the system GMM estimator to account for potential issues of endogeneity, simultaneous determination bias, and reverse causality. The empirical findings suggest that a one-percentage-point increase in the bond yield leads to a decrease in private investments by 0.14 percent. To assess the impact of various scenarios on the relationship between the bond yield and private investment, several estimation models are conducted. The findings indicate that inflation and GDP forecasts significantly influence the impact of the bond yield on private investment levels. Additionally, measures related to market volatility both globally and locally exhibit significant impacts on private investments independently of the bond yields. Moreover, the study reveals that countries in the GIIPS group (Greece, Ireland, Italy, Portugal, and Spain) and unmet growth expectations have significant and negative effects on private investments.

Keywords: interest rate channel, private investment, system gmm estimator

ÖZET

Bu makale, 2004-2022 dönemini kapsayan 20 Euro Bölgesi ülkesinden oluşan bir panel veri setini kullanarak reel uzun vadeli faiz oranlarının özel yatırım seviyeleri üzerindeki etkisini incelemektedir. Çalışma, olası içsellik, eşzamanlı belirleme yanlılığı ve ters nedensellik sorunlarını ele almak için sistem GMM tahmincisini kullanmaktadır. Bulgular, borçlanma oranındaki bir yüzde puanlık artışın özel yatırımları % 0.14 oranında azalttığını göstermektedir. Borçlanma oranı ile özel yatırım arasındaki ilişkinin farklı senaryolar altındaki etkisini değerlendirmek için çeşitli ekonometrik modeller kurgulanmıştır. Bulgular, enflasyon ve GSYH tahminlerinin, borçlanma oranının özel yatırım seviyeleri üzerindeki etkisini önemli ölçüde etkilediğini göstermektedir. Ayrıca, küresel ve lokal volatilité, borçlanma oranlarından bağımsız olarak özel yatırımlar üzerinde önemli etkiler göstermektedir. Çalışma ayrıca, GIIPS ülkeleri (Yunanistan, İrlanda, İtalya, Portekiz ve İspanya) ve karşılanmayan büyüme beklentilerinin özel yatırımlar üzerinde önemli ve olumsuz etkileri olduğunu ortaya koymaktadır.

Anahtar Kelimeler: faiz kanalı, özel yatırımlar, enstrümental değişken yaklaşımı

CONTENT

Abstract	i
Abbreviations	iv
Introduction	1
Literature Review	4
Data Description	24
Methodology	29
Empirical Results	32
Conclusion	56
References	58
Appendix	61

ABBREVIATIONS

ABSPP	Asset-backed Securities Purchase Program
APP	Asset Purchase Programme
CSPP	Corporate Sector Purchase Program
ECB	European Central Bank
EFFR	Effective Fed Funds Rate
EMU	Economic and Monetary Union
FDI	Foreign Direct Investment
FED	Federal Reserve
GDP	Gross Domestic Product
GIIPS	Greece, Ireland, Italy, Portugal, Spain
GMM	Generalized Method of Moments
LTRO	Long-Term Refinancing Operations
MMR	Money Market Rate
OECD	Organisation for Economic Co-operation and Development
PEPP	Pandemic Emergency Purchase Program
SMP	Securities Market Programme
VIX	Volatility Index
VSTOXX	Volatility Stoxx

INTRODUCTION

The study investigates the impact of real long-term sovereign bond yields on private investments and examines how the magnitude of the transmission mechanism changes in response to various fiscal and monetary determinants in Euro Area countries. The analysis includes twenty Euro Area countries: Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia, and Finland. The data covers the period from 2004 to 2022.

The Economic and Monetary Union (EMU) of the European Union represents a distinctive economic arrangement encompassing twenty member countries that share a common currency and adhere to a unified monetary policy framework. Despite this monetary unity, fiscal policies remain within the purview of individual national governments, albeit subject to certain regulations and constraints imposed by the EMU.

To provide a clearer context, it is important to first define monetary policy. Monetary policy refers to the set of measures that central banks implement using tools such as the effective policy rate, which is the short-term nominal interest rate, or alternative programs that impact the monetary base. The goal of monetary policy is to achieve macroeconomic objectives such as price stability, full employment, output growth, and external balance. In response to domestic or global shocks, these monetary policy tools are highly significant for maintaining stability in the economy.

Interest rates constitute a primary instrument employed by monetary authorities to uphold price stability, given their diverse effects on macroeconomic variables. Within the Euro area, the European Central Bank (ECB) directs its monetary policy towards the primary goal of maintaining price stability. Conversely, fiscal policy remains under the purview of individual national governments. Consequently, variations in financial structures, fiscal management practices, and internal economic cycles among member countries engender a heterogeneity in the transmission mechanism of monetary policy across the Euro area.

During the period under study, Euro Area countries have undergone three significant crises, with two of them occurring concurrently. These crises have underscored the vulnerability of certain Euro Area countries, particularly those on the periphery, and have prompted the European Central Bank (ECB) to implement unconventional monetary policy measures aimed at bolstering the transmission of policy rate decisions across all member states.

Therefore, the objective of this study is to examine the extent of the transmission mechanism of real long-term interest rates on private investments, a crucial component of future economic growth. Private investment is often the first element to be compromised during periods of crisis, underscoring its importance in economic stability and development. Apparently, in times of financial distress, economies struggle to maintain existing structures rather than developing new techniques, production facilities, or new sectors.

Why is private investment so important for future economic growth? Even the most basic scenario of private investment leads to employment creation and a general increase in household welfare. In more complex scenarios, private investment can bring new technologies that accelerate production processes or foster the development of new sectors and innovations. It supports infrastructure, transportation, and various other systems, paving the way for further private investments in subsequent years.

The rise of private investments can attract foreign direct investment (FDI), creating a positive image for the country and encouraging even more cash flow through this channel. The expansion of the private sector is also advantageous for governments. Increased private investment leads to higher government revenue through taxes, enhancing the government's ability to fund public services and infrastructure projects.

In summary, private investment and capital accumulation are critical factors for economic growth. They drive technological progress, job creation, and overall economic stability, contributing significantly to a nation's long-term prosperity.

Private investment tends to decline during these specific periods due to the demand for cash holdings and deleveraging by economic agents, tragically affecting both households and the private sector. The significant drops in private investment are a common result of major crises, primarily due to the uncertainty in the markets and the increased debt levels in both public and private entities.

As will be elucidated in the following section, expectations regarding policy changes, inflation, or the trajectory of the crisis are pivotal factors influencing changes in macroeconomic variables such as private investment and aggregate output. Uncertainty stemming from the crisis is a primary driver of increased cash holdings. During times of crisis and heightened uncertainty, households tend to reduce consumption, and the private sector often decreases private investments. To avert recession and revitalize the economy, both monetary and fiscal measures play a crucial role.

In examining the impact of long-term interest rates, this study incorporates various determinants of private investment. The analysis draws from different approaches in the literature. Given the current focus on indebtedness and the debt overhang hypothesis—which explains the impact of firm debt on private investment—it is essential to include firm debt, household debt, and public debt in the analysis. This comprehensive approach will provide a better perspective on the debt concept and its influence on private investment in the Eurozone.

In addition to debt, the impact of public investment is also crucial to determine whether it is complementary or has adverse effects. Real GDP growth is another significant determinant, as it reflects the economic performance of the country during the specific period. Foreign direct investment (FDI) will also be included in the analysis to assess its complementary effects, such as the introduction of new technologies and the creation of new sectors in the market.

The study utilizes the System Generalized Method of Moments (GMM) estimator, developed by Blundell and Bond (2000), to address potential endogeneity issues between variables. This approach is particularly suitable for dynamic panel models, considering the potential persistence in private investment.

In addition to analyzing the fundamental determinants and the variable of interest, this study explores various scenarios that could affect private investment. By examining these impacts through the lens of the long-term interest rate channel, the paper aims to enhance understanding of the strength of the transmission mechanism under different circumstances.

The study investigates the influence of individualistic country characteristics, economic growth expectations, national indebtedness levels, inflationary pressures, monetary policy decisions of United States, and uncertainty on private investment, using the long-term interest rate as a lens.

The existing literature on the impact of monetary policy on private investment levels primarily consists of cross-sectional analyses. This study contributes to this body of literature by examining a unified structure, the Eurozone, in which each member functions as an individual entity with unique environmental factors. These distinct dynamics among Eurozone countries alter both the nature and extent of the impact of monetary policy. By investigating the behavior of private investment levels in response to monetary policy decisions over a period encompassing three major crises, this study extends the current understanding of this relationship.

LITERATURE REVIEW

This section aims to provide a comprehensive review of the literature relevant to the study's focus. It will cover several key areas, including the significance of the interest rate channel in monetary policies, the specific monetary transmission mechanism of the Euro area, the non-standard measures of the European Central Bank, the interaction between monetary and fiscal policies, the impact of Global Financial Crisis and Sovereign Bond Crisis over the Euro Area, the debt overhang hypothesis, and the resurgence of the importance of monetary policy in economic growth components, including the impacts of the COVID-19 crisis. The objective is to deepen the understanding of the determinants of private investment, particularly focusing on the role of real long-term bond yields, and how their responses vary under different circumstances.

The study uses the study of Vanlaer et al.'s "Debt and Private Investment: Does the European Union Suffer from a Debt Overhang?" as a primary example, particularly for the model it establishes, it is crucial to understand the effects of the determinants from the perspective of that paper. This study distinguishes itself from the exemplary paper by rigorously analyzing the strength of the transmission mechanism through the interest rate channel. Additionally, it assesses the impact of various factors, including local and global shocks, fiscal balances, growth expectations, and other determinants, on the magnitude of this transmission mechanism affecting private investment levels.

The exemplary study focuses on the debt overhang hypothesis, which primarily explains the relationship between firm debt levels and their impact on private investment levels. The hypothesis posits that as debt levels increase, they create a crowding-out effect for private investment due to limited financial resources and uncertainty.

The study reveals that private investment levels have not returned to the threshold levels of the pre-global crisis period. The graphics in Figure 1, Figure 2, Figure 3 and Figure 4 present the private investment-to-GDP ratios for each country. The graphs indicate that, with the exception of Malta, France, Italy, Austria, Ireland, and Germany, the private investment levels have not returned to their pre-Global Financial Crisis levels. During the same period, the impact of the global financial crisis led to a significant decline in both real GDP and private investment levels, particularly in the euro area periphery countries, while the indebtedness of both the public and private sectors, as well as households, increased.

As observed in the graphs in Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9, public debt and firm debt increases significantly in Euro Area countries, with the exceptions of Malta, Luxembourg, and Estonia, following the Global Financial Crisis. The graphs in Figure 10, Figure 11, Figure 12, Figure 13 and Figure 14 indicate that real GDP growth sharply decreases, similarly the real long-term interest rates decreases during the crisis years as can be observed in the graphs in Figure 15, Figure 16, Figure 17 and Figure 18, and subsequently, inflation rates generally increases across the Euro Area.

The exemplary study contributes to the literature on the debt overhang hypothesis by examining the impacts of government debt, in addition to firm debt, on private investment.

The independent variables in the analysis include firm debt, household debt, public debt, public investment, GDP forecast, foreign direct investment levels, trade openness, and long-term real interest rate, while the dependent variable is private investment.

The results of the analysis indicate that private debt and public investment levels do not have a significant impact on private investment. It is noteworthy that the debt overhang effect is only observed through the government debt channel. Other determinants, such as public investment, GDP forecasts, and foreign direct investment, show a significant impact on private investment levels. (Vanlaer et al. 2021)

Given that the focal point of this study is the real long-term interest rate and its transmission mechanism over private investment levels, it is imperative to comprehend its primary mechanism and its function within Europe. This is particularly critical due to the Eurozone's composition of twenty distinct countries, each with unique economic cycles and histories.

Monetary policy is a policy measure that leverages various channels to produce tangible effects on macroeconomic outcomes, including price stability, aggregate demand, output growth, external balance, and full employment. It's functionality mainly depends on the credibility of the Central Bank applies it.

Monetary policy authorities take direct or indirect actions to effect changes in short-term interest rates. As Keynes asserted in his writings, changes in short-term nominal interest rates have a parallel effect on long-term nominal interest rates. However, prices and wages adjust slowly due to their stickiness, leading to varying rates of real interest rates. (Ndubuisi 2014)

As Angeloni et al. (2003) explains the transmission mechanism of monetary policy operates in two stages. In the first stage, changes in the money market interest rate or the monetary base directly influence market interest rates, borrowing and lending conditions, asset prices, and exchange rates. This has a substantial impact on overall market liquidity.

The second stage involves the transmission of these changes to households and corporations. In the long run, the alterations in behavior among these entities do not have a lasting impact, except for the general change in price levels. However, in the short run, these changes can lead to real effects. Variations in consumption and investment decisions, as well as spending, may have varying degrees of impact on the economy, depending on price and wage rigidities.

Angeloni et al. (2003) asserts that expectations, particularly regarding inflation, have a significant impact on the effectiveness of the transmission mechanism, given that monetary policies are structured around the target of price stability. If the credibility of the monetary authorities is sufficiently high, market rates may begin to align with the expected rate even before the official announcement, anticipating the forthcoming effective policy rate.

The expectations theory elucidates how an unexpected change in short-term interest rates can influence long-term interest rates through the expectations channel. According to the theory, the impact of short-term interest rates on long-term interest rates varies based on how the market perceives this change with respect to the future trajectory of interest rates. (Angeloni et al. 2003)

The transmission mechanism also operates through the asset channel. A change in the policy rate affects the present value of assets, as the present value of an asset is the discounted form of its expected future value, discounted by the current policy rate. (Angeloni et al. 2003)

For equities, in the scenario of a contractionary monetary policy implementation, an increase in the interest rate will lead to higher financial costs for firms. This, in turn, will affect revenues and result in decreased profits. The decline in profits will be reflected as a decrease in stock prices, due to the heightened risk of default. However, this may be mitigated by the decrease in inflation risk premia resulting from contractionary monetary policies. (Angeloni et al. 2003)

Angeloni et al. (2003) explains how the transmission of interest rate changes across the banking system depends on various factors. These include supply and demand conditions across markets, the maturity and conditions of contracts, country and sector risk premia, banks' administrative and menu costs, and the levels of uncertainty in the economy both locally and globally. All these factors influence how effectively changes in policy rates are transmitted to the banking system.

The study illustrates how real interest rates affect the cost of capital. An increase in real interest rates raises the cost of acquiring machinery, equipment, and other capital assets, thereby reducing the profitability of investments. However, the impact varies across different sectors depending on their capital intensity. (Angeloni et al. 2003)

Angeloni et al. (2003) presents households as the net creditors of the economy, while corporations and the governments as the net debtors, as is the case in most economies within the Euro Area. Consequently, an increase in interest rates boosts household income but reduces corporate profits and exacerbates government budget deficits. The magnitude of these impacts, however, depends on the maturities of the debt and the amount of household deposits.

The magnitude of the exchange rate channel's impact depends on a country's reliance on imported goods. If imported goods are used as production inputs, changes in the exchange rate will be reflected in the final goods' prices, leading to an increase in consumer price inflation. However, if the country is export-oriented, the negative effects of exchange rate depreciation could be mitigated or even become positive. (Angeloni et al. 2003)

The financial structure plays a crucial role in enhancing the effectiveness of the monetary transmission mechanism in implementing monetary policy. The Economic and Monetary Union (EMU) represents an integrated system that eliminates the individual monetary authorities of member countries. However, these countries retain their own distinct financial structures. Consequently, the transition to the EMU system may lead to asymmetric impacts across different countries due to variations in the performance of the monetary transmission mechanism. Nonetheless, this union has the potential to converge these countries' financial systems to similar levels. (Mojon 2000)

Mojon (2000) delves into two pivotal elements of the monetary transmission mechanism, which collectively represent the interest rate channel: the pass-through of policy rates to retail bank rates, and the balance sheet structure of the non-financial private sector. These elements elucidate the wealth and income effects of the interest rate channel. However, as previously noted, the disparity in financial structures results in a gradual transmission of policy to targeted instruments, such as assets and interest rate contracts. This gradual process according to Mojon (2000) stems from differences in consumer behaviors, applicable laws, and financial constraints across countries.

The Economic and Monetary Union's (EMU) convergence strategy instigates competition among banks, fostering a robust pass-through of the policy rate to credit and deposit rates. As noted in the literature, there exists an downward rigidity in bank rates. (Mojon 2000)

Mojon (2000) presents several factors contribute to the rigidity of pass-through in the banking sector. Firstly, an increase in the credit rate can strain the customer's financial position, especially when there is a high demand for credit. Secondly, there are menu costs associated with adjusting rates, which can deter frequent rate changes. Thirdly, different types of credit offer varying maturities, resulting in different interest rates.

Additionally, banks may offer interest rate insurance to long-term customers, and operational costs can also influence the rigidity of policy adjustments. Higher operational costs lead to a smaller pass-through effect. Inflation has a positive correlation with the speed of pass-through, meaning higher inflation rates lead to faster pass-through effects. Moreover, volatility in the money market rate (MMR) creates uncertainty, which slows down the adjustment process. (Mojon 2000)

Balance sheets, the maturity structures of credit and deposit contracts, and asset responses to external shocks are key channels that indicate the income effect of monetary policy. The wealth effect, primarily influenced by balance structure, is significantly impacted by changes in asset prices. (Mojon 2000)

The global financial crisis and the subsequent sovereign debt crisis led to a reduction in the ECB's policy interest rate to mitigate potential liquidity issues. However, the absence of a fiscal union among Eurozone countries means that the transmission mechanism operates differently for each country as mentioned above. Following the lowering of interest rates to the zero lower bound, the ECB began implementing non-standard monetary policies to stabilize prices and enhance the effectiveness of the transmission mechanism.

These non-standard measures do not function in the same manner as standard policy measures. Their objective is to complement the monetary policy decisions regarding interest rates and to improve the effectiveness of the transmission mechanism across the entire Eurozone. (Cour-Thimann et al. 2013)

As Cour-Thimann et al. (2013) explains the adoption of a single currency has substantial implications for the perceived credibility of the Eurozone, bond yields, and trade balances. Therefore, fiscal policies should be coordinated with the decisions of the ECB. However, due to the heterogeneity among countries in terms of financial systems, fiscal management, uncertainty risks and cultural differences, the transmission mechanism does not operate uniformly across all economies.

In the Eurozone, non-financial corporations rely heavily on external financing for their investments and general needs. As a result, interbank refinancing operations are significant. The European Monetary Union has enhanced financial integration among Eurozone countries, leading to a uniform structure and conditions for interbank refinancing operations. Although intended to strengthen the financial system,

obtaining funding is equally easy for any country in the Eurozone, including those with high levels of indebtedness. (Cour-Thimann et al. 2013)

The Treaty on the Functioning of the European Union contains provisions addressing heterogeneity issues and establishes uniform rules regarding potential deficits and indebtedness. These rules are intended to reduce potential vulnerabilities and barriers to the transmission mechanism of monetary policy decisions within the financial systems of member countries. (Cour-Thimann et al. 2013)

The Stability and Growth Pact is one of the precautionary measures implemented by the Treaty. This agreement, signed by all Eurozone countries, aims to ensure control over budget deficits and indebtedness ratios. According to the agreement, a government's annual budget deficit should not exceed 3% of GDP, and public debt should not exceed 60% of GDP. However, even before the crisis, some countries had already exceeded these limits, especially those on the periphery. (Cour-Thimann et al. 2013)

As mentioned earlier, the heterogeneity resulting from the various economic structures causes the transmission mechanisms to sometimes not function as intended. The ECB has implemented non-standard measures to address these transmission mechanism issues and stabilize the economy using its standard tools.

As liquidity flows primarily through the banking system in the Eurozone, non-standard measures are designed to influence funding systems by reducing deleveraging, especially among corporations, and maintaining liquidity.

Cour-Thimann et al. (2013) presents some of the non-conventional policies in his study. During the global crisis, the ECB provided access to ten eligible financial institutions for refinancing operations at a fixed main refinancing rate. It altered the maturity durations of the refinancing operations and expanded the definitions of eligible collateral. The ECB also entered into currency swap agreements, which significantly alleviated the need for US dollars in euro markets. The ECB initiated the Covered Bond Purchase Programme, which aims to support the covered bond market. These assets are long-term debt securities used to refinance loans, particularly those related to real estate transactions.

To stabilize the securities market, the ECB initiated the Securities Market Programme to provide necessary liquidity by purchasing sovereign bond yields in the securities market, sterilizing the system with liquidity-absorbing operations. Under the program, the ECB was authorized to intervene in the secondary market, but not the primary market. The SMP was active until mid-2010, after which the Outright Market Transactions took place. (Cour-Thimann et al. 2013)

The Outright Monetary Transactions (OMT) program is a non-standard policy that has never been implemented. This measure is designed to alleviate pressure on sovereign bonds by allowing the ECB to purchase them in the secondary market. It is intended to reduce borrowing costs in economies with high public debt and high interest rates. Although the program was never activated, its announcement alone was sufficient to reduce borrowing costs. (Cour-Thimann et al. 2013)

The European Central Bank (ECB) introduced the Long-Term Refinancing Operations (LTROs) to enhance liquidity in the financial system by offering banks loans with maturities of up to three years. This initiative provides an arbitrage opportunity for banks, given the favorable borrowing costs it offers.

The ECB has implemented various quantitative easing programs, including the Asset Purchase Programme (APP), Asset-backed Securities Purchase Program (ABSPP), Pandemic Emergency Purchase Program (PEPP), and Corporate Sector Purchase Program (CSPP). These initiatives involve the purchase of sovereign bonds, covered bonds, asset-backed securities, and private securities to stimulate the economy and stabilize financial markets. (Cour-Thimann et al. 2013)

Given that the Euro Area only has a monetary union, fiscal policies are left to the local authorities of individual countries, resulting in varying magnitudes of the transmission mechanism across different banking systems and economies. To analyze how the transmission mechanism operates, it is crucial to understand the interaction between monetary and fiscal policies.

During the global financial crisis and the sovereign debt crisis, monetary authorities implemented expansionary monetary policies to stimulate the economy, resulting in a dramatic decrease in interest rates as they approached the zero lower bound. The presence of a lower bound on interest rates can constrain the effectiveness of traditional monetary policy in managing price stability. Under such circumstances, the use of non-standard measures becomes crucial. (Debrun et al. 2021)

As Debrun et al. (2021) explains when inflation expectations are low, there is a risk of falling into a low-inflation or liquidity trap. This situation can lead to a decline in demand, resulting in excess production capacity. Consequently, both production levels and employment rates decrease, negatively impacting consumption and private investment decisions by firms. Ultimately, these factors can lead to a recession.

Several factors influence price stability from the fiscal management point of view. An increase in government spending or a reduction in tax revenues, often resulting from tax cuts, can inject liquidity into the economy, stimulating consumption. (Debrun et al. 2021)

However, in the event of inflationary pressures, a central bank can implement a contractionary monetary policy by raising interest rates. This policy action reduces both private investment and consumption, thereby mitigating inflationary pressures and inflation expectations. (Debrun et al. 2021)

In a scenario where the policy rate remains at the lower bound and inflation increases, real interest rates decrease. This decrease encourages borrowing by firms, creating a "crowd-in" effect that boosts private investment and consumption. (Debrun et al. 2021)

According to Debrun et al. (2021) fiscal policies should be tailored to the specific characteristics of a country, including its internal economic cycles, government debt-to-GDP ratios, unemployment levels, and the anticipated responses of economic agents to fiscal adjustments.

Nevertheless, the perception of a monetary union in the Euro Area can create a misleading impression for fiscal policymakers. In the absence of a fiscal union and with the ECB solely responsible for maintaining price stability, inflation resulting from misguided fiscal policies may not prompt intervention by policymakers through fiscal consolidation measures. This is because the ECB is perceived as bearing the responsibility for addressing inflation, even when its root causes lie in flawed fiscal policy. Despite the maintenance of price stability by the monetary union, local shocks cannot be effectively addressed by a single monetary policy for each country. The management of such shocks necessitates the use of fiscal policy. (Debrun et al. 2021)

Debrun et al. (2021) asserts that the asymmetries within the Euro Area have become more pronounced following the sovereign debt crisis. The financial structures of individual economies, coupled with differences in indebtedness levels and fiscal management practices, have led to fragmentation across the euro area. As a result, the transmission mechanism of monetary policy has not operated efficiently in many countries.

The yield spreads observed were primarily driven by the credit and default risks associated with the governments of the countries, as well as liquidity and redenomination risks. Both standard and non-standard measures were implemented to ensure the adequate liquidity in the market, stabilize the supply of credit, manage government repayment processes, and mitigate redenomination risk. (Debrun et al. 2021)

Examining the European debt crisis is essential for understanding the structural dynamics of the Euro Area and the interaction between fiscal and monetary policies. While the literature presents diverse perspectives on the causes of the crisis, financial integration and the transition to the euro are commonly cited factors.

Ullah and Ahmed (2014) endeavors to elucidate the origins and outcomes of the European sovereign debt crisis. Key factors contributing to the crisis include international trade imbalances and the coinciding global financial crisis. Countries within the eurozone that were already burdened with high levels of debt were particularly susceptible to sovereign debt risks. The confluence of these factors, compounded by the global financial crisis, exacerbated the fragility of the financial sectors in these countries, deepening the crisis. Consequently, public debt-to-GDP ratios escalated, aggregate output and private investment declined, unemployment rates rose, and both bond yields and credit default swap (CDS) rates increased.

Similar to the United States, Europe witnessed a real estate market boom driven by comparable factors. Unsecured and inexpensive lending to consumers led to the formation of a substantial bubble, resulting in an overpriced real estate market and initiating a detrimental cycle. (Ullah and Ahmed 2014)

The collapse of this bubble led to the deterioration of banks' balance sheets. Subsequent bailouts and expenditures to revitalize the economy markedly escalated public spending. Spillovers experienced from periphery countries to on-periphery ones. The prevailing explanation in the literature attributes these events to the introduction of the euro, which reduced interest rates for credit owing to the perceived stability of the eurozone. (Ullah and Ahmed 2014)

Another significant aspect is that the establishment of the ECB necessitates that member countries of the euro area relinquish their individual monetary policy authorities. Consequently, these countries are unable to swiftly address their own economic challenges. Additionally, since each country exhibits distinct patterns in their economic cycles, formulating a unified policy tool demands more time and coordination. (Ullah and Ahmed 2014)

Beker (2014) expresses that the general perception of the reason for the Sovereign Debt Crisis is attributed to the introduction of the euro currency for its members and the financial integration within the European Union as mentioned above. The issue with the introduction of the euro currency is primarily linked to the decline in interest rates. Given that member countries exhibit diverse macroeconomic conditions, they struggle with high inflation expectations. Particularly, the periphery countries, which require a contractionary approach, are compelled to adjust their interest rates in alignment with other countries. Consequently, the main response has been an increase in borrowing.

Beker (2014) asserts that from the European Union perspective, all sovereign bonds are considered risk-free assets under its umbrella. This perspective has led countries with already significant exposure to sovereign debt risk to purchase more bonds, as they are perceived as risk-free assets regardless of the country of origin. Another explanation for the European Crisis is that it was triggered by the global financial crisis.

The study of Beker (2014) aims to provide a more comprehensive and detailed explanation of the causes of the European Crisis by categorizing countries based on their economic positions. The countries are divided into three groups. The first group consists of old indebted countries, which were already highly indebted before the crisis but did not significantly worsen their indebtedness after 2007. The second group comprises new highly indebted countries that experienced a worsening of their indebtedness after the crisis. The third group is a special case of Spain. The article suggests that there is no simple and unique explanation for the euro area crisis. (Beker 2014)

For the first group of countries, such as Greece and Italy, they were already heavily indebted long before the crisis erupted. This situation persisted even after the crisis, yet their condition did not significantly worsen due to the crisis. (Beker 2014)

As Beker (2014) presents the establishment of the European Union, banks in Germany and France exhibited a demand for Greek sovereign bonds, as they were considered risk-free assets under the EU umbrella. The perception was that the low interest rates adjusted due to the introduction of the euro currency created a seemingly safe economic atmosphere and lowered inflation expectations, even in the periphery countries that previously had higher inflation expectations.

However, while this explanation may seem plausible, countries such as Greece, Italy, Belgium, and Spain had nearly the same debt levels in both 2001 and 2007. Therefore, while the introduction of the euro may have contributed to the onset of the crisis to some extent, it cannot be considered the sole reason. (Beker 2014)

These same countries had debt levels well above the 60% Maastricht level of the European Union when the global financial crisis erupted. Yet, they were among the countries that experienced the slowest rise in their indebtedness levels during the crisis. (Beker 2014)

The second group consists of Ireland and Iceland, referred to as the new highly indebted countries. These countries experienced the fastest growth in their indebtedness levels. (Beker 2014)

As a last one Beker (2014) explains the special case of Spain. The case of Spain bears similarities to the global financial crisis. A real estate bubble, fueled by mortgage credits extended even to customers with lower credit profiles and inadequate conditions, led to a surge in real estate prices. When these lower-profile customers began to struggle with meeting payment deadlines, the bubble burst. Subsequent bailouts further increased the government's indebtedness level.

Another effect of the introduction of the euro is the establishment of a common currency, which led to fixed exchange rates among member countries. Consequently, the external competitiveness of countries, especially those struggling with high debt ratios in the periphery, decreased. This resulted in a decrease in export numbers and an increase in import numbers. (Beker 2014)

As Beker (2014) indicates the slowdown was particularly evident in countries like Greece. In the case of Greece, higher budget deficits led to an increase in debt ratios. However, the introduction of the euro currency exacerbated the acceleration of indebtedness due to the loss of competitiveness in its exports.

In Italy's case, the country was heavily indebted long before the global financial crisis. The Italian government and banking sector relied heavily on refinancing its debt structures, which posed no significant issues until the mortgage crisis emerged. (Beker 2014)

The close linkages between banks in Italy resulted in a strong transmission mechanism. Liquidity constraints became a common problem, leading banks to reduce their loan lending and raise collateral conditions. Consequently, a significant slowdown occurred in Italy, with production rates falling, GDP growth rates decreasing, and the government's tax cuts policy causing an increase in public expenditure. (Beker 2014)

In conclusion, there is no single, simple explanation for the sovereign debt crisis. Each member of the Eurozone has different internal cycles, and the introduction of the euro, the common perception of being a member of the European Union, and the global crisis are all significant triggers for the crisis. However, there are various underlying reasons specific to each country. (Beker 2014)

The sovereign debt crisis has led to significant credit constraints and a contraction in lending sources, especially in the periphery countries exposed to significant sovereign risk. The uncertainty stemming from the crisis has resulted in a decrease in loan supply, leading to significantly lower growth rates and output growth. This is primarily due to reduced private investment and deleveraging by both firms and households. (Acharya et al. 2018)

Acharya's et al. (2018) contribution lies in its explanation of the behavior of the banking sector and the channels through which it operates. The analysis reveals that banks exposed to high sovereign risk and with strong linkages to periphery country-centered banks experience more severe liquidity crises, leading to a significant contraction in loan supply compared to other banks.

It is evident that banks originating from periphery countries, which have the highest exposure to sovereign risks, encountered liquidity problems. The firms relying on these banks for financing suffered the most severe negative outcomes. (Acharya et al. 2018)

As Acharya et al. (2018) explains banks exhibited two main reactions with two main channel to the crisis. Firstly, banks with balance sheets exposed to severe sovereign risks decided to contract the loan supply which is called as balance sheet channel.

Secondly, there was a risk-shifting behavior observed for the weakly-capitalized observed which is called risk-shifting. Due to the establishment of the European Union, there was a widely accepted perspective that all sovereign bonds were considered risk-free assets regardless of their country of origin. So the union regulations removed the concentration limits for sovereign debt exposures. As a result, banks, relying on the perceived trust in the system, decided to purchase more sovereign bonds from various countries, thereby making themselves even more vulnerable to the crisis. (Acharya et al. 2018)

Both of these reactions led to a crowding-out effect on corporate investment. As a result, sales and output growth decreased, and unemployment rates in some countries increased.

As an important note, the financial integration achieved through the establishment of the European Union is a significant factor in the deepening of the crisis. Strong linkages between banks have made the transmission mechanism of shocks easier, exacerbating the impact of the crisis. (Acharya et al. 2018)

Acharya et al. (2018) asserts the escalation of indebtedness, particularly in the periphery countries, emerged as a primary catalyst for the initial stages of the sovereign debt crisis. Given the Eurozone's historical challenges with both public and firm debt, the system's fragility must be carefully weighed when implementing fiscal or monetary policies. (Acharya et al. 2018) The COVID-19 pandemic further exacerbated this issue, leading to increased government spending and consequently higher levels of public debt. As a result, the debt overhang theory has garnered increased attention in recent times. Since the analysis bases its econometric model on the consideration of both private and public debt, a more detailed explanation of the impact of debt overhang is required.

Kalemli-Özcan et al. (2019) contributes to the literature on the debt overhang effect hypothesis by incorporating an analysis of the rollover effect. It primarily focuses on the financial factors contributing to the deteriorating performance of private investment across the Euro area.

The study of Kalemli-Özcan et al. (2019) employs a firm-level analysis, examining the balance sheets of banks and firms to assess the fragility of the financial system and the response of both the banking sector and firms in the post-crisis period. The results support the debt overhang hypothesis and emphasize the rollover effect. The significance of the impact of both changes depends on the fragility of banks, mainly due to their liabilities and exposure to sovereign risk.

Kalemli-Özcan et al. (2019) notes a decrease in private investment levels across Europe in the aftermath of the global financial crisis. As a result of the economic downturn, debt metrics surged across Europe. The study aims to measure the impact of this high borrowing on private investment, a phenomenon referred to in the literature as the debt overhang effect.

The primary contribution of the study is the analysis of the impact of debt maturity on the debt overhang effect. The study suggests that borrowing during or after the crisis with short-term maturity, defined as a payment period of less than one year, significantly accentuates the rollover effect.

During economic slowdowns, agents are inclined to restructure their debts, while lenders tend to constrain their resources, making it challenging to renew these short-term debts. (Kalemli-Özcan et al 2019)

Kalemli-Özcan et al. (2019) underscores the significance of banks' balance sheets as a crucial indicator of their fragility. During the crisis, banks with greater exposure to sovereign bond debt experienced severe financial constraints, leading to deteriorating credit conditions.

Firms that had relationships with these banks encountered more difficulties in borrowing or restructuring their debts. This was particularly challenging for smaller firms, which appear to be more dependent on borrowing from banks due to their limited internal resources for financing. (Kalemli-Özcan et al 2019)

The findings of Kalemli-Özcan et al. (2019) support the validity of the debt overhang effect hypothesis for the Euro area. Firms with high leverage in the pre-crisis period and high debt service in the short term experience greater financial distress and reduce their investments, particularly if they have a relationship with banks that have high exposure to sovereign risk.

The deteriorating lending conditions, stemming from increased default risk for both firms and banks, are exacerbated by shorter debt maturity, reinforcing the debt overhang effect and thus negatively impacting private investments. (Kalemli-Özcan et al 2019)

As previously noted by Vanlaer et al. (2021) public debt exerts a debt overhang effect on private investment. Consequently, Checherita and Rother's (2010) study delves into the threshold levels of public debt that may adversely affect other economic variables.

Checherita and Rother (2010) aim to elucidate the relationship between government debt and economic growth, utilizing a panel of twelve Euro area countries over a forty-year period starting from 1970. The analysis reveals the existence of a threshold for the government debt-to-GDP ratio, estimated to be around 90%, beyond which government debt has a detrimental impact on GDP per capita.

The primary estimation model of Checherita and Rother (2010) treats GDP per capita as the dependent variable, with explanatory variables including the population growth rate, initial level of income per capita, public investment-to-GDP ratio, and government debt. Various estimations are employed for robustness checks.

The analysis indicates that while the threshold for government debt to have a negative impact on GDP growth is 90%, its negative impact on private and public investments has a lower threshold. Moreover, government deficits and changes in the debt ratio are both negatively associated with GDP growth and long-term interest rates, suggesting that government debt has negative effects even before reaching the threshold. (Checherita and Rother 2010)

The most significant channel through which government debt affects GDP growth is the interest rate channel. When government spending is predominantly financed through the credit channel, an increase in government debt leads to a contraction in the financial resource pool, resulting in higher long-term interest rates. As a consequence, private investment is crowded out by government debt, which has a detrimental effect on output growth. (Checherita and Rother 2010)

Reinhart and Rogoff (2010) examine the relationship between the growth rate, public debt, and inflation. The findings, as in the work of Checherita and Rother's (2010), suggest that there exists a critical threshold, approximately at 90% of GDP, beyond which public debt has a detrimental effect on the growth rate.

The notable observation of Reinhart and Rogoff (2010) is that while the effect of public debt on GDP growth appears consistent across both advanced and emerging countries, the dynamic differs concerning the correlation between inflation and public debt. In emerging countries, their movements are parallel, largely due to fiscal dominance as a policy measure. However, within the advanced countries group, no such specific relationship exists between inflation and public debt.

The discussion presented in the study regarding the post-crisis reactions of both private and public debt aligns with existing literature. The results indicate that following a crisis, public debt tends to increase while private debt tends to decrease, primarily due to deleveraging efforts. The study also emphasizes the significance of maturity structure. Consistent with the literature, shorter maturities for loans expose both the financial sector and corporate entities to greater vulnerability to financial shocks. (Reinhart and Rogoff 2010)

As this investigation centers on the determinants of private investment and the influence of the long-term interest rate on it, it is logical to emphasize the impact of uncertainty on the economy.

Private investment is often the primary component of the economy to undergo cutbacks in the midst of a crisis or an impending recession. The study of Bussiere et al. (2015) aims to evaluate the factors contributing to this phenomenon, commonly referred to as an "investment slump." The principal causes of this decline in investment typically include subdued aggregate demand, limitations in credit supply, and heightened uncertainty. Given that the policies addressing these issues vary, it is imperative to scrutinize them explicitly.

Bussiere et al. (2015) asserts that uncertainty plays a pivotal role in shaping the expectations and behaviors of economic actors. An intriguing illustration of the significance of expectation management lies in the aftermath of the crisis, where erroneously calculated GDP forecasts led to a surge in investments. The study of Bussiere et al. (2015) suggests that had the calculations been accurate, private investment levels would have been 12 percentage points lower than the recorded figures.

According to Bussiere et al. (2015), uncertainty regarding future developments often prompts investors to delay their investment decisions. The volatility in financial markets, prevailing liquidity conditions, and the policy directives of regulatory authorities all exert significant influences over investment returns and the cash requirements of firms. Highly leveraged firms reliant on bank financing may opt to reduce their debt burdens rather than pursue new investments, while more autonomous and potentially financially robust firms may postpone investment decisions due to uncertainties surrounding internal rate of return calculations. The restructuring of monetary policy authorities and the adoption of the euro have introduced considerable changes to the financial system. Consequently, liquidity issues and uncertainties have had a more pronounced impact on these entities. (Bussiere et al. 2015)

Another noteworthy finding of Bussiere et al. (2015) reveals that the growth rate of private investment has been considerably sluggish compared to the pre-crisis period, with no significant rebound observed after the crisis.

Bussiere et al. (2015) presents three theories regarding fixed investment. The first theory is Chenery and Koyck's accelerator model, which posits that the desired changes in capital depend on changes in output levels. Accordingly, the actual level of capital is contingent upon the desired levels of capital.

The second theory is the neoclassical model, which elucidates investment determination based on its dependency on the marginal product of capital and the marginal cost of production. In this model, technological advancements and labor contribute to the first aspect, while the sensitivity of the cost of capital to financial market changes, such as upward pressure on interest rates, may lead to decreased profit levels. (Bussiere et al.2015)

The third theory, proposed by Tobin, suggests that since the marginal product of capital is not directly observable, the stock-market value of the firm serves as a crucial indicator for assessing the marginal benefits of investment. According to Tobin, if the market value of capital exceeds its replacement cost, then investment is deemed profitable. (Bussiere et al.2015)

Segal et al. (2015) elucidate the impact of uncertainty on macroeconomic variables, including aggregate output, demand, growth, investment decisions, employment levels and asset prices. Segal et al. (2015) categorizes uncertainty into two groups, termed "good uncertainty" and "bad uncertainty." Good uncertainty denotes positive shocks to the economy, such as technological advancements, while bad uncertainty represents negative shocks, such as real estate bubbles or, as exemplified in recent times, the COVID-19 pandemic.

Segal et al. (2015) utilizes the semivariances of industrial production growth as proxies for both types of uncertainty. As a result, the initial market reaction to uncertainty, whether categorized as good or bad, is a decrease in prices and risk-free rates. In cases where a positive correlation exists between future growth prospects and good uncertainty, prices are expected to rise subsequently. Conversely, for bad uncertainty, the situation is reversed. If the relationship between future growth expectations and bad uncertainty is negative, prices are likely to continue falling. (Segal et al.2015)

When considering the aggregate impact of both types of uncertainties, it is observed that the impact of bad uncertainty is stronger than that of good uncertainty. (Segal et al.2015)

Segal et al. (2015) presents that regarding the market price of good uncertainty risk, both equity beta and risk premium exhibit a positive reaction to good uncertainty. Therefore, even in the absence of further price reductions and instead witnessing an increase, good uncertainty has a positive impact on the risk premium as bad uncertainty. This is the only common feature of them.

Segal's et al. (2015) primary finding underscores that total uncertainty, which is not disaggregated into the categories of good or bad, exerts a negative impact on aggregate macroeconomic variables. However, this impact is expected to be weaker than that of the explicitly identified bad uncertainty.

As previously discussed, the responses to each type of uncertainty are opposite, with bad uncertainty demonstrating a stronger and more persistent impact. Therefore, when uncertainty cannot be distinctly classified, its impact is presumed to represent an amalgamation of both types, resulting in a muted version of the impact of bad uncertainty. Consequently, total uncertainty has the potential to lead to misinterpretations and exacerbate economic conditions if it is not adequately defined and understood. (Segal et al.2015)

To comprehend the potential complementary effects of foreign direct investment on private investment levels, it is beneficial to understand its impact on both its home and host countries.

Lipsey (2002) seeks to provide a clearer perspective on the effects of foreign direct investments (FDI) on both home and host countries. According to the findings, foreign-owned firms consistently offer higher wage levels than domestic firms in the host country, thereby contributing to an overall increase in wages within the country.

As Lipsey (2002) asserts the productivity level of foreign firms is higher when compared to domestic firms. However, the spillover effect of this higher productivity varies depending on the development level of the country.

According to Lipsey (2002), the most significant contributions of foreign direct investments (FDI) to the host country include improvements in export levels and the transfer of knowledge regarding world markets. When a host country heavily relies on exporting raw materials, FDI can facilitate a shift towards exporting manufactured goods or even high-tech products.

Regarding the effects on the home country, there are arguments suggesting that foreign direct investments (FDI) lead to a decrease in wage levels and employment levels. (Lipsey 2002)

As Lipsey (2002) explains foreign-owned firms have the ability to transfer their capital and workforce to the host country, which is a primary concern regarding their potentially depressing effects on their home countries. However, this process does not necessarily lead to a decrease in unemployment levels in their home country. Physical investments in the host country can be financed through the accumulated profits of the firms, without affecting their current operations in the home country. Nevertheless, the most significant transfer and investment by foreign-owned firms is the transfer of know-how. (Lipsey 2002)

As Lipsey (2002) presents, in the context of multinational firms, there can be a reallocation of resources, including labor, between the parent and affiliate firms. Many multinational corporations invest in foreign countries to capitalize on lower production costs and leverage their comparative advantages. As a result, affiliates often serve as the labor-intensive component, while the parent company assumes a more skill-intensive supervisory role to sustain the production process. (Lipsey 2002)

Arslanalp and Poghosyan (2014) investigate foreign investor flows to Eurozone countries, emphasizing that the investor base is an important yet not very transparent factor regarding its impact on sovereign bond yields.

As Arslanalp and Poghosyan (2014) express, after the global financial crisis, the euro area witnessed a divergence in long-term bond yields among its member countries. Expectations regarding the future prospects of each country began to vary. Periphery countries, which had already faced challenges with public debts and financial stability, experienced a sovereign debt crisis, further reinforcing their negative reputation. Consequently, expectations are shaped by the current situation and the credibility of each country's authorities, leading to varying bond yields and influencing investment decisions, aggregate output, unemployment levels, and growth rates.

The study of Arslanalp and Poghosyan (2014) suggests that the foreign investor base plays a crucial role in driving changes in sovereign bond yields. For instance, an increasing share of foreign ownership of government debt is associated with a decrease in long-term bond yields.

A decrease in the foreign investor base in the securities market results in an increase in long-term bond yields, and conversely, the opposite is also true. One of the most famous examples of this phenomenon is the situation in the United States in 2004. (Arslanalp and Poghosyan 2014)

As Arslanalp and Poghosyan (2014) express despite the Federal Reserve implementing a contractionary monetary policy, long-term bond yields continued to decrease. This was due to a shift in the foreign investor base of the United States. The demand from foreigners for U.S. bonds led to an increase in bond prices, thereby suppressing long-term bond yields.

The findings of Arslanalp and Poghosyan (2014) indicate that policy stance is a significant factor, along with several others. Long-term bond yields are primarily influenced by expectations, where expected values hold more significance than actual ones. Inflation emerges as one of the most significant variables affecting sovereign bonds, showing a positive correlation with yields.

The findings of Arslanalp and Poghosyan (2014) also indicates that the debt-to-GDP ratio is positively linked to sovereign bond yields, as higher debt levels increase risk. Expected growth rate exhibits a negative relationship with long-term bond yields. Furthermore, domestic official debt purchases, such as quantitative easing programs by the European Central Bank, lead to a decrease in long-term bond yields. Finally, uncertainty is identified as another determinant of sovereign bond yields, showing a negative relationship with yields. (Arslanalp and Poghosyan 2014)

Given the study examines the potential debt overhang effect of both household and firm debt on private investment levels, it is important to understand the relationship between household debt and firm debt.

Bricongne and Mordonu (2015) investigate the relationship between household debt deleveraging and non-financial corporations' debt leveraging, utilizing a panel of OECD countries for analysis. The results indicate a mutual and positive relationship between the two. When agents in the economy base their expectations on ongoing uncertainty or potential crisis outcomes, the resulting impact leads to deleveraging for both households and non-financial corporations. Due to financial constraints, corporations delay their investment decisions and begin deleveraging their debts. Consequently, cost-cutting measures, including reducing cash holdings, are implemented. The most expedient way to reduce costs is through decreased employment, which affects households through the income channel, leading to further deleveraging. This, in turn, reduces corporations' revenues, prompting them to engage in additional deleveraging. Thus, a vicious cycle ensues. (Bricongne and Mordonu 2015)

Ehnts and Paetz (2021) conducted a study during the COVID-19 crisis, discussing the situation of Euro Area countries prior to the pandemic. The study of Ehnts and Paetz (2021) emphasizes the importance of cooperation between fiscal and monetary policies by comparing the actions taken by the Euro Area with those of the United States.

Throughout the paper of Ehnts and Paetz (2021), the Euro area has been criticized for its fiscal consolidation policies and perceived lack of courageous and sufficient measures. This criticism is substantiated by the data on real GDP and private investment. Compared to the United States, which was at the epicenter of the global financial crisis, the Euro area's recovery has been slow and divergent among member countries.

According to the study of Ehnts and Paetz (2021), United States responded quickly by implementing broader and longer-lasting expansionary fiscal policies, whereas the Euro area was more conservative, with shorter-lasting expansionary fiscal policies and a quicker return to fiscal consolidation. Despite this, the United States continues to support its economy with expansionary fiscal policies.

As a result of these policy differences, while the United States was able to avoid the zero lower bound, the Euro area had to reduce its interest rates to negative values, a policy that persisted until the pandemic. (Ehnts and Paetz 2021)

As a consequence of the measures taken, as Ehnts and Paetz (2021) shows that the Euro area has experienced lower growth, high unemployment in periphery countries, and higher debt ratios. The most significant impact of these crises has been the increase in the debt ratios of both corporations and households, resulting from a decrease in cash flow caused by the economic slowdown. This leads to a deleveraging process, characterized by reduced private investment by corporations and decreased consumption by households. (Ehnts and Paetz 2021)

The study of Ehnts and Paetz (2021) highlights the crucial role of fiscal policies in the Euro Area, particularly during crisis periods, due to the limited effectiveness of the interest rate channel. This limitation arises from the changes in the transmission mechanism caused by the heterogeneity between countries. (Ehnts and Paetz 2021)

Demmou et al. (2021) indicates the importance of fiscal policies over the economy through a firm-level analysis, that aims to determine the proportion of firms that would encounter liquidity constraints or potentially default in the absence of any policy interventions during the COVID-19 crisis. The findings of Demmou et al. (2021) reveal that 38% of firms are projected to experience severe liquidity constraints within ten months since the onset of the crisis.

According to the study, government support for wage bills is deemed the most crucial policy tool, surpassing tax deferrals and debt moratoriums, in addressing the economic challenges posed by the COVID-19 crisis. (Demmou et al. 2021)

As the studies in the literature review indicate, both fiscal and monetary measures can significantly impact private investment decisions through the interest rate channel. Given the single monetary policy and various fiscal authority decisions, it is essential to examine how the transmission mechanism operates and what influences its magnitude, particularly in relation to one of the main components of economic growth: private investments.

DATA DESCRIPTION

Private investment stands as a pivotal driver of future economic growth within countries. It represents a crucial contribution from the private sector, encompassing firms, households, and non-governmental entities. This form of investment can manifest in various ways, including the augmentation of physical capital such as buildings, infrastructure, machinery, and equipment, as well as through technological advancements.

In this study, private investment will serve as the dependent variable for the estimation. The data representing private investment will be derived from the gross fixed capital formation of the private sector.

For the econometric model equation, the independent variables include public debt, public investment, non-financial firm debt, household debt, foreign direct investment, real gross domestic product (GDP) growth, and, of particular interest, the real long-term bond yield.

Public debt, non-financial firm debt, and household debt may significantly impact private investment due to the debt overhang hypothesis.

Public debt refers to the total outstanding borrowing by a government, typically incurred through issuing government bonds and other securities or through direct loans. It is used to finance government expenditures when revenues are insufficient. Public debt can have a significant impact on private investment. For instance, if public debt levels are perceived to be unsustainable or if there is a decrease in available funding, it can lead to a reduction in private investment. This is because high levels of public debt can be associated with higher interest rates, crowding out private sector borrowing, and reducing investor confidence. The public debt variable is defined in the model as the government's consolidated gross debt.

Non-financial firm debt encompasses the liabilities of enterprises not engaged primarily in financial activities, such as banking or insurance. Levels of indebtedness serve as a crucial gauge of economic health, as indicated in literature suggesting that private sector borrowing stagnation may stem from deleveraging motives, leading to reduced private investment. The dataset employed to analyze the influence of non-financial firm debt encompasses all available borrowing instruments.

Household debt is intricately linked with other private sector agents, serving as a key customer base and labor force within the economy. This creates a robust interplay between these variables.

Economic growth and private investments directly affect households through wages, employment levels, inflation, and the credit sector. Therefore, studying the impact of household debt on private investment can yield valuable insights. In this study, household debt includes both household debt and the debt of non-profit institutions serving households. The dataset used to analyze the influence of household debt includes all available borrowing instruments.

Considering the data period used for the estimation, the impact of these variables may be more pronounced, as the Eurozone experienced the Global Financial Crisis, the European Sovereign Debt Crisis and COVID-19 Crisis during this time.

Foreign direct investment (FDI) is a strategic investment made by foreign corporations in businesses located in different countries. These investments are typically aimed at expanding market presence, reducing costs, and leveraging advantages such as access to cheap labor or unique geographical features. FDI plays a pivotal role in economic growth by increasing capital flow, introducing new production techniques, generating employment opportunities, and enhancing the overall perception and expectations of the country among investors. FDI is measured by the stock of liabilities in the direct investment account.

Public investment is a critical element of economic growth, providing essential support for both private enterprises and households. Government investments typically target infrastructure, education, transportation, and healthcare, among other sectors. These investments are instrumental in fostering the development of the private sector, enhancing human capital, and improving the overall well-being of households. Public investment has been measured as the gross fixed capital formation of the government sector.

Private investment, public debt, public investment, non-financial firm debt, and household debt, and foreign direct investments are normalized as percentages of GDP to account for variations in the welfare levels of countries.

Real GDP growth is another key explanatory variable in the estimation. It is utilized to observe the impact of the overall health of the economy on private investment levels, leveraging its previous levels.

After completing the econometric model and observing the magnitude and significance of the impacts, interaction variables were created and added to the baseline models accordingly. These interaction variables will elucidate the relationships wherein various explanatory variables induce a change in the fundamental impact of the respective variables on the dependent variable.

The first set of interaction variables was created by interacting the long-term bond yield variable with the existing explanatory variables in the model. Consequently, the long-term bond yield variable was interacted with public debt, public investment, non-financial firm debt, household debt, real GDP growth, and foreign direct investment.

The second set of interaction variables aims to capture changes in the magnitude and significance of the impact of long-term bond yield on private investment through indicators that reflect the current economic conditions and future expectations.

In this regard, the bond yield variable has been interacted with the previous period's inflation to reflect the current economic situation. With this inflation interaction, the study aims to examine the influence of the relationship between the bond yield and inflation on private investment levels.

The Volatility Index, abbreviated as the VIX indicator, represents prevailing market uncertainty. This index measures the option price fluctuations of companies included in the S&P 500 Index (SPX). As the frequency and magnitude of these price swings increase, indicating dramatic movements within a short time frame, market volatility heightens. The VIX reflects market expectations for the following 30 days. An increase in the VIX indicator signifies rising uncertainty.

VSTOXX is a closely analogous indicator to the VIX, measuring local market expectations for the subsequent 30 days. It is derived from the option index prices of the EURO STOXX 50 index, which is specific to Eurozone countries.

GDP forecast, generated by the IMF, is another measure utilized in this study.

For the assessment of future expectations, the VIX indicator, VSTOXX indicator and GDP forecast are used for the interaction variables. All of these variables are crucial for assessing the impact of expectations on private investment decisions through the long-term interest rate channel.

To assess the impact of United States monetary policy on the spread of bond yield effect on private investment, an interaction variable with the FED funds rate has been created. This interaction variable indicates the relationship between the monetary policies of United States and Eurozone through the long-term interest rate channel.

Another interaction variable has been created to investigate the impact of unrealized expectations of growth on private investment through the long-term interest rate channel. This interaction variable is constructed as the product of the long-term interest rate and the difference between the real GDP growth and the GDP forecast for a given year. It aims to capture the effect of deviations between actual economic performance and forecasted growth on the impact of long-term interest rates on private investment.

The term "GIIPS" is the acronym consisting of Portugal, Ireland, Italy, Greece, and Spain, all of which were particularly affected by the global financial crisis and the European sovereign debt crisis, resulted as high unemployment rates, slow economic growth, high public debt because of their fragile financial systems, weak fiscal governance, and significant sovereign debt exposure during the particular periods.

A dummy variable representing GIIPS countries and its interaction with the real long-term bond yield have been created to investigate the impact of long-term interest rates on private investments in these countries.

With respect to the threshold theories regarding public debt which asserts that the public debt over 90% GDP has a detrimental effect on the economic growth, the study investigates the magnitude of the real long-term bond yield impact on private investments for countries with public debt ratios exceeding the threshold values.

Finally, for the crisis periods, a crisis dummy variable has been created, and its interaction with the real long-term bond yields has been analyzed to observe the impact of these years on private investment through real long-term bond yields.

The descriptive statistics are presented in Table 1 and the correlation results between variables are presented in Table 2.

Table 1

Variable	Unit	No. Obs.	Mean	Std. Dev.	Min.	Max.
Private Investment		380	18,15	4,31	6,9	52
Public Debt		380	69,31	39,01	3,8	207
Public Investment		380	3,59	1,05	1,5	6,4
Household Debt		371	61,29	27,65	10,05	150,87
Firm Debt		371	159,05	72,93	51,49	408,56
FDI		371	15,54	110,02	-830,1	1106,8
Bond Yield (LT)		302	0,99	3,37	-10,42	22,97
Real GDP Growth		380	2,11	4,28	-14,8	24,5
Inflation Rate		380	2,34	2,73	-1,7	19,4
VIX Indicator		380	19,25	6,36	11,09	32,69
VSTOXX Indicator		380	22,33	6,13	14,04	33,72
GDP Forecast		380	2,46	1,93	-4	9
FED Funds Rate		380	1,31	1,54	0,078	5,026

Table 2

correlation	private investment	public debt	public investment	firm debt	household debt	fdi	bond yield (lt)	real gdp growth
private investment	1							
public debt	-0,4022	1						
public investment	-0,1198	-0,3683	1					
firm debt	0,1619	-0,2128	-0,1170	1				
household debt	-0,1965	0,1053	-0,0526	0,4729	1			
fdi	-0,0113	-0,0509	-0,0397	0,1655	0,1296	1		
bond yield (lt)	-0,3985	0,3539	-0,0225	-0,0216	0,2469	0,1075	1	
real gdp growth	0,4133	-0,2784	-0,0749	0,1407	-0,1614	0,0382	-0,3605	1

METHODOLOGY

To examine the influence of interest rates on private investment levels, this analysis employs a model based on a comprehensive study encompassing twenty Euro Area countries: Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia, and Finland, covering the period from 2004 to 2022.

The notation i represents the country, while t represents the time period.

Equation 1

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * X_{it-1}) + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

Private investment, as explained in the previous section, is measured as the gross fixed capital formation of the private sector as a percentage of GDP. X is a vector of explanatory variables which are the public debt, household debt, firm debt, public investment, foreign direct investment, real GDP growth. Public debt is defined as the gross consolidated debt of the government to GDP ratio. Household debt and firm debt are also considered as a percentage of GDP to facilitate healthier comparisons. Public investment is measured as the gross fixed capital formation of the government as a percentage of GDP. Foreign direct investment (FDI) is calculated as the capital inflows to GDP ratio. Real GDP growth is already expressed as a percentage change. Lastly, our variable of interest, the long-term government bond yield, referred to as the bond yield, is considered in its real value rather than its nominal value. The interaction variable is constructed by multiplying the lagged long-term interest rate variable with the lagged explanatory variables, and it is included in the subsequent regressions. ε_{it} is the observation specific error and v_t represents the year fixed effects which has a year-specific impact due to particular occurrences in those specific years and μ_i represents the country fixed effects which has a country-specific impact due to particular occurrences in those specific countries, affecting all the countries in the sample uniformly.

In addressing the potential presence of a time trend, the unit root test proposed by Pesaran (2007) has been applied to each variable under consideration. Prior to estimation, each variable, along with its respective version, was either inherently stationary or rendered stationary through the application of a differencing method.

Given the study's heavy reliance on macroeconomic variables, there is a potential for endogeneity, simultaneous bias, and reverse causality between the variables.

First and foremost, it is essential to explain how the model is constructed. The completion of private investments takes time. Consequently, by the time these investments are realized, the macroeconomic environment both domestically and globally may have changed.

Intuitively, it can be said that private investments realized today are the result of decisions made based on economic conditions at least a year prior. Therefore, both the previous year's economic conditions and future expectations are important considerations. That's why the dependent variable—private investment—indicates the current value for the specific year, while all the explanatory variables reflect the conditions of the previous year. Technically, the dependent variable is measured at time t , while all explanatory variables are considered as their lagged values.

Private investment is a persistent value for several reasons. The time between the planning and execution of projects can be long, and if the costs are high, firms may prefer a gradual adjustment. Additionally, expectations play a crucial role in investment decisions, as they significantly impact consumer supply and demand as well as the financial aspects of the economy.

To address the persistence of private investment, its lagged value should be included in the estimation as an explanatory variable. However, introducing the lagged value of a dependent variable as an independent variable can lead to dynamic panel bias. This bias arises from the correlation between the error terms and the requirement that the error terms be uncorrelated with the other explanatory variables.

Simultaneous determination bias and reverse causality present significant challenges in the estimation of the impacts under analysis. These issues arise when variables are interrelated due to potential endogeneity, or when, despite the intuitive expectation of a one-way causality, the results suggest otherwise, possibly indicating bidirectional causality.

In such cases, the Generalized Method of Moments (GMM) estimator emerges as an efficient tool for addressing these complexities. It uses an instrumental variable approach to examine the effects of explanatory variables on the dependent variable.

To address the potential endogeneity, simultaneous bias, reverse causality and the dynamic panel bias possibility in the study, the Generalized Method of Moments (GMM) estimator method, as improved by Arellano and Bond is used. In the first step of the regression, the estimator eliminates the fixed effects by applying a first-difference transformation. Then the estimator applies the standard procedure of GMM and exploits instrumental variable approach to determine the effects. To mitigate the risk of overfitting, the study employs a collapsed set of instruments. (Arellano and Bond 1991)

For the subsequent analysis, the enhanced version of the GMM estimator is employed, as the Arellano and Bond GMM estimator model may be susceptible to weak instrument bias. The system GMM estimator is preferred to mitigate this bias and to more precisely estimate the impact of the variables by utilizing the additional moment conditions method. (Blundell and Bond 2000)

To assess the impact of real long-term interest rates under different circumstances, interaction variables have been added to the baseline estimation. These interacted variables will allow us to observe how real long-term interest rates respond to these interaction variables.



EMPIRICAL RESULTS

This section begins with an analysis of the empirical findings of Equation 1.

The results of the econometric model align with the prevailing literature concerning the components of private investment and the debt overhang hypothesis, particularly from the perspectives of public and household debt.

Table 3 indicates that private investment made in the previous year has a significant impact on current private investment levels. Specifically, the findings of the estimation of Equation 1 in Table 3 indicate that a one percentage point increase in private investment in the previous period leads to a 0.314 percentage point increase in current private investment levels. Therefore, private investment exhibits a high level of persistence. It can represent a long-term commitment extending beyond a one-year period, or it may act as a catalyst for further investment, thereby demonstrating a complementary effect.

As previously mentioned, the results of the estimation of Equation 1 support the debt overhang hypothesis across various types of debt. According to the findings of the estimation of Equation 1 in Table 3, a one percentage point increase in public debt leads to a 0.04 percentage point decrease in private investment levels. Evidently, an escalation in public debt has a crowding-out effect on private investment. This observation aligns with the debt overhang hypothesis, which underpins the analysis of this variable. The hypothesis posits that as government debt increases, the availability of financial resources diminishes, leading to heightened uncertainty regarding debt sustainability. This, in turn, limits the resources accessible to other economic agents, potentially impeding private investment.

Similarly, as indicated in Table 3, a one percentage point increase in household debt results in a 0.046 percentage point decrease in private investment levels. Households play a pivotal role in the economy through their consumption patterns. The findings of the estimation of Equation 1 indicate that an increase in household debt leads to a crowding-out effect on private investment. As household debt levels rise, there is a reduction in the capacity for savings and consumption. The escalation in debt often triggers a deleveraging process among households, prompting them to reduce consumption. This reduction in consumption diminishes the demand for goods and services in the market, creating a negative cycle.

Consequently, firms experience a decline in profits, leading to cost-cutting measures, such as workforce reductions. This cycle perpetuates as rising unemployment further decreases household income, thereby reducing consumption even more. With the private sector grappling with reduced demand and profitability, the financial capacity for private investment becomes constrained.

Conversely, as indicated in Table 3, a one percentage point increase in firm debt causes a 0.033 percentage point increase in private investment levels. The findings of the estimation of Equation 1 in Table 3 suggest a crowd-in effect of firm debt on private investment. An increase in the previous year's firm debt is associated with higher levels of private investment in the current year. This implies that a significant portion of private investment is financed through debt rather than equity. Therefore, firm debt, in its various forms, appears to be primarily utilized for funding private investment activities.

The results of the estimation of Equation 1 in Table 3 also indicate a positive relationship between real GDP growth in the previous period and private investment. Specifically, as presented in Table 3, a one percentage point increase in real GDP growth in the previous period leads to a 0.17 percentage point increase in current private investment levels. Real GDP growth serves as a critical indicator of economic health, providing insights into future economic prospects. An increase in real GDP growth fosters positive expectations regarding future growth forecasts. Given that private investments, being in the planning phase, are influenced by future profit expectations, the role of expectations is pivotal in decision-making. Consequently, an increase in the previous year's real GDP growth contributes to positive expectations regarding future growth rates. This, in turn, leads to an increase in private investment levels in the subsequent year.

Lastly, the variable of interest, the real long-term interest rate (bond yield), exhibits a negative relationship with private investment levels, as anticipated. The results of the estimation of Equation 1 in Table 3 indicate that a 1 percentage point increase in real long-term bond yield leads to a 0.145 percentage point decrease in private investment levels. The monetary policy in the Eurozone is uniform across countries. To assess its effects on private investments accurately, this study employs the real long-term interest rate.

The real rates vary among countries due to their individual economic cycles, and the long-term interest rates reflect future expectations concerning price stability. As long-term interest rates rise, they signal heightened inflationary expectations and the potential use of tightening monetary policies. The increase in long-term interest rates signifies a tightening of credit conditions and negative expectations for the future, leading to a decrease in private investment levels.

According to the findings of the estimation of Equation 1 indicated in Table 3, public investment exhibits a negative, albeit statistically insignificant effect on private investment levels.

Foreign investments are a pivotal element of an economy, making substantial contributions to cash flows, technological advancement, employment expansion, and the welfare of households. Moreover, they play a key role in enhancing the international image of the respective country. In this context, foreign investments could have either a complementary or opposing impact on private investment. However, the findings of the estimation of Equation 1 in Table 3 indicate that the influence of foreign investments is exceptionally marginal and statistically insignificant.

As a robustness check, in addition to the System GMM Estimator mentioned earlier, the Arellano-Bond GMM estimator method has been employed. The findings of the estimation of Equation 1 in Table 4 closely align with those of the System GMM Estimator in Table 3, both in terms of magnitude and statistical significance levels.

The dependent variable is “Private Investment at year t”.

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 3

Table 3: Regression Results for the Eurozone Countries without Interaction Variables

System GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,314***	(0,050)
Public Debt _{t-1}	-0,040***	(0,010)
Public Investment _{t-1}	-0,022	(0,247)
Firm Debt _{t-1}	0,033***	(0,004)
Household Debt _{t-1}	-0,046***	(0,014)
Bond Yield (LT) _{t-1}	-0,145**	(0,062)
Real GDP Growth _{t-1}	0,170***	(0,036)
Foreign Direct Investment _{t-1}	-0,000	(0,001)

Table 4

Table 4: Regression Results for the Eurozone Countries without Interaction

Variables		
Arellano-Bond GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,329***	(0,064)
Public Debt _{t-1}	-0,040***	(0,011)
Public Investment _{t-1}	-0,169	(0,268)
Firm Debt _{t-1}	0,029***	(0,007)
Household Debt _{t-1}	-0,071***	(0,017)
Bond Yield (LT) _{t-1}	-0,130**	(0,067)
Real GDP Growth _{t-1}	0,105*	(0,040)
Foreign Direct Investment _{t-1}	0,000	(0,001)

In this phase of the analysis, the study seeks to examine the influence of explanatory variables included in the econometric model on the relationship between long-term interest rates and private investment levels. To achieve this, interaction variables combining the long-term interest rate with the selected explanatory variables are introduced into the estimation process.

Equation 2

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2(\text{Bond Yield}_{it-1} * \text{Public Debt}_{it-1}) + \beta_x X_{it-1} +$$

$$\mu_i + v_t + \varepsilon_{it}$$

The initial interaction variable was constructed with public debt. The outcomes of the estimation of Equation 2 in Table 5 closely align with the econometric model results. According to the findings of the estimation of Equation 2 in Table 5, a one-percentage-point rise in private investment levels from previous periods corresponds to a 0.32 percentage point increase in current investment levels. A one-percentage-point increase in firm debt leads to a 0.032 percentage point increase, while the same increase in household debt results in a 0.046 percentage point decrease in private investment levels.

Consistent with previous observations, the results of the estimation of Equation 2 in Table 5 indicate that the real GDP growth exhibits a robust positive relationship with private investment. A one-percentage-point increase in real GDP growth is associated with a 0.174 percentage point increase in private investment levels. Conversely, foreign direct investment and public investment show no significant impact on private investment.

However, it is noteworthy that the findings of the estimation of Equation 2 in Table 5 indicate that neither the interaction variable nor the bond yield variable is statistically significant. Therefore, public debt does not create any change over the magnitude of the impact of bond yield on private investment levels.

Equation 3

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2(\text{Bond Yield}_{it-1} * \text{Public Investment}_{it-1}) + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

The second interaction variable has been constructed with public investment, yielding results of the estimation of Equation 3 in Table 5 align with the econometric model. The findings of the estimation of Equation 3 in Table 5 indicate that a one-percentage-point increase in the previous year's private investment levels leads to a 0.302 percentage point increase in current private investment levels.

Additionally, consistent with the debt overhang hypothesis, public debt and household debt exhibit negative relationships with private investment levels. Specifically, the results of the estimation of Equation 3 in Table 5 indicate a one-percentage-point increase in public debt corresponds to a 0.041 percentage point decrease in private investment levels, while a one-percentage-point increase in household debt results in a 0.053 percentage point decrease in private investment levels.

Conversely, firm debt shows a positive relationship with private investment levels. As presented in Table 5, a one-percentage-point increase in firm debt is associated with a 0.034 percent increase in private investment levels. Moreover, real GDP growth demonstrates a positive impact on private investment, with a one-percentage-point increase in real GDP growth leading to a 0.162 percentage increase in the findings of the estimation of Equation 3 of Table 5.

However, as findings of the estimation of Equation 3 in Table 5 indicate that, consistently with prior observations, the interaction variable lacks statistical significance. Consequently, public investment does not create a change in the magnitude of bond yield's impact as well.

Equation 4

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2(\text{Bond Yield}_{it-1} * \text{Firm Debt}_{it-1}) + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

The third interaction variable has been formulated with firm debt, yielding results of the estimation of Equation 4 in Table 5 closely resemble those of the econometric model. Previous year's private investment levels exhibit strong persistence, with a one-percentage-point increase in these levels corresponding to a 0.307 percentage point increase in current private investment levels.

Consistent with the debt overhang hypothesis, public debt, household debt, and firm debt continue to demonstrate their respective impacts on private investment levels. Specifically, as indicated in Table 5 a one-percentage-point increase in public debt leads to a 0.041 percentage point decline in private investment levels, while the same increase in household debt results in a 0.043 percentage point decrease in private investments.

Conversely, the findings of the estimation of Equation 4 in Table 5 indicates a one-percentage-point increase in firm debt levels is associated with a 0.034 percentage point increase in private investment levels.

Moreover, real GDP growth exhibits a positive relationship with private investment, as presented in Table 5, a one-percentage-point increase in real GDP growth corresponds to a 0.166 percentage point increase in private investment levels. However, both public investment and foreign direct investment continue to show no significant relationship with private investment.

According to the findings of the estimation of Equation 4 in Table 5, the interaction variable lacks statistical significance. So it does not have any impact over the magnitude of bond yield's impact.

Equation 5

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2(\text{Bond Yield}_{it-1} * \text{Household Debt}_{it-1}) + \beta_3 X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

Another interaction variable has been introduced, this time involving household debt. The outcomes of the estimation of Equation 5 in Table 5 closely mirror those of the econometric model. As presented in Table 5, a one-percentage-point increase in previous years' private investment levels results in a 0.312 percentage point increase in current investment levels.

Consistent with previous findings, public debt, household debt, and firm debt continue to exhibit their respective impacts on private investment levels. Specifically, as indicated in Table 5, a one-percentage-point increase in public debt leads to a 0.04 percentage point decrease in private investment levels, while the same increase in household debt corresponds to a 0.032 percentage point decrease in private investment levels. Conversely, a one-percentage-point increase in firm debt is associated with a 0.33 percentage point increase in private investment levels.

Furthermore, real GDP growth maintains its positive relationship with private investment levels, as presented in Table 5, with a one-percentage-point increase in real GDP growth resulting in a 0.169 percentage point increase in private investment levels. However, according to the results of the estimation of Equation 5 in Table 5 both foreign direct investment and public debt continue to show no significant impact on private investment.

In this iteration, as the results of the estimation of Equation 5 in Table 5 indicate, the interaction variable is found to be significant. The analysis reveals a mitigating effect of household debt over the long-term interest rate. However, the findings of the estimation of Equation 5 in Table 5 indicate that in this regression, the bond yield is not a significant variable. Nonetheless, household debt emerges as a significant factor.

The results of the estimation of Equation 5 in Table 5 indicate that an increase in the long-term interest rate strengthening the impact of household debt on private investment levels. The increase in interest rates significantly impacts household debt, which subsequently leads to a decrease in private investment levels due to the deleveraging effect.

Indeed, an increase in long-term bond yield tends to increase household debt accumulation due to the higher costs associated with borrowing. Moreover, such an increase may signify higher uncertainty, prompting an increase in contractionary policy measures within the economy. This, in turn, can lead to an increased demand for cash holdings among households.

Equation 6

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{Real GDP Growth}_{it-1}) + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

An interaction variable constructed with real GDP growth has also been examined, with the regression yielding results of the estimation of Equation 6 in Table 5 similar to the econometric model analysis. The findings of the estimation of Equation 6 in Table 5 indicate that a one-percentage-point increase in previous year's private investment leads to a 0.317 percentage point increase in current private investment.

Consistent with previous observations, the debt overhang hypothesis remains applicable. Specifically, as presented in Table 5 a one-percentage-point increase in public debt is associated with a 0.039 percentage point decrease in private investment, while the same increase in household debt corresponds to a 0.047 percentage point decrease in private investment. Conversely, a one-percentage-point increase in firm debt leads to a 0.033 percentage point increase in private investment levels according to the results in Table 5.

As presented in Table 5, in line with prior regressions, a one-percentage-point increase in real GDP growth results in a 0.149 percentage point increase in private investment. Similarly, public investment and foreign direct investment continue to exhibit no significant impact on private investment.

The interaction variable, as observed in the findings of the estimation of Equation 6 in Table 5, the household interaction regression, remains significant. However, bond yield continues to lack significance concerning its impact on private investment levels.

Equation 7

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2(\text{Bond Yield}_{it-1} * \text{FDI}_{it-1}) + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

The final econometric model interaction variable is constructed with foreign direct investment levels, yielding results of the estimation of Equation 7 in Table 5 similar to those of the econometric model. As presented in Table 5, a one-percentage-point increase in previous private investment levels leads to a 0.31 percentage point increase in current private investment levels.

Consistent with previous findings, the impact of public debt, household debt, and firm debt on private investment levels remains unchanged. Specifically, as indicated in Table 5, a one-percentage-point increase in public debt results in a 0.041 percentage point decrease in private investment, while the same increase in household debt corresponds to a 0.045 percentage point decrease in private investment. Conversely, as presented in Table 5, a one-percentage-point increase in firm debt leads to a 0.33 percentage point increase in private investment levels.

According to the results of the estimation of Equation 7 in Table 5, in line with prior regressions, a one-percentage-point increase in real GDP growth results in a 0.167 percentage point increase in private investment. Conversely, a one-percentage-point increase in long-term interest rates is associated with a 0.133 percentage point decline in private investment levels. Lastly, both public investment and foreign direct investment continue to exhibit no significant impact on private investment levels.

As indicated in Table 5, the interaction variable is not statistically significant, and its effect magnitude is considerably lower than that of the other variables. Therefore, it means that it does not have any impact over the impact of bond yield's.

The dependent variable is “Private Investment at year t”.

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 5

Table 5: Regression Results for the Control Variable Interactions												
System GMM Estimator												
	Public Debt		Public Investment		Firm Debt		Household Debt		Real GDP Growth		Foreign Direct Inv.	
	Impact	Std. Errors	Impact	Std. Errors	Impact	Std. Errors	Impact	Std. Errors	Impact	Std. Errors	Impact	Std. Errors
Private Investment _{t-1}	0.320***	(0,050)	0.302***	(0,051)	0.307***	(0,051)	0.312***	(0,050)	0.317***	(0,050)	0.310***	(0,050)
Public Debt _{t-1}	-0.037***	(0,010)	-0.041***	(0,010)	-0.041***	(0,010)	-0.040***	(0,010)	-0.039***	(0,009)	-0.041***	(0,010)
Public Investment _{t-1}	-0.067	(0,253)	0.219	(0,219)	-0.039	(0,248)	-0.133	(0,253)	-0.060	(0,246)	-0.047	(0,249)
Firm Debt _{t-1}	0.032***	(0,004)	0.034***	(0,034)	0.034***	(0,004)	0.033***	(0,004)	0.033***	(0,004)	0.033***	(0,004)
Household Debt _{t-1}	-0.046***	(0,014)	-0.053***	(0,015)	-0.043***	(0,014)	-0.032**	(0,015)	-0.047***	(0,014)	-0.045***	(0,014)
Bond Yield (LT) _{t-1}	-0.025	(0,152)	0.140	(0,214)	-0.059	(0,112)	0.198	(0,168)	-0.098	(0,066)	-0.133**	(0,063)
Real GDP Growth _{t-1}	0.174***	(0,037)	0.162***	(0,037)	0.166***	(0,037)	0.169***	(0,036)	0.149***	(0,038)	0.167***	(0,037)
Foreign Direct Investment _{t-1}	-0.000	(0,001)	-0.000	(0,001)	-0.000	(0,001)	-0.000	(0,001)	-0.000	(0,001)	-0.000	(0,001)
Bond Yield (LT) _{t-1} * Public Debt _{t-1}	-0.000	(0,001)	-	-	-	-	-	-	-	-	-	-
Bond Yield (LT) _{t-1} * Public Investment _{t-1}	-	-	-0.093	(0,302)	-	-	-	-	-	-	-	-
Bond Yield (LT) _{t-1} * Firm Debt _{t-1}	-	-	-	-	-0.000	(0,000)	-	-	-	-	-	-
Bond Yield (LT) _{t-1} * Household Debt _{t-1}	-	-	-	-	-	-	-0.004**	(0,015)	-	-	-	-
Bond Yield (LT) _{t-1} * Real GDP Growth _{t-1}	-	-	-	-	-	-	-	-	0.016*	(0,008)	-	-
Bond Yield (LT) _{t-1} * Foreign Direct Investment _{t-1}	-	-	-	-	-	-	-	-	-	-	-0.000	(0,001)

Equation 8

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{Inflation Rate}_{it-1}) + \beta_3 \text{Inflation Rate}_{it-1} + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

In this analysis, the study aims to investigate the impact of the relationship between inflation and the long-term interest rate on private investment levels. Regarding the standard explanatory variables, the results align closely with those of the econometric model.

As the findings of the estimation of Equation 8 in Table 6 indicates, one-percentage-point increase in previous year's private investment is associated with a 0.302 percentage point increase in current private investment levels. Conversely, as presented in Table 6, a one-percentage-point increase in public debt leads to a 0.049 percentage point decrease in private investment, while the same increase in household debt results in a 0.038 percentage point decrease in private investment levels.

In contrast, the findings of the estimation of Equation 8 in Table 6, a one-percentage-point increase in firm debt leads to a 0.03 percentage point increase in private investment levels.

Moreover, according to the results of the estimation of Equation 8 in Table 6, a one-percentage-point increase in real GDP growth is associated with a 0.184 percentage point increase in private investment levels. However, as presented in Table 6, both public investment and foreign direct investment show no significant effects on private investment.

The variable of interest in this study, the bond yield, as demonstrated in Table 6, indicates a strong impact on private investment in this regression. Specifically, the findings of the estimation of Equation 8 in Table 6 indicates, a one-percentage-point increase in the bond yield corresponds to a 0.26 percentage point decrease in private investment levels.

The findings of the estimation of Equation 8 in Table 6 indicate that both the inflation variable and the interaction variable have a significant impact on private investment. The interaction variable is significant and exhibits a positive effect, indicating a negative relationship between long-term interest rates and the inflation rate.

Due to the increase in inflation, if nominal interest rates do not adjust accordingly in a timely manner, real interest rates decline. Consequently, as observed in the interaction variable, there is a negative relationship between real long-term interest rates and inflation. It can be concluded that in inflationary scenarios, the impact of bond yield on private investments is mitigated.

As observed in the Table 6, one-percentage-point increase in the inflation rate results in a 0.348 percentage point decrease in private investment levels. The increase in inflation in the previous period signals a forthcoming monetary policy tightening, as monetary authorities aim to stabilize prices. Contractionary monetary policy results in more costly financing, leading to reduced private investment decisions. Consequently, in the subsequent year, this results in lower levels of private investment.

The dependent variable is “Private Investment at year t”.

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 6

Table 6: Regression Results for the Inflation Rate Interaction		
System GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,302***	(0,049)
Public Debt _{t-1}	-0,049***	(0,010)
Public Investment _{t-1}	-0,099	(0,247)
Firm Debt _{t-1}	0,030***	(0,004)
Household Debt _{t-1}	-0,038***	(0,014)
Bond Yield (LT) _{t-1}	-0,265***	(0,076)
Real GDP Growth _{t-1}	0,184***	(0,036)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
Inflation Rate _{t-1}	-0,348***	(0,128)
Bond Yield (LT) _{t-1} *Inflation Rate _{t-1}	0,061**	(0,028)

Equation 9

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{VIX}_{it-1}) + \beta_3 \text{VIX}_{it-1} + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

To assess the impact of global uncertainty on private investment, an interaction variable with the VIX indicator has been introduced. Similar to previous regression models, this model yields consistent results regarding the standard explanatory variables.

Table 7 indicates that one-percentage-point increase in previous year's private investment levels is associated with a 0.307 percentage point increase in current private investment levels. Similarly, the findings of the estimation of Equation 9 in Table 7 indicate that a one-percentage-point increase in both public debt and household debt results in a 0.043 and 0,055 percentage point decline in private investment respectively. Conversely, the results of the estimation of Equation 9 in Table 7 indicate a one-percentage-point increase in firm debt leads to a 0.036 percentage point increase in private investments.

According to the findings of the estimation of Equation 9 in Table 7, a one-percentage-point increase in real GDP growth is associated with a 0.086 percentage point increase in private investments. However, both foreign direct investment and public investment show no significant impact on private investment levels.

The findings of the estimation of Equation 9 in Table 7 indicate that the interaction variable between long-term interest rates and the VIX indicator lacks statistical significance. Therefore, VIX indicator has no impact over the impact of bond yield's impact on private investment levels.

However, the VIX variable itself is significant, indicating that a one-percentage-point increase in the VIX indicator results in a 0.088 percentage point decrease in private investment. Notably, a one-percentage-point increase in the long-term interest rate corresponds to a 0.156 percentage point decrease in private investments. Yet, it is not significant in this estimation.

The sign and significance of the VIX indicator show that as expectations of global conditions tightening increase, private investment decisions are deterred. Consequently, private investment level in the subsequent year is negatively impacted.

Equation 10

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{VSTOXX}_{it-1}) + \beta_3 \text{VSTOXX}_{it-1} + \beta_4 X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

The VSTOXX index, similar to the VIX indicator, measures market volatility for the next 30 days by deriving option prices of companies included in the Euro STOXX 50.

It serves as an indicator of future expectations. The results align with the regression using the VIX indicator.

The findings of the estimation of Equation 10 in Table 8 indicates that one percentage increase in the previous year's private investment levels leads to a 0.295 percentage point increase in current private investments.

Consistent with previous regressions, as presented in Table 8, a one percentage increase in public debt decreases private investments by 0.042 percentage points, while a one percentage increase in household debt decreases private investments by 0.056 percentage points. Conversely, the findings of the estimation of Equation 10 in Table 8 indicates, a one percentage increase in firm debt increases private investment by 0.037 percentage points. Additionally, a one percentage increase in real GDP growth results in a 0.090 percentage point increase in private investment levels. As with previous regressions, public investment and foreign direct investment remain insignificant.

The results of the estimation of Equation 10 in Table 8 indicate that the bond yield loses its significance in this regression, and the interaction variable is also not significant. However, the VSTOXX indicator is highly significant, exerting a strong impact on private investment levels. Specifically, as presented in Table 8, a one percentage increase in the VSTOXX indicator results in a 0.962 percentage point decrease in private investment levels.

The rise in the VSTOXX index signifies increased uncertainty and volatility within the market. In response to this heightened volatility, private investment decisions may be deterred.

However, the inclusion of the VSTOXX index and its associated impact has led to the bond yield variable losing its significance.

Equation 11

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{GDP Forecast}_{it-1}) + \beta_3 \text{GDP Forecast}_{it-1} + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

To assess the impact of expectations on private investment, an interaction variable has been created with the GDP forecast variable. The regression results align closely with previous analyses.

The findings of the estimation of Equation 11 in Table 9 indicates that one-percentage-point increase in previous year's private investment leads to a 0.307 percentage point increase in current private investment levels.

Consistent with prior findings, as presented in Table 9, a one-percentage-point increase in public debt results in a 0.047 percentage point decrease in private investments, while the same increase in household debt leads to a 0.037 percentage point decrease. Conversely, the findings of the estimation of Equation 11 in Table 9 indicate, a one-percentage-point increase in firm debt is associated with a 0.032 percentage point increase in private investment levels.

According to Table 9, a one-percentage-point increase in real GDP growth corresponds to a 0.201 percentage point increase in private investments. However, both public debt and foreign direct investment continue to show no significant impact on private investment levels.

The results of the estimation of Equation 11 in Table 9 indicate that both the GDP forecast variable and the interaction variable are significant factors affecting private investment levels. The negative sign of the interaction variable suggests a positive relationship between the GDP forecast and long-term interest rates.

Strong GDP growth may induce investors to increase their investments, thereby raising the demand for capital and enhancing consumer confidence, which, in turn, boosts consumption. To control potential inflationary pressures, monetary authorities may raise policy rates. If inflation rates do not rise at the same pace as nominal rates, real interest rates will increase, leading to further declines in private investments.

The results of the estimation of Equation 11 in Table 9 show that a one percentage point increase in the GDP forecast causes a 0.501 percentage point increase in private investment levels. As mentioned in the literature, GDP forecasts are highly significant and are taken seriously by economic agents. The impact of the long-term interest rate on private investments remains negative but is amplified. As presented in Table 9, a one percent increase in the bond yield results in a 0.176 percentage point decline in private investment.

The dependent variable is “Private Investment at year t”.

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 7

Table 7: Regression Results for the VIX Interaction

System GMM Estimator

	Impact	Std. Errors
Private Investment _{t-1}	0,307***	(0,050)
Public Debt _{t-1}	-0,043***	(0,010)
Public Investment _{t-1}	-0,27	(0,259)
Firm Debt _{t-1}	0,036***	(0,004)
Household Debt _{t-1}	-0,055***	(0,014)
Bond Yield (LT) _{t-1}	-0,156	(0,176)
Real GDP Growth _{t-1}	0,086**	(0,042)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
VIX _{t-1}	-0,088***	(0,026)
Bond Yield (LT) _{t-1} *VIX _{t-1}	-0,000	(0,008)

Table 8

Table 8: Regression Results for the VSTOXX Interaction

System GMM Estimator

	Impact	Std. Errors
Private Investment _{t-1}	0,295***	(0,050)
Public Debt _{t-1}	-0,042***	(0,010)
Public Investment _{t-1}	0,293	(0,255)
Firm Debt _{t-1}	0,037***	(0,004)
Household Debt _{t-1}	-0,056***	(0,014)
Bond Yield (LT) _{t-1}	-0,003	(0,206)
Real GDP Growth _{t-1}	0,090**	(0,04)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
VSTOXX _{t-1}	-0,962***	(0,025)
Bond Yield (LT) _{t-1} *VSTOXX _{t-1}	-0,004	(0,008)

Table 9

Table 9: Regression Results for the GDP Forecast Interaction		
System GMM Estimator		
	GDP Forecast	
	Impact	Std. Errors
Private Investment _{t-1}	0,307***	(0,048)
Public Debt _{t-1}	-0,047***	(0,009)
Public Investment _{t-1}	-0,016	(0,240)
Firm Debt _{t-1}	0,032***	(0,004)
Household Debt _{t-1}	-0,037***	(0,014)
Bond Yield (LT) _{t-1}	-0,176***	(0,060)
Real GDP Growth _{t-1}	0,201***	(0,036)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
GDP Forecast _{t-1}	0,501***	(0,103)
Bond Yield (LT) _{t-1} *GDP Forecast _{t-1}	-0,071***	(0,020)

Equation 12

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{EFFR}_{it-1}) + \beta_3 \text{EFFR}_{it-1} + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

To assess the impact of United States' monetary policy on private investment levels in the Euro-area, an interaction variable has been created with the effective FED funds rate. The regression results in Table 10 are largely consistent with previous analyses, except for public debt.

The findings of the estimation of Equation 12 in Table 10 indicate a one-percentage-point increase in previous year's private investment levels leads to a 0.2 percentage point increase in current private investment levels. In line with earlier findings, as presented in Table 10, a one-percentage-point increase in household debt levels results in a 0.081 percentage point decline in private investments, while the same increase in firm debt leads to a 0.049 percentage point increase in private investment levels.

According to the findings of the estimation of Equation 12 in Table 10, a one-percentage-point increase in real GDP growth is associated with a 0.081 percentage point increase in private investments. However, both public investment and foreign direct investment continue to show no significant impacts on private investment levels.

According to the results of the estimation of Equation 12 in Table 10, the interaction variable between the bond yield and the Federal Funds Rate is not statistically significant, so EFFR has no impact over the bond yield's impact on private investments.

On the other hand, the Federal Funds Rate variable itself is significant. Specifically, the findings of the estimation of Equation 12 in Table 10 indicate a one-percentage-point increase in the Federal Funds Rate is associated with a 0.619 percentage point increase in private investment levels in the Euro area. The results suggest that the Fed's contractionary monetary policy increases private investment levels in the Eurozone. This can be explained by the appreciation of the dollar, which makes imports more expensive but exports cheaper. Given that the Eurozone has an export-oriented trade policy, these results may be interpreted as indicating that private investment levels increase due to the rising demand for export goods from the region.

Regarding the variable of interest, the findings of the estimation of Equation 12 in Table 10 show that the a one-percentage-point increase in bond yield corresponds to a 0.155 percentage point decline in private investment levels, which is very close to the econometric model results.

The dependent variable is "Private Investment at year t".

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 10

Table 10: Regression Results for the EFFR Interaction		
System GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,200***	(0,047)
Public Debt _{t-1}	-0,012	(0,009)
Public Investment _{t-1}	0,326	(0,231)
Firm Debt _{t-1}	0,049***	(0,004)
Household Debt _{t-1}	-0,081***	(0,013)
Bond Yield (LT) _{t-1}	-0,155**	(0,063)
Real GDP Growth _{t-1}	0,081**	(0,035)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
EFFR _{t-1}	0,619***	(0,135)
Bond Yield (LT) _{t-1} *EFFR _{t-1}	0,075	(0,063)

Equation 13

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{UEG}) + \beta_3 \text{UEG} + \beta_x X_{it-1} + \mu_i + \nu_t + \varepsilon_{it}$$

To assess the impact of the compatibility between expectation fulfillment and countries, an interaction variable has been constructed using the bond yield and the disparity between real GDP growth and the GDP forecast of each specific country.

First, a dummy variable was constructed by measuring the difference between the GDP forecasts for a specific year and the actual GDP levels for that year. Countries that did not meet the forecasted GDP levels were coded with this dummy variable. The interaction variable was then created using this dummy variable.

This regression has produced results similar to the previous analyses. The findings of the estimation of Equation 13 in Table 11 indicates that one-percentage-point increase in the previous year's private investment levels increase current private investment levels by 0.314 percentage points. The findings of the estimation of Equation 13 in Table 11 indicate a one-percentage-point increase in public debt decreases private investment levels by 0.041 percentage points, while a one-percentage-point increase in household debt decreases private investment by 0.037 percentage points.

Conversely, as presented in Table 11, a one-percentage-point increase in firm debt leads to a 0.032 percentage point rise in private investments.

According to the findings of the estimation of Equation 13 in Table 11, a one-percentage-point increase in real GDP growth results in a 0.182 percentage point increase in private investments. Our variable of interest indicates that a one-percentage-point increase leads to a 0.133 percentage point decrease in private investment levels as presented in Table 11. As in previous regressions, public investment and foreign direct investment remain insignificant.

The results of the estimation of Equation 13 in Table 11 indicate that the interaction variable of under-expectation growth countries and the long-term interest rate is insignificant. However, the dummy variable for these countries is significant. This signifies that if a country does not meet its forecasted levels of growth, it has a significant and negative impact on private investment. As shown in the Table 11, the magnitude of this impact is a 0.685 percentage point decrease.

The dependent variable is “Private Investment at year t”.

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 11

Table 11: Regression Results for the Under Expectation Growths Interaction		
System GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,314***	(0,050)
Public Debt _{t-1}	-0,041***	(0,010)
Public Investment _{t-1}	0,022	(0,248)
Firm Debt _{t-1}	0,032***	(0,004)
Household Debt _{t-1}	-0,037**	(0,014)
Bond Yield (LT) _{t-1}	-0,133*	(0,073)
Real GDP Growth _{t-1}	0,182***	(0,037)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
UEG	-0,685**	(0,301)
Bond Yield (LT) _{t-1} *UEG	-0,085	(0,087)

Equation 14

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2 (\text{Bond Yield}_{it-1} * \text{GIIPS}) + \beta_3 \text{GIIPS} + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

In this model, a dummy variable named "GIIPS Countries" and it's interaction with bond yield have been added to the regression to measure the impact of being a GIIPS country and it's influence on the transmission of the impact of bond yield on private investment levels. The results for the standard variables are consistent with the econometric model.

The results of the estimation of Equation 14 in Table 12 indicate, previous period's private investment levels have a strong impact on current private investment levels. As it's shown in Table 12, a one percentage point increase in previous period's private investment levels increases current investment levels by 0.357 percentage points.ö

According to the results of the estimation of Equation 14 in Table 12, a one percentage point increase in public debt causes a 0.035 percentage point decline in private investment levels. Household debt maintains its similar effect as previously mentioned, with a one percentage point increase in household debt leading to a 0.032 percentage point decrease in private investment. In contrast, the findings in Table 12 indicate that firm debt has an opposite effect: a one percentage point increase in firm debt results in a 0.038 percentage point increase in private investment levels.

As previously, the results of the estimation of Equation 14 in Table 12 indicate that public investment and foreign direct investment do not have a significant relationship with private investment levels.

Being a GIIPS country has a very strong and negative impact on private investment levels. The results of the estimation of Equation 14 in Table 12 suggest that private investment levels decrease by 3.72 percentage points if a country belongs to the GIIPS group. As previously discussed, the GIIPS countries, namely Greece, Italy, Ireland, Portugal, and Spain, are highly indebted eurozone economies.

Both the global financial crisis and the sovereign debt crisis have highlighted the fragility of these economies and their exposure to various risks. Increasing unemployment rates and high levels of indebtedness are significant factors contributing to the lower levels of private investment in comparison to other members of the eurozone.

According to the findings of the estimation of Equation 14 in Table 12, the interaction of bond yield and the GIIPS country dummy has no significant effect. So, being included in GIIPS countries do not have any influence on the impact of bond yield over private investment levels.

The dependent variable is “Private Investment at year t”.

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 12

Table 12: Regression Results for the GIIPS Countries Interaction

System GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,357***	(0,052)
Public Debt _{t-1}	-0,035***	(0,010)
Public Investment _{t-1}	0,004	(0,250)
Firm Debt _{t-1}	0,038***	(0,004)
Household Debt _{t-1}	-0,032**	(0,015)
Bond Yield (LT) _{t-1}	-0,036	(0,091)
Real GDP Growth _{t-1}	0,182***	(0,037)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
GIIPS Countries	-3,72***	(1,161)
Bond Yield (LT) _{t-1} * GIIPS Countries	-11,452	(0,114)

Equation 15

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2(\text{Bond Yield}_{it-1} * \text{Over-thresholds}_{it-1}) + \beta_3 \text{Over-thresholds}_{it-1} + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

The literature includes numerous studies investigating the threshold levels of public debt, demonstrating that beyond certain levels, public debt negatively affects economic growth. Given that this analysis focuses on recent years, which encompass three significant crises leading to substantial government spending, it is pertinent to measure the impact of this threshold issue on private investment levels.

A over-threshold dummy variable has been created for public debt levels exceeding 90 percent of GDP, following the literature. An interaction variable has been constructed using this over-threshold variable and the long-term interest rate.

The results of the estimation of Equation 15 are similar to the previous analyses, except for the bond yield.

As shown in the Table 13, both the over-threshold variable and the interaction variable are insignificant. Therefore, indebtedness ratio does not create any change in the magnitude of the impact of bond yield's over private investments.

The findings of the estimation of Equation 15 in Table 13 indicate that an increase of one percent in the previous year's private investment levels raises current investment levels by 0.315 percentage points. As presented in Table 13, a one percent increase in public debt causes a 0.039 percent decline in private investment. Similarly, a one percent increase in household debt results in a 0.046 percent decrease in private investment levels. In contrast, as shown in Table 13, a one percent increase in firm debt raises private investment levels by 0.33 percentage points. Additionally, a one percent increase in real GDP growth leads to a 0.171 percent increase in private investment levels.

The dependent variable is "Private Investment at year t".

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 13

Table 13: Regression Results for the Over-thresholds Interaction

System GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,315***	(0,051)
Public Debt _{t-1}	-0,039***	(0,011)
Public Investment _{t-1}	0,04	(0,255)
Firm Debt _{t-1}	0,033***	(0,004)
Household Debt _{t-1}	-0,046***	(0,014)
Bond Yield (LT) _{t-1}	-0,121	(0,101)
Real GDP Growth _{t-1}	0,171***	(0,037)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
Over-thresholds	0,037	(0,836)
Bond Yield (LT) _{t-1} *Over-thresholds	-0,036	(0,118)

Equation 16

$$\text{Private Investment}_{it} = \beta_1 \text{Bond Yield}_{it-1} + \beta_2(\text{Bond Yield}_{it-1} * \text{Crisis Periods}_{it-1}) + \beta_3 \text{Crisis Periods}_{it-1} + \beta_x X_{it-1} + \mu_i + v_t + \varepsilon_{it}$$

A crisis variable has been created to measure the impact of both global and local crises on the transmission of long-term interest rates. The periods have been selected in accordance with the literature, covering the years 2008, 2009, 2010, 2011 and 2012.

The results of the estimation of Equation 16 in Table 14 align with the econometric model. Specifically, as presented in Table 14, a one percentage increase in the previous year's private investment increases current private investment by 0.325 percent. Public debt and household debt continue to exhibit a debt overhang effect on private investment.

According to the findings of the estimation of Equation 16 in Table 14, a one percent increase in public debt results in a 0.043 percentage point decline in private investment levels, while a one percent increase in household debt leads to a 0.042 percentage point decline in private investment levels. Conversely, a one percent increase in firm debt increases private investments by 0.031 percent. Additionally, as presented in Table 14, a one percent increase in the real GDP growth rate increases private investments by 0.173 percentage points. In all cases, foreign direct investment and public investment remain statistically insignificant.

According to the findings of the estimation of Equation 16 in Table 14, the interaction variable is not statistically significant. So it does not create any change in the magnitude of the impact of bond yield's over private investment. Nonetheless, the crisis dummy variable itself is significant and has a strongly negative effect. During crisis periods, private investment experiences a substantial decline.

Our variable of interest is significant and exhibits a negative effect on private investment levels, consistent with the econometric model. Specifically, as presented in Table 14 a one percent increase in the bond yield results in a 0.16 percent decrease in private investments.

The dependent variable is “Private Investment at year t”.

The significance levels are expressed as *, ** and *** at the 10%, 5% and 1% respectively.

Table 14

Table 14: Regression Results for the Crisis Periods Interaction		
System GMM Estimator		
	Impact	Std. Errors
Private Investment _{t-1}	0,325***	(0,050)
Public Debt _{t-1}	-0,043***	(0,010)
Public Investment _{t-1}	-0,056	(0,252)
Firm Debt _{t-1}	0,031***	(0,004)
Household Debt _{t-1}	-0,042***	(0,014)
Bond Yield (LT) _{t-1}	-0,16**	(0,063)
Real GDP Growth _{t-1}	0,173***	(0,038)
Foreign Direct Investment _{t-1}	-0,000	(0,001)
Crisis Periods	-1,038**	(0,586)
Bond Yield (LT) _{t-1} *Crisis Periods	0,289	(0,189)

CONCLUSION

Private investment stands out as one of the most critical drivers of economic growth. However, during periods of crisis and uncertainty, it tends to be the first element to be sacrificed. Factors such as a heightened demand for cash-holding, deleveraging, financial constraints, and uncertainty are key reasons for the postponement of private investments.

This study delves into the determinants of private investment, with a particular emphasis on investigating the effect of the real long-term interest rate on private investment levels.

In the current post-COVID-19 era, contractionary monetary policy measures are ongoing due to the inflation resulting from the expansionary policies enacted during the crisis. Consequently, after a period of significant economic slowdown, the effect of contractionary monetary policies on private investment has become an intriguing subject of study.

The study examined the channels and characteristics of a country that influence the magnitude of the transmission of the long-term interest rates.

The results indicate that inflation and GDP forecasts are highly influential in determining the impact of the bond yield on private investment levels. The study demonstrates that the bond yield's impact is mitigated under inflationary pressures. Regarding GDP forecasts, the findings suggest a positive relationship between the bond yield and GDP forecasts. Specifically, as growth expectations rise, real long-term interest rates increase due to contractionary monetary policies regarding the demand rise for capital by investors and potential inflation increase.

In other scenarios, the VIX indicator, VSTOXX indicator, Effective Federal Funds Rate (EFFR), and ECB policy rate all emerge as significant determinants of private investment levels. The VIX and VSTOXX indicators offer insights into market volatility on a global and local scale, respectively. Increases in these indices lead to a decrease in private investment levels, as demonstrated by the results.

Regarding the policy stance of the United States, the findings indicate a positive relationship with private investment levels in the Euro Area. An increase in the EFFR is beneficial for Europe, given its export-oriented trade strategy.

The dummy variables constructed for specific countries, years, and situations have significant impacts on private investment. According to the results, inclusion in the GIIPS countries is associated with a decrease in private investment. Another variable, the under-expectation growth, is defined as the difference between GDP forecasts and actual GDP growth. Countries that fail to meet their forecasted GDP growth experience lower levels of private investment. Additionally, a crisis dummy variable was created to measure the impact of crisis periods on private investment and their influence on the bond yield. The results indicate that crisis periods have a very strong detrimental effect on private investment.

The econometric model and over-threshold controls have remained insignificant.

In the Euro Area, the monetary policy stance is uniform across all member countries. However, variations in the real long-term interest rates arise due to the individual economic cycles of these countries. These differences in real long-term interest rates and how the transmission mechanism of the countries works significantly impact private investment levels within the Euro Area.

REFERENCES

Abel, A.B. (1983), “Optimal Investment under Uncertainty”, *The American Economic Review*, 73 (1), 228-233.

doi: 20.500.14332/34311

Acharya, V.V., Eisert, T., Eufinger, C., Hirsch, C.(2018), “ Real Effects of the Sovereign Debt Crisis in Europe: Evidence from Syndicated Loans”, *The Review of Financial Studies*, v31n82018

doi:10.1093/rfs/hhy045

Angeloni, I., Kashyap, A.K., Mojon, B., Terlizzese, D. (2003), “Monetary Transmission in the Euro Area: Does the Interest Rate Channel Explain All?”, *NBER Working Paper Series*, No. 9984.

<http://www.nber.org/papers/w9984>

Angeloni, I., Kashyap, A.K., Mojon, B. (2003), “Monetary Policy Transmission in the Euro Area”, *Cambridge University Press*

doi : 10.1017/CBO9780511492372

Arellano, B., Bond, S. (1991), “Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations”, *The Review of Economic Studies*, Volume 58, Issue 2, 277-297.

doi: 0034-6527/91/00180277802.00

Arslanalp, S., Poghosyan, T. (2014), “Foreign Investor Flows and Sovereign Bond Yields in Advanced Economies”, *IMF Working Paper*, WP/14/27.

<https://www.imf.org/external/pubs/ft/wp/2014/wp1427.pdf>

Beker, V. A. (2014), “The European Debt Crisis: Causes and Consequences”, *OMICS International, Stock & Forex Trading*, 3:2.

doi: 10.4172/2168-9458.1000115

Blundell, R., Bond, S., Windmeijer, F. (2000), “Estimation in Dynamic Panel Data Models: Improving on the Performance of the Standard GMM Estimator”, *IFS Working Papers*, No.W00/12, Institute for Fiscal Studies (IFS), London.

doi: 10.1920/wp.ifs.2000.0012

Bricongne, J.C., Mordonu, A.M. (2015), “Interlinkages between Household and Corporate Debt in Advanced Economies”, European Commission, Discussion Paper 017.

http://ec.europa.eu/economy_finance/publications/

Bussiere, M., Ferrara, L., Milovich, J.(2015), “Explaining the Recent Slump in Investment: the Role of Expected Demand and Uncertainty” , Banque de France, Eurosystem.

www.banque-france.fr

Checherita, C., Rother, P. (2010), “The Impact of High and Growing Government Debt on Economic Growth: An Empirical Investigation for the Euro Area”, European Central Bank, Eurosystem, Working Paper Series, 1237

http://ssrn.com/abstract_id=1659559

Cour-Thimann, P., Winkler, B. (2013), “ The ECB’s Non-standard Monetary Policy Measures: The Role of Institutional Factors and Financial Structure”, Working Paper Series, No 1528

doi:10.1093/oxrep/grs038

Debrun, X., Masuch, K., Ferrero, G., Vansteenkiste, I. (2021), “Monetary - Fiscal Policy Interactions in the Euro Area”, European Central Bank, Eurosystem, Occasional Paper Series, No 273

Demmou, L., Franco, G., Calligaris, S., Dlugosch, D.(2021), “Liquidity Shortfalls during the Covid-19 Outbreak: Assessment and Policy Responses”, OECD, Economics Department Working Papers, No.1647.

www.oecd.org/eo/workingpapers

Ehnts, D., Paetz, M. (2021), “COVID-19 and it’s economic consequences for the Euro Area”, Springer, Eurasian Economic Review, 11:227-249.

doi: 10.1007/s40822-020-00159-w

Kalemli-Özcan, S., Laeven, L., Moreno, D. (2019), “Debt overhang, rollover risk, and corporate investment: evidence from the European Crisis”, European Central Bank, Eurosystem, Working Paper Series, No.2241.

Lang, S., Schadner, W.(2021), “The trilemma of expansionary monetary policy in the Euro area during the COVID-19 crisis”, Science Direct, Finance Research Letters, 42: 102048.

doi: 10.1016/j.frl.2021.102048

- Lipsey, R.E. (2002), “Home and Host Country Effects of FDI”, NBER Working Paper, No.9293.
<http://www.nber.org/papers/w9293>
- Mojon, B.(2000), “ Financial Structure and the Interest Rate Channel of ECB Monetary Policy”, European Central Bank, Working Paper Series, No.40.
- Ndubuisi, G.O.(2014), “Interest Rate Channel of Monetary Policy Transmission Mechanisms: What do we know about it?”
- Pesaran, M.H., (2007) “A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence”
 doi: 10.1002/jae.951
- Reinhart, C.M., Rogoff, K.S. (2010), “Growth in a Time of Debt”, American Economic Review: Papers & Proceedings 100”, 573-578
 doi: 10.1257/aer.100.2.573
- Roodman, D.(2009), “A Note on the Theme of Too Many Instruments”, Oxford Bulletin of Economics and Statistics, 71 (1), 0305-9049.
 doi: 10.1111/j.1468-0084.2008.00542.x
- Segal, G., Shaliastovich, I., Yaron, A.(2015), “Good and Bad Uncertainty: Macroeconomic and Financial Market Implications, Journal of Financial Economics, 117 (2), 369-397
 doi:10.1016/j.jfineco.2015.05.004
- Ullah, G.M., Ahmed, S. P. (2014), “A Review of European Sovereign Debt Crisis: Causes and Consequences”, International Journal of Business and Economics Research. Vol.3, No.2, pp. 66-71.
 doi: 10.11648/j.ijber.20140302.13
- Vanlaer, W.,Picarelli, M.,Marneffe, W.(2021), “Debt and Private Investment: Does the EU Suffer from a Debt Overhang?”, Springer, Open Economies Review, 32:789-820.
 doi: 10.1007/s11079-021-09621-x

Appendix 1

Variable Name	Description	Source
Private Investment	Private gross fixed capital formation by households and non-financial corporations, as a percentage of GDP	Difference between total gross fixed capital formation and general government gross fixed capital formation, as a percentage of GDP
Public Debt	Government consolidated gross debt, as a percentage of GDP	Eurostat
Firm Debt	Non-financial firm debt, as a percentage of GDP	IMF
Household Debt	Debt of households and non-profit institutions serving households, as percentage of GDP	IMF
Public Investment	General government gross fixed capital formation as a percentage of GDP	Eurostat
Bond Yield (LT)	Real long term government bond yield, percent	IMF
Foreign Direct Investment	Investment made by from one itself or through business entity for the business purposes in a foreign country, as a percentage of GDP	Eurostat
Real GDP Growth	Real GDP growth, annual percentage change	IMF
Inflation Rate	General level of price increase in goods and services, percent	IMF
VIX Indicator	Volatility Index, derived from the change in SPX index option prices	CBOE
VSTOXX Indicator	Volatility Index, derived from the change in EURO STOXX 50 index option prices	STOXX
GDP Forecast	One-year-ahead IMF World Economic Outlook GDP growth forecast (fall)	IMF
FED Funds Rate	Effective Federal Funds Rate, FED policy rate, percent	FED

Appendix 2

Private Investment to GDP in between 2004-2022 in Euro Area

Figure 1

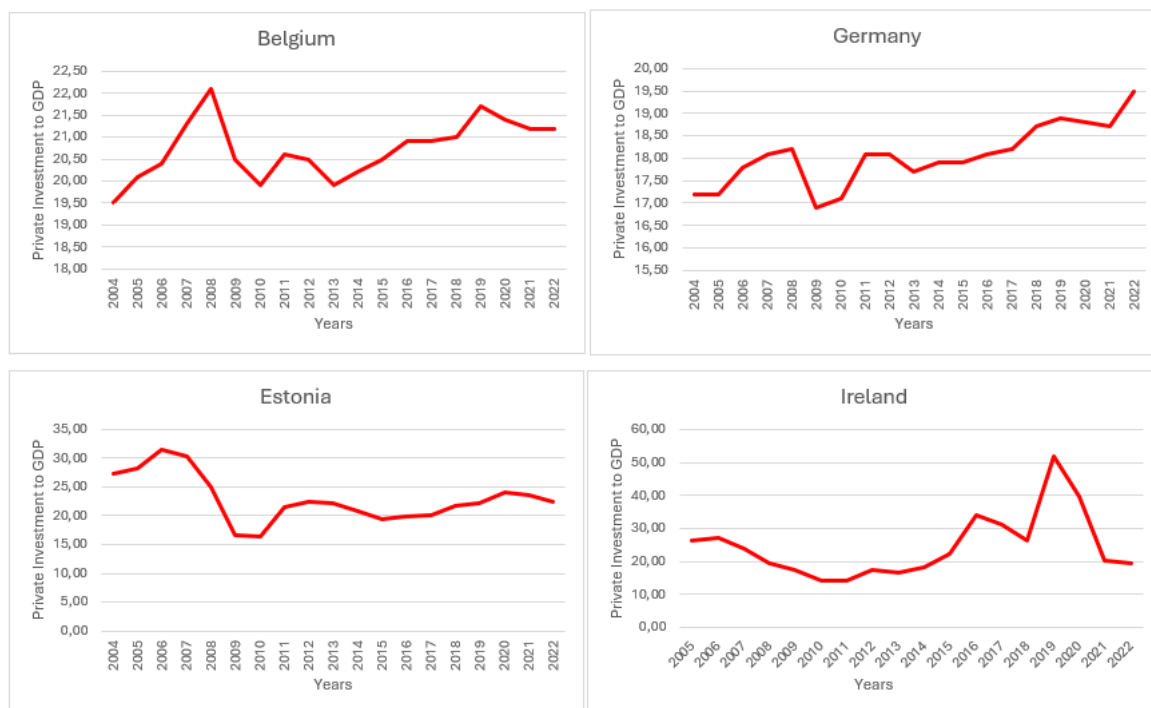


Figure 2

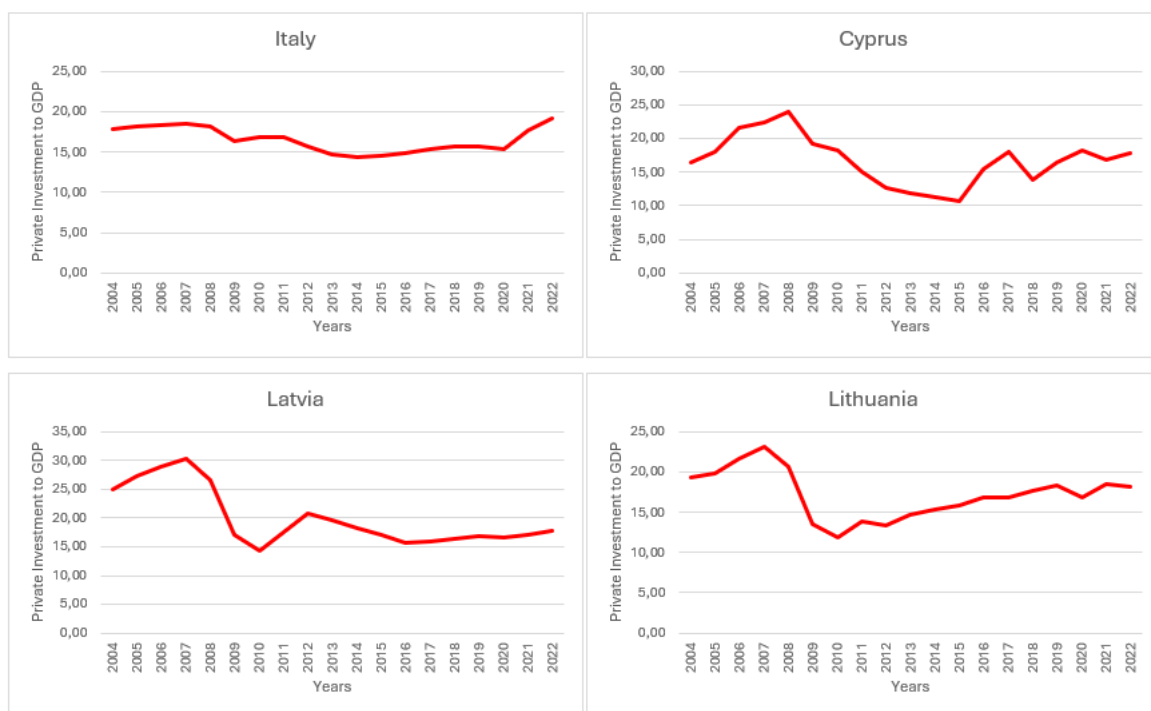


Figure 3

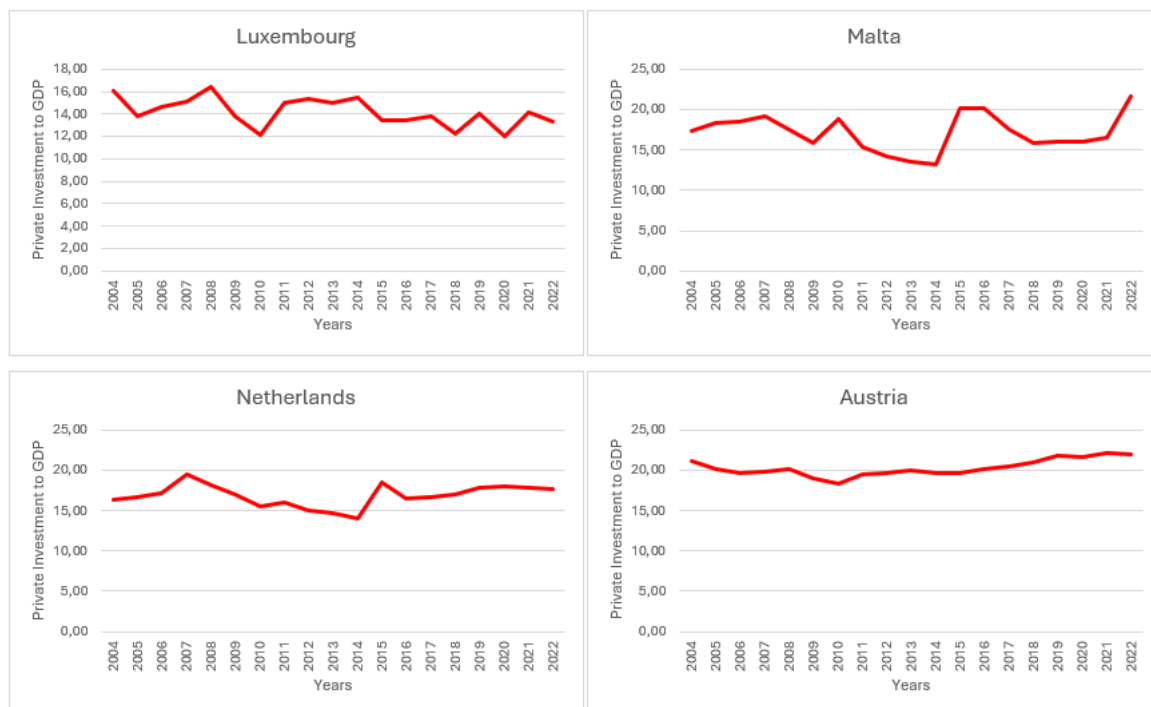
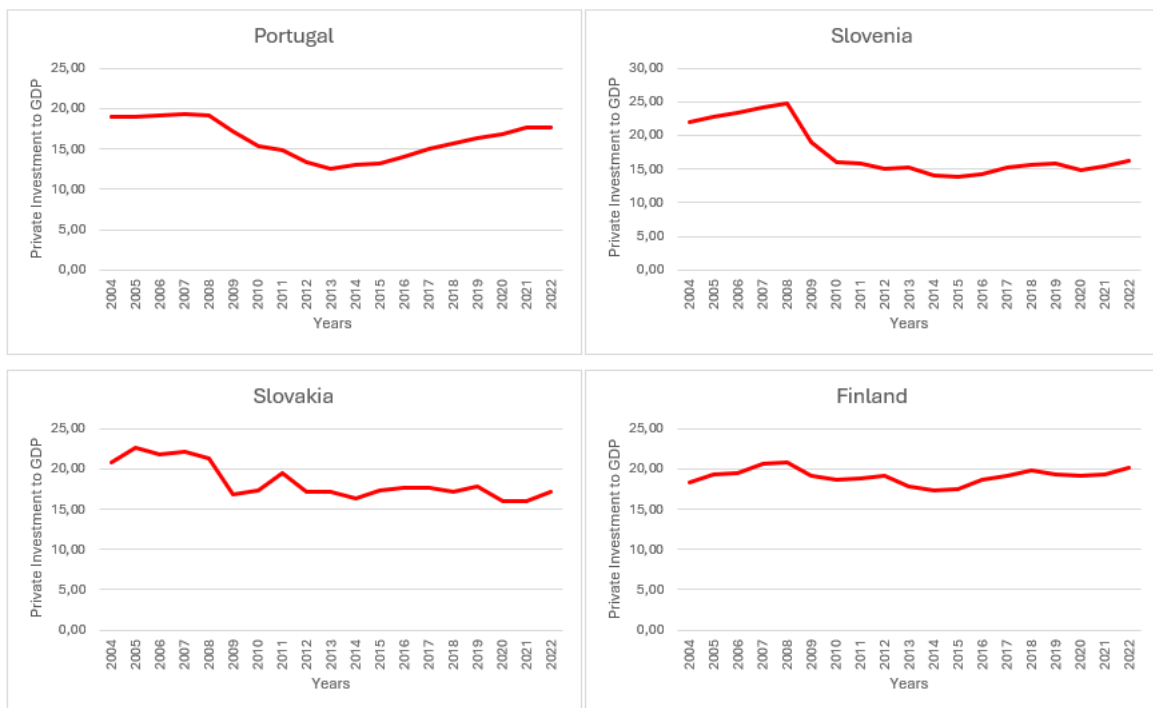


Figure 4



Appendix 3

Public Debt, Firm Debt and Household Debt to GDP Ratios in between 2004-2022 in Euro Area

Figure 5

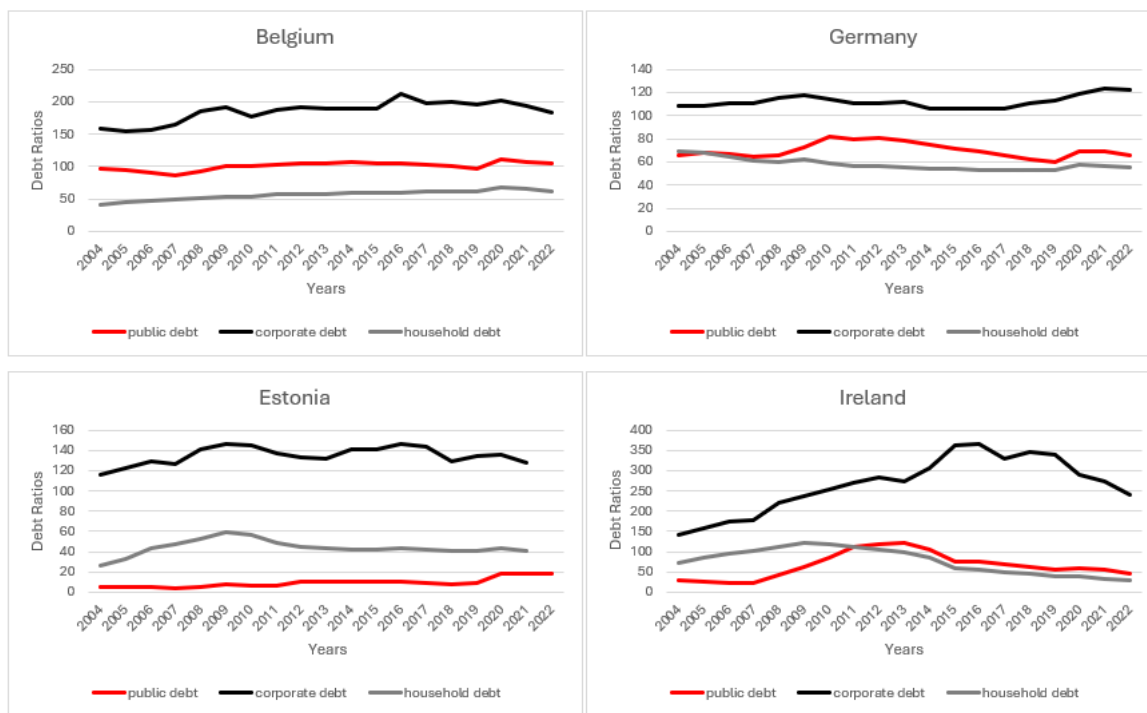


Figure 6

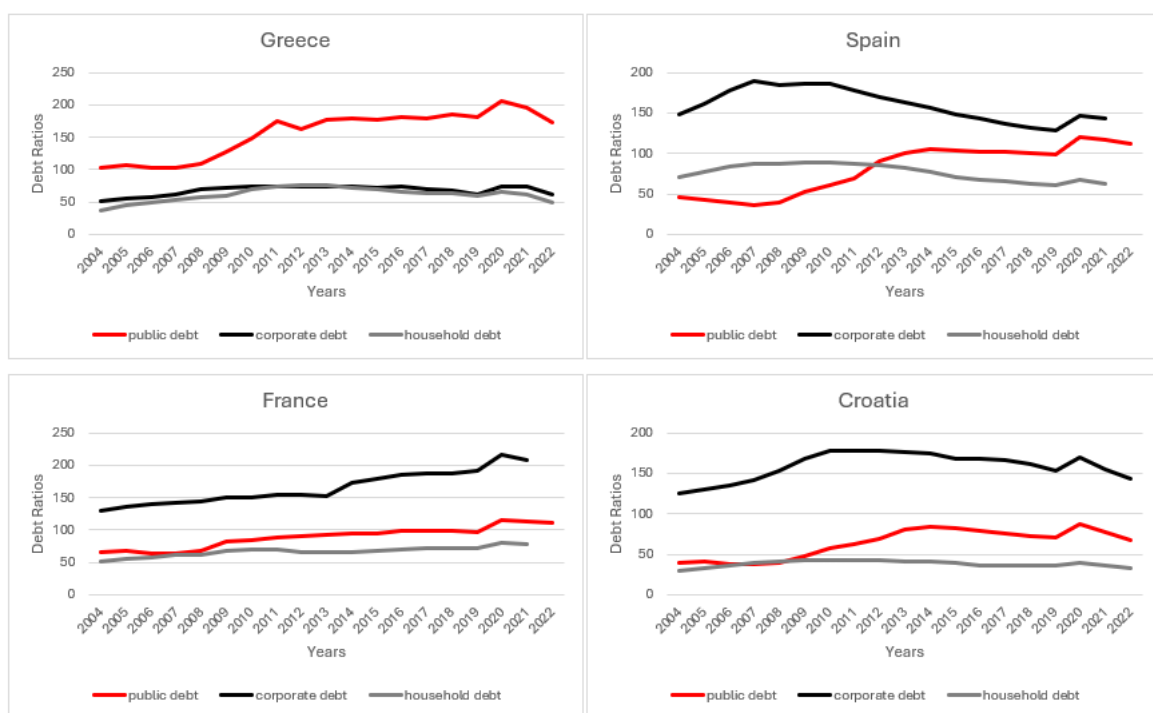


Figure 7

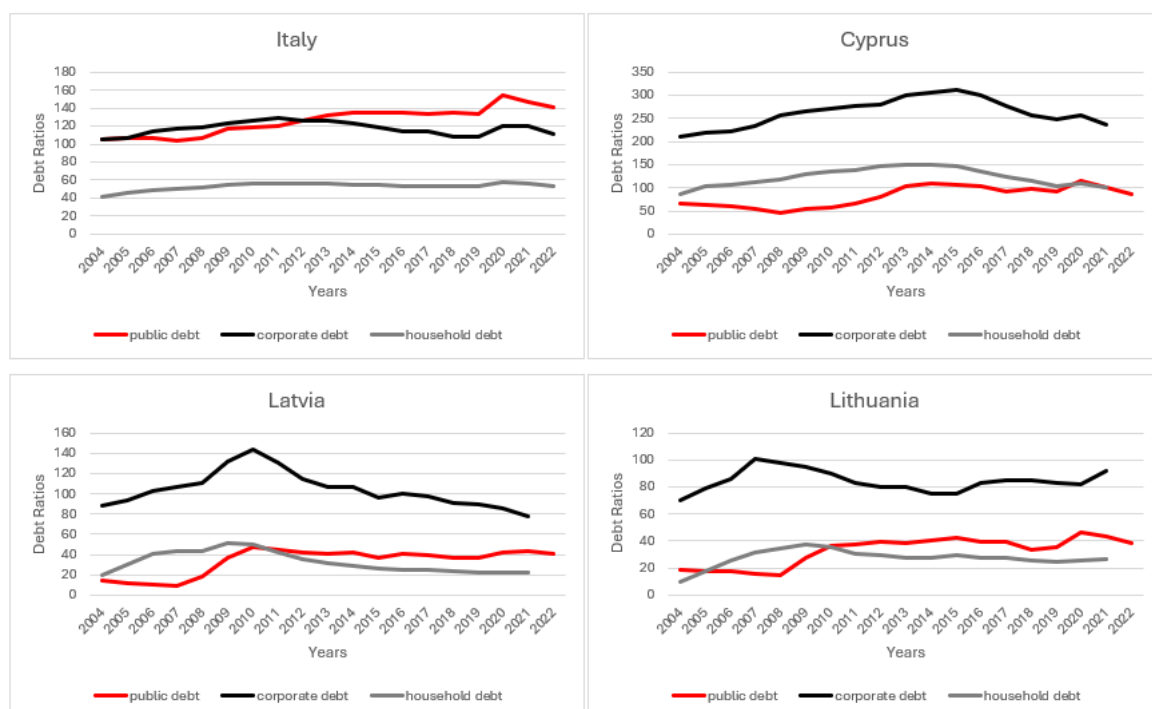


Figure 8

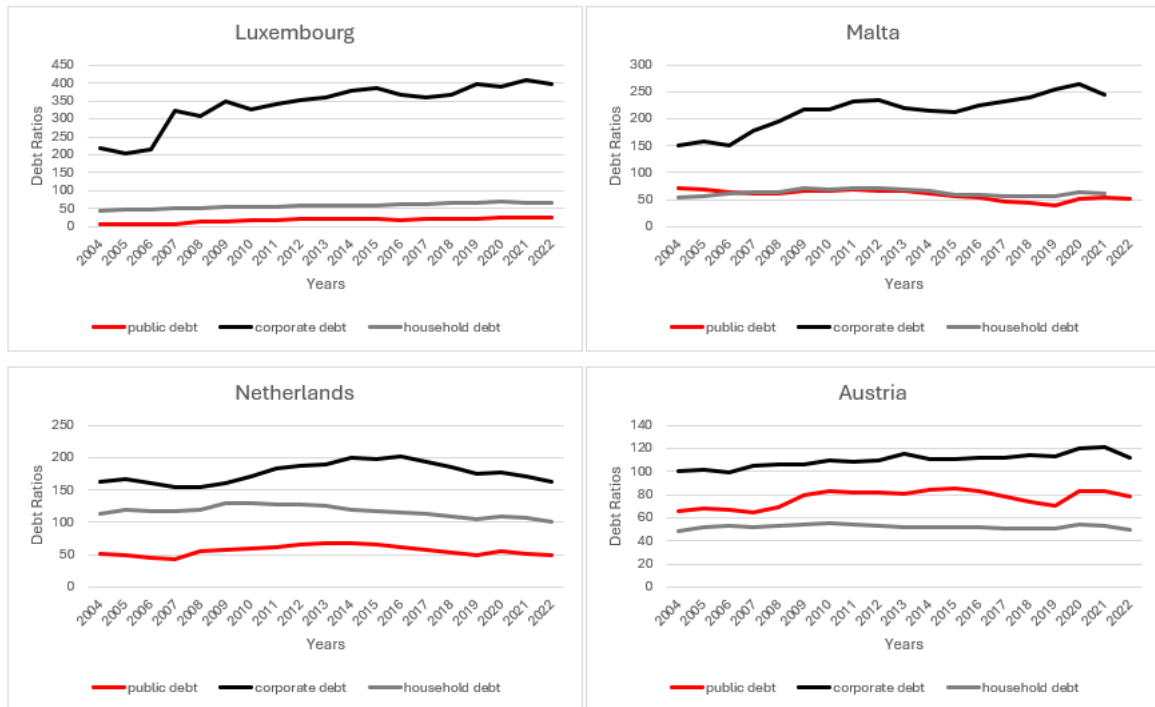
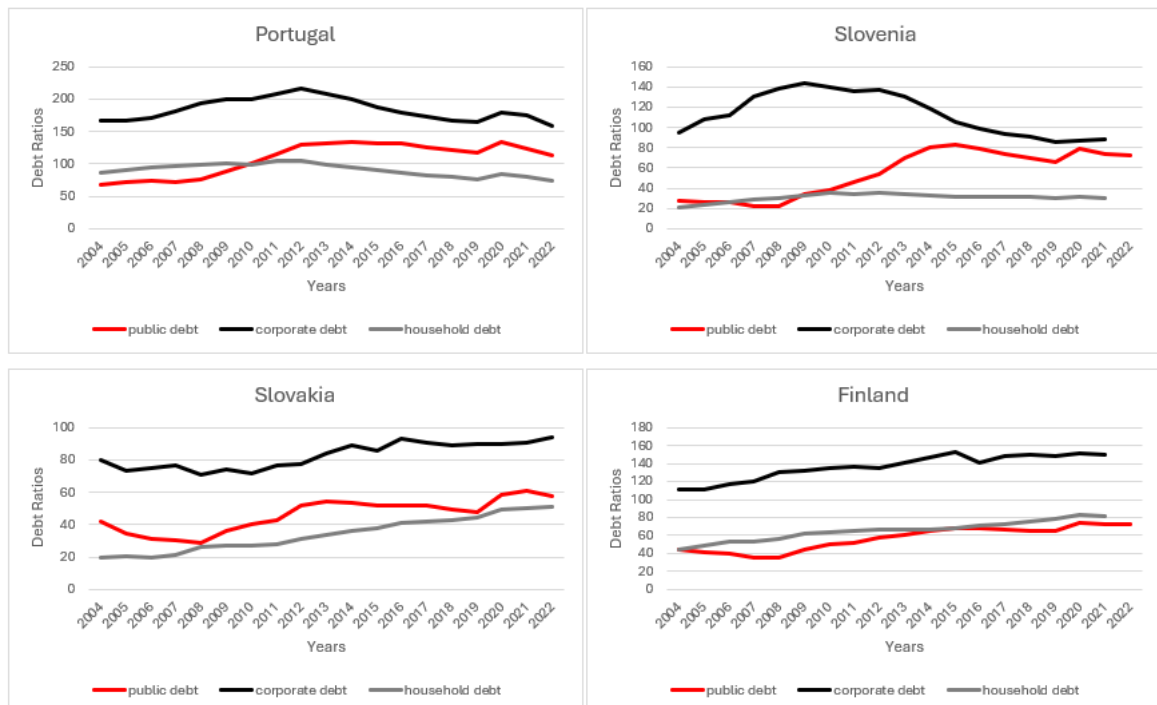


Figure 9



Appendix 4

Inflation Rate and Real GDP Growth in between 2004-2022 in Euro Area

Figure 10

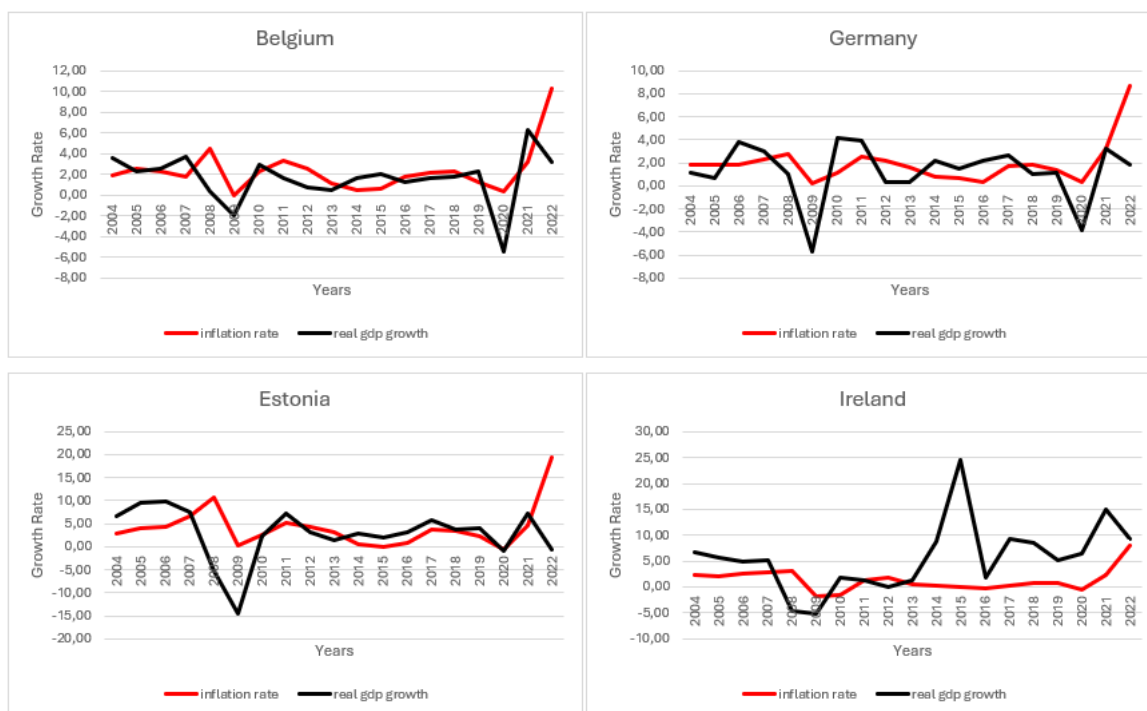


Figure 11

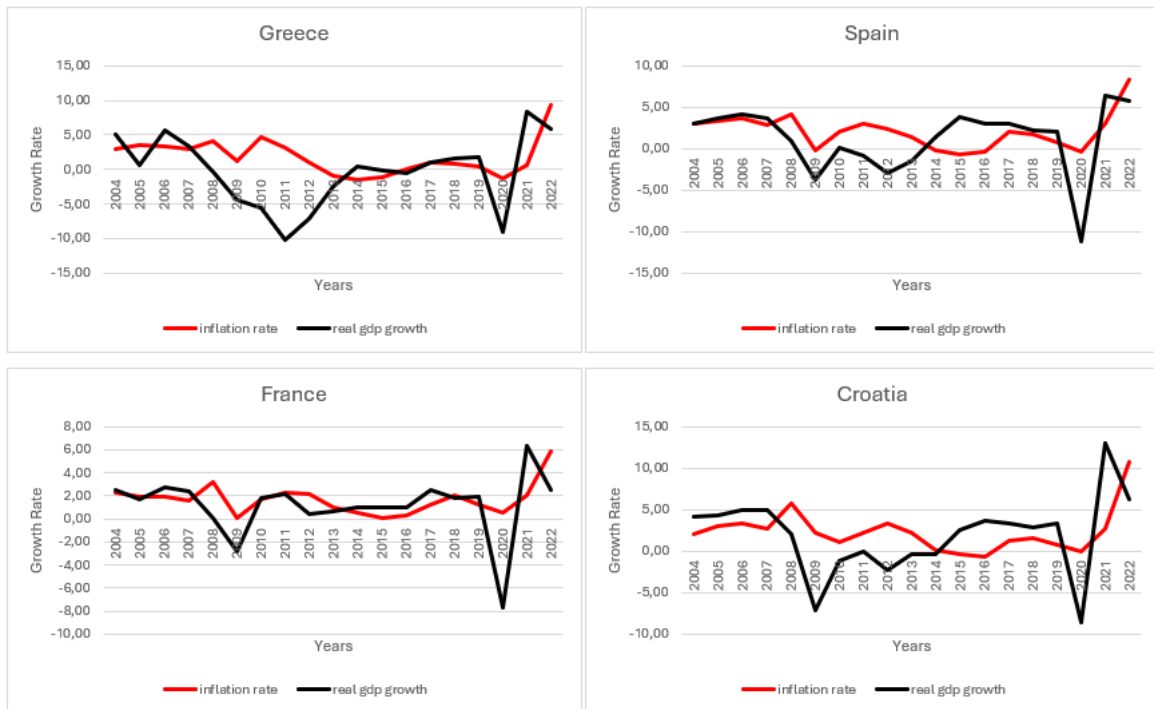


Figure 12

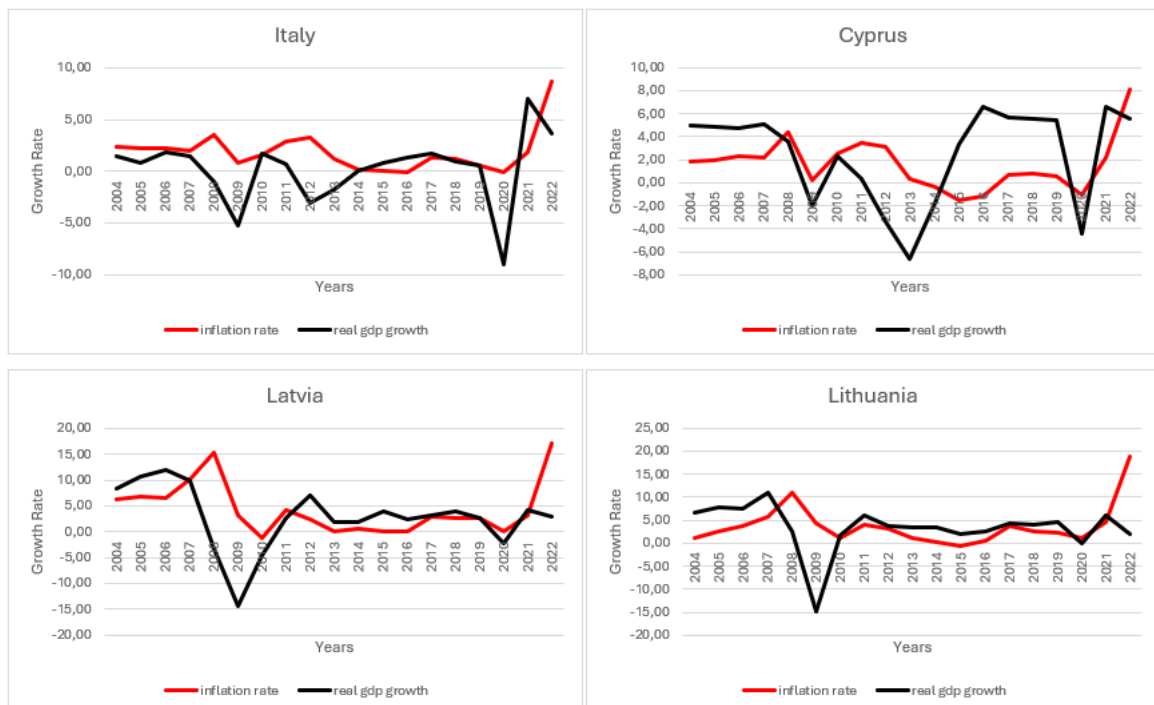


Figure 13

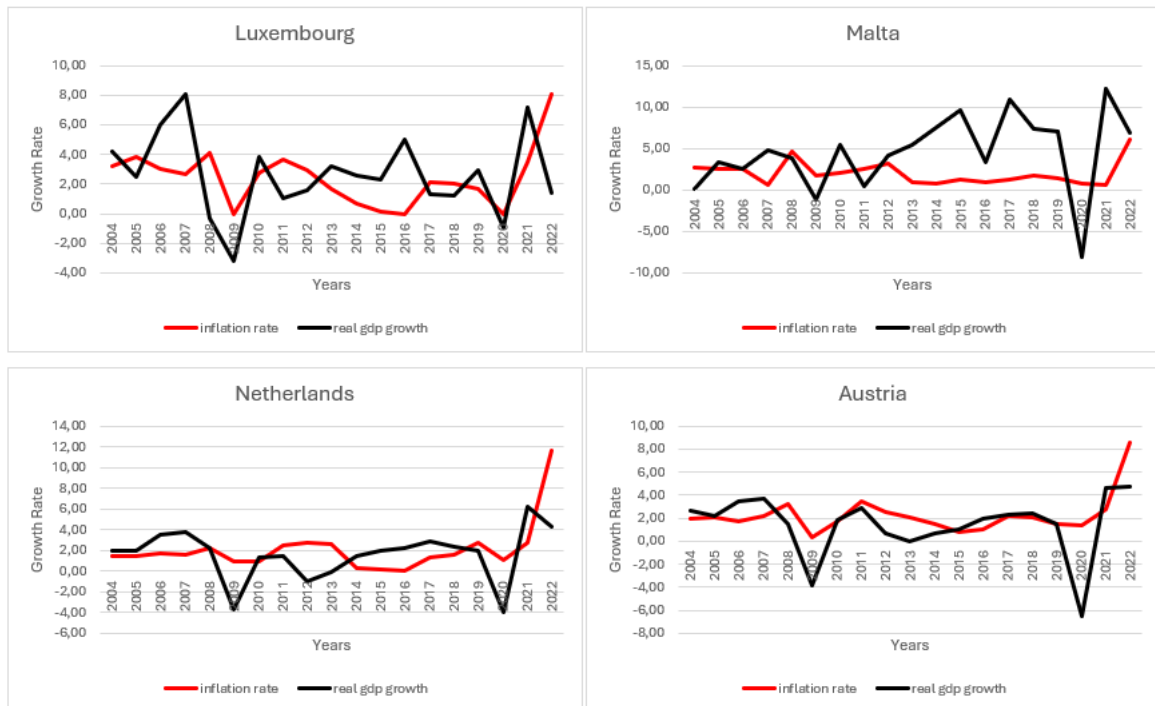
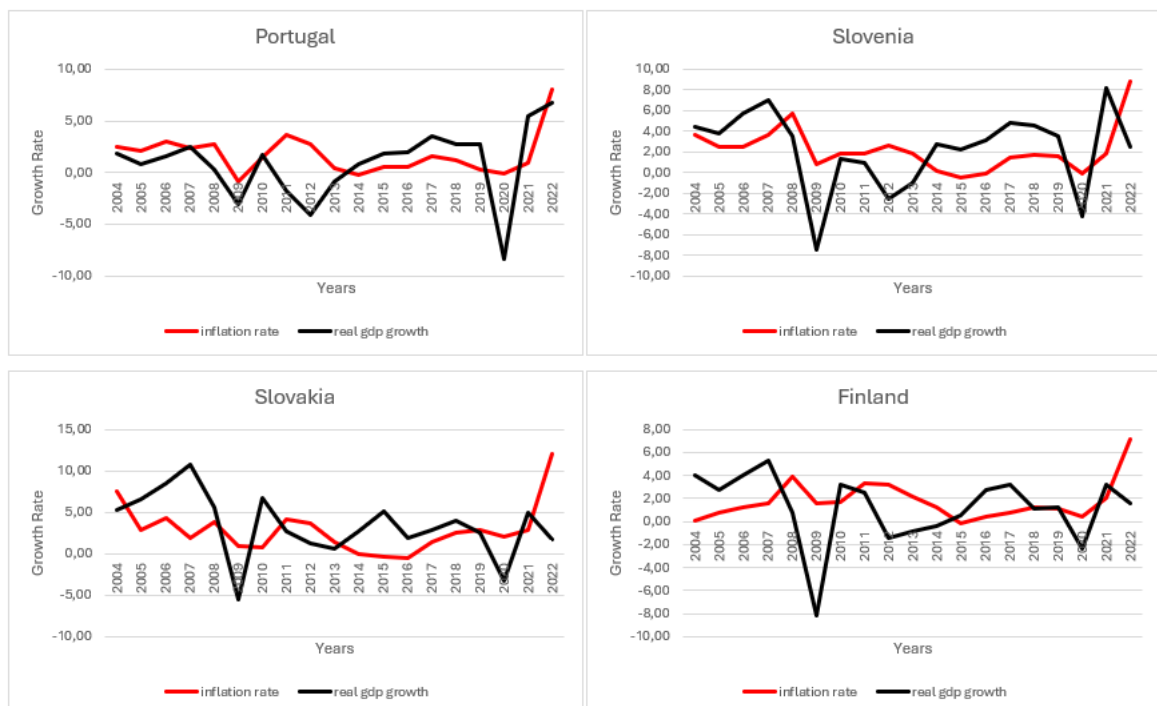


Figure 14



Appendix 5

Real Long-Term Interest Rate and Average Policy Interest Rate in between 2004-2022 in Euro Area

Figure 15

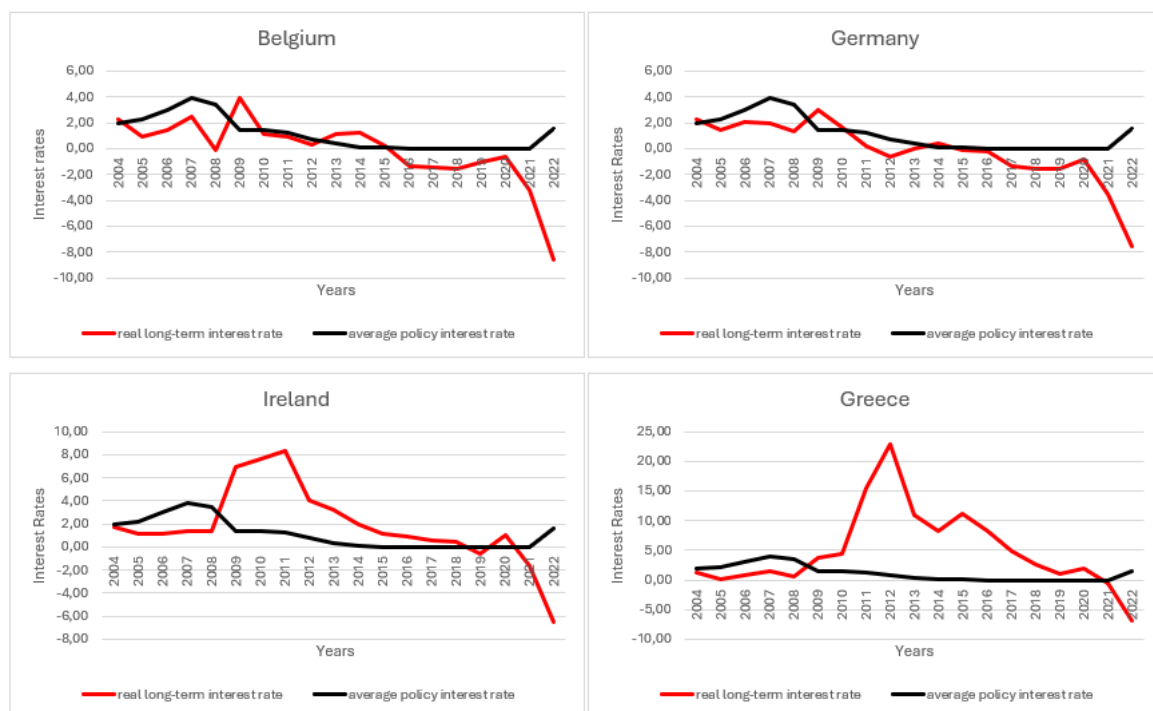


Figure 16

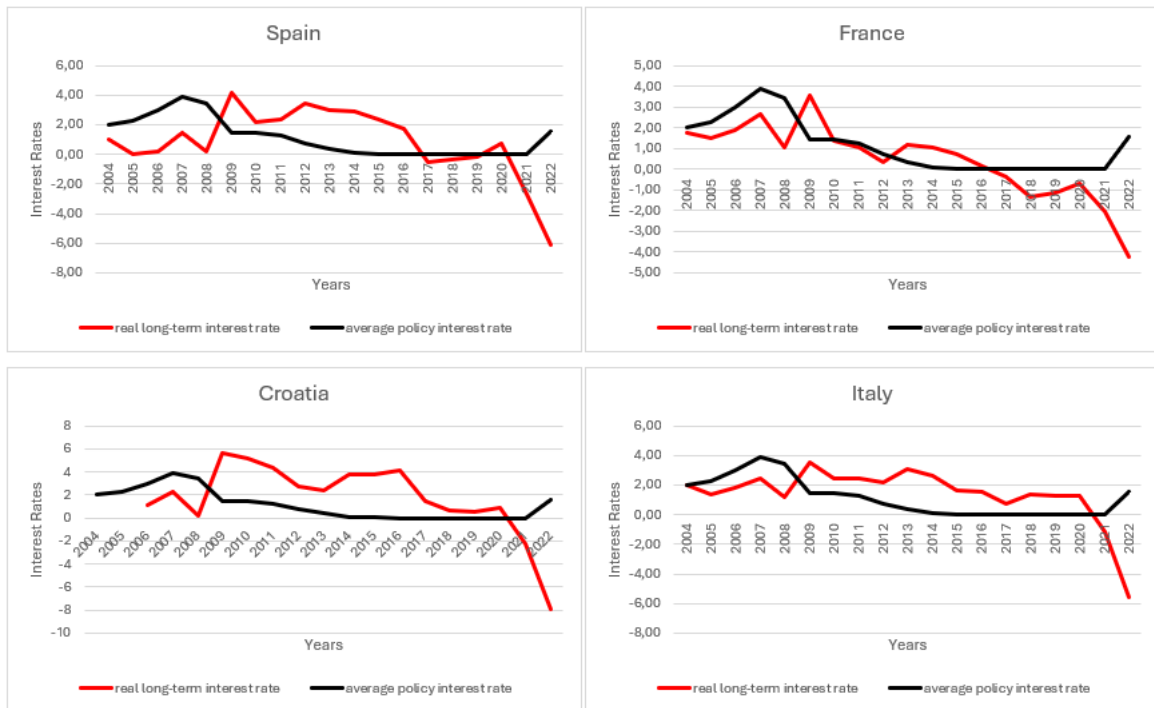


Figure 17

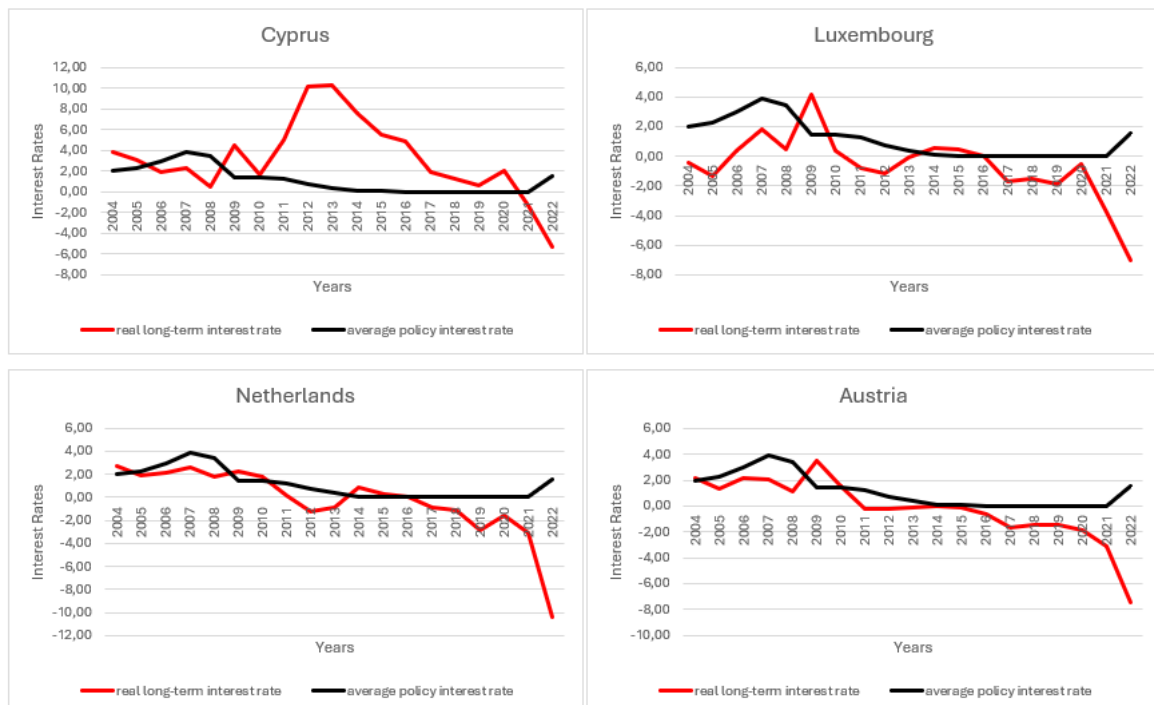


Figure 18

