



Effects of macroeconomic variables on Southern European government bond spreads in different monetary policy environments

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ABSTRACT

This thesis assesses the impact of the three major macroeconomic variables inflation, GDP-growth and unemployment on the sovereign bond spreads of the GIIPS countries. I regress these monthly variables on the monthly spreads over the last ten years. By controlling for various other macroeconomic variables and daily data, I ensure to observe their effect on the spreads as well. Furthermore, I split the data of the main monthly data set into two different periods (QE- and QT-times) to obtain possible differences in the spread determinants during different monetary policy environments. The research focus is to determine the effect of the three variables in general first, before analysing them in different monetary policy periods (QE- and QT-period). Indeed, all three main variables of interest are very significant drivers of the respective spreads for the whole time period, regardless of the monetary policy environment and within the single countries. But other control variables and variables such as the VIX index or credit ratings also have a significant impact on the spreads. Especially the QT-period needs to be observed further over the future as QT in the Eurozone just began. Existing literature has shown that monetary policies by the ECB have a significant impact on the spreads, but my results indicate that the three macroeconomic and market factors have a very significant impact on the spreads, regardless of the environment or country, as well.

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RESUMO

Esta tese avalia o impacto das três principais variáveis macroeconómicas - inflação, crescimento do PIB e desemprego - nos spreads das obrigações soberanas dos países do GIIPS. Regrido estas variáveis mensais nos spreads mensais dos últimos dez anos. Ao controlar diversas outras variáveis macroeconómicas e dados diários, asseguro a observação do seu efeito nos spreads. Além disso, divido os dados do conjunto principal de dados mensais em dois períodos diferentes (período QE e QT) para obter possíveis diferenças nos determinantes dos spreads durante diferentes ambientes de política monetária. O objectivo da investigação é determinar primeiro o efeito das três variáveis em geral, antes de as analisar em diferentes períodos de política monetária (período QE e período QT). Com efeito, as três principais variáveis de interesse são factores determinantes muito significativos dos respectivos diferenciais durante todo o período, independentemente do contexto de política monetária e nos diferentes países. Mas outras variáveis de controlo e variáveis como o índice VIX ou as notações de crédito também têm um impacto significativo nos diferenciais. O período QT, em especial, deve ser objecto de uma observação mais aprofundada no futuro, uma vez que o período QT na zona euro acabou de começar. A literatura existente mostrou que as políticas monetárias do BCE têm um impacto significativo nos spreads, mas os meus resultados indicam que os três factores macroeconómicos e de mercado também têm um impacto muito significativo nos spreads, independentemente do ambiente ou do país.

Título: Efeitos das variáveis macroeconómicas nos spreads das obrigações de dívida pública do sul da Europa em diferentes ambientes de política monetária

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Palavras-chave: Obrigações do Tesouro Europeias, spreads, determinantes macroeconómicos, política monetária, países GIIPS

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GLOSSARY

APP.....Asset purchase programme
 bps basis points
 CBOEChicago Board Options Exchange
 CPI..... Consumer Price Index
 ECBEuropean Central Bank
 EMU European Monetary Union
 FTSE..... Financial Times Stock Exchange
 GDP Gross domestic product
 GIIPS..... Greece, Italy, Ireland, Portugal, Spain
 IBEX.....Iberia Index
 IOBE..... The Foundation for Economic & Industrial Research
 ISEQ Overall Index Irish Stock Exchange Overall Index
 MIBMilano Italia Borsa
 OMTOutright Monetary Transactions
 PEPP..... Pandemic emergency purchase programme
 q/q..... quarter on quarter
 QE..... Quantitative Easing
 QT.....Quantitative Tightening
 S&PStandard & Poors
 SMP.....Securities Markets Programme
 SVBSilicon Valley Bank
 TLTRO Targeted longer-term refinancing operations
 TPI..... Transmission Protection Instrument
 UBSUnion de Banques Suisses
 USA.....United States of America
 VIX..... Volatility Index
 y/y.....year-on-year

CHAPTER 1: INTRODUCTION

“Whatever it takes”. In a critical and highly anticipated speech by the former ECB president Mario Draghi in 2012, he used those three words to reassure confidence in European government bonds (ECB, 2012). Such a European sovereign debt crisis was unprecedented because after the introduction of the Euro, the government bond yield of most European countries was almost identical until the financial crisis in 2007/2008. With the financial crisis, things changed and most European governments increased spending to absorb a part of the economic breakdown or to bail out banks. This led to different views on the financial stability of some countries and their respective government bond yield was rising significantly. Especially the spreads of Southern European countries against German government bonds began to deteriorate and peaked in 2012 during the European sovereign debt crisis. This evolution has shown the importance of understanding the dynamics and determinants of spreads, as a country's borrowing costs are of enormous political and public interest.

More relevant and recently, inflation in the Eurozone started to increase and reached double-digit percentage points on a y/y basis in most countries and the Eurozone as a whole. This marked the urge for a change in monetary policy. The ECB announced their first interest rate hike in July 2022 in almost a decade, coupled with an announcement to drive back their open-market purchasing programmes and other adjustments to monetary policy tools such as TLTRO. Such changes directly impact the yields of European government bonds and therefore, the borrowing costs of these countries (Acharya et al., 2019). The discussion about the borrowing costs of European countries is critical as it directly determines the government's ability to spend. It even gets more crucial if the borrowing conditions for some countries worsen but not for others. This is particularly dramatic for countries in the same monetary union, as we have seen in the deterioration of spreads in the past and recently. If the differences in funding costs become too severe, the questionable financial sustainability of high cost countries ultimately threatens to cause a break-up of the monetary union. In 2022 we saw a substantial increase in Italy's government bond spread, being one of the reasons for the ECB to implement their TPI tool (Transmission Protection Instrument). The ECB announced tools, such as the OMT program, that helped to bring down spreads in the past as well (Acharya et al., 2019) and it seems clear that QE and other central bank policies have a significant impact on bond yields and therefore spreads too (Belke and Gros 2021; Malliaropoulos and Migiakis 2023; Acharya et al., 2019). All this underlines the importance of understanding the drivers of spreads.

The question remains about what drives the spreads apart from monetary policy and moreover, does the relevance and significance differ in varying monetary policy environments. Focusing on macroeconomic variables, it makes sense to look closer at inflation, GDP-growth and unemployment, as these variables are among the most important macroeconomic data (Afonso and Tovar Jalles, 2019). Many papers analyse macroeconomic effects, by also focusing on three main variables (Arghyrou and Kontonikas, 2012; Manganelli and Wolswijk, 2009). As mentioned before, understanding the drivers of spreads as good as possible can be very valuable for politicians and policymakers.

This leads to the main research question of this thesis:

“How significant are the macroeconomic variables inflation, GDP-growth and unemployment as determinants of European government bond spreads in different monetary policy environments?”

The focus hereby lies on the Southern European countries labelled as the GIIPS countries (Greece, Italy, Ireland, Portugal, Spain), because these countries' spreads have been the most discussed and volatile since the financial crisis. Moreover, they have been at the centre of attention during the European sovereign debt crisis (Beetsma et al., 2013). For the analyses and the regressions, I use monthly data for the macroeconomic variables over the last ten years. In a separate step, this data set gets split into a QE- and QT-period to account for different monetary policy environments. The gathered and cleaned data is used for multiple regressions over the whole period and two multiple regressions for the two respective time periods to make comparisons. Additionally, I include a daily data set with market factors and monetary policy variables to control for more spread determinants. For this step, I conduct an event-study regression to account for monetary policy announcements. The data is retrieved from Datastream and the respective statistical bureaus. Further detailed explanations regarding the methodology and the reasoning behind the separation of the data set as well as the event-study approach can be found in Chapter 3.

The three main variables of interest are indeed very significant drivers of the spreads for the entire time period, over different points in time (QE- and QT-period) and within the specific countries. These results are robust after checking for endogeneity, multicollinearity and

controlling for more macroeconomic variables. While conducting these robustness checks I also find credit ratings to be a significant determinant as well as the VIX as a significant market factor from the daily data set. It will be especially interesting to confirm these results over the future for the ongoing QT-period.

The second chapter will give an overview of the existing literature and underlines the contribution of this thesis to the overall discussion on European government bond spreads.

The 3rd chapter describes the methodology, the research approach, as well as limitations of this work. In the fourth chapter, the results and implications from the regressions are displayed and discussed and the last chapter summarises the conclusions of the thesis and gives indications about the discussion in the future as well as prospective research.

CHAPTER 2: LITERATURE REVIEW

2.1 Literature on the determinants of spreads

The existing literature and papers define and find various determinants of spreads and significant effects of monetary policy announcements on spreads as well. Dewachter et al. (2015) analyse the components of European sovereign yield spreads by looking at country-specific economic factors, fundamentals and international influences. Moreover, they find that economic fundamentals are the “dominant driver behind sovereign bond spreads”, although shocks that are unrelated to these fundamentals also have a significant impact. These findings are particularly interesting for this thesis, as it underlines the importance of macroeconomic factors for spreads. The difference in this thesis is not to confirm this significance in comparison to other factors but to analyse the main three macroeconomic factors and how they differ in different monetary policy environments and across different countries.

Georgoutsos and Migiakis (2013) investigate macroeconomic variables, economic conditions and volatility as determinants of European sovereign spreads during and after the financial crisis. As this paper groups them into domestic and euro-area aggregates and makes observations over different points in time, it is very similar to this thesis. They find significant results, especially for volatility measures but the results differ between time and country, making general implications difficult. D’Agostino and Ehrmann (2014) take macroeconomic variables into account as well. But in contrast to this thesis, they focus on expected values for these variables and not the variable itself. To make observations over time they use these high-frequency expectations as proxies to allow for time-varying parameters. They find a significant relationship between these macroeconomic variables on the spread but additionally they see asymmetries in the pricing of risk over time.

This thesis is closest to Afonso and Tovar Jalles (2019), who analyse European government bond spreads by the following approach. First, they confirm and estimate the determinants of spreads for the years 1999-2016 with macroeconomic and market factors being the variables. In the second step, they compute a time-varying model based on the first step that tries to capture the temporal dynamics. Due to their long time horizon, they can split their dataset into a pre-financial crisis period and a post-financial crisis period. This thesis follows the same approach but focuses on observing the general effects of macroeconomic variables on the spread before comparing results for different monetary policy environments in different periods

of time. Ultimately, they find significant results with the time-varying model, especially for long-term refinancing operations and the Covered Bond Purchase Programme by the ECB, meaning they are consistently significant. Time-varying models can be found in several other papers as well (Paniagua, Sapena, and Tamarit, 2017). Still, in this thesis, the data set rather gets split into two time periods than applying a time-varying model to control more strictly for the respective differences in these time periods.

Bernoth and Erdogan (2012) studied the determinants of sovereign bond spreads by implementing a similar time-varying coefficient model for 10 EMU countries between 1999 and 2010. They find significant results, especially for the respective countries' debt level and investors' risk aversion at the beginning of the observed period. Later, during the financial crisis, they found loosening fiscal policies and Germany's "safe haven" status as significant drivers for the increase in spreads. This significant "safe haven" status is confirmed by other papers for different periods as well (De Santis, 2012; Costantini and Sousa, 2022). Among many significant determinants of spreads that are observed during the financial crisis, De Santis (2012) defines three main and similar determinants to other papers: i) an aggregate macroeconomic risk factor, ii) the country-specific credit risk and iii) the spillover effect from Greece.

In a different approach, Klose and Weigert (2014) define "fundamental factors versus redenomination risk" as the main determinants for the spreads. They find significant results for both, but argue that without the existence of the same currency, the GIIPS countries would depreciate their own currency. In contrast, the other European countries would appreciate their domestic currency. This is interpreted as a systemic risk factor that also influences sovereign bond yields. Another paper tries to identify drivers of European sovereign spreads by looking at a broad range of variables such as macroeconomic factors, market factors and the domestic banking sector, for the period after the financial crisis in 2008 until 2013. They find that the increase in spreads over this period of time is not only explained by worsening macroeconomic factors but by the overall market and risk sentiment and the indebtedness of the domestic banking sector (Gómez-Puig, Sosvilla-Rivero, and Ramos-Herrera, 2014).

For example, Arnold and Soederhuizen (2018) analyse the relationship between ECB policy decisions and the sovereign bond holdings of the domestic banking sector and therefore ultimately the impact on the bond yields as well.

Afonso et al. (2015) look at macroeconomic variables in relation to increasing risk (default risk) and volatility to gain insights into European government bond spreads. They find macroeconomic variables are rather unstable as spread determinants, but their effect increases in times of crisis or with increasing default risk and volatility. Aßmann and Boysen-Hogrefe (2012) and Favero, Pagano, and von Thadden (2010) define differing credit and liquidity risks of the respective countries in the Euro-zone as the primary driver of spreads during and after the financial crisis and conclude that both types of risks are significant drivers of the spreads with credit risk (or default risk) being the more significant one for the first paper. The latter finds a relatively comparable effect of the two types of risk.

It is interesting to see that many papers, whether they analyse the spreads during the financial crisis, during the first asset purchase programs or during the COVID-19 pandemic, find relatively similar determinants that have a significant impact on the spreads. Namely these are credit ratings and default risk, macroeconomic variables like inflation or GDP, overall market risk proxied by volatility, contagion and spillover effects.

Contrary to focusing on fundamentals and macroeconomic data, Silvapulle et al. (2016) concentrate on market determinants such as the domestic stock markets, volatility indices, interbank interest rates and S&P 500 returns as the determinants of European sovereign spreads. Additionally, they look at contagion effects among the five GIIPS countries as well, meaning how they might influence each other's spread. They find not only significant results for the market factors in driving the spreads but also quantify an "overwhelming evidence of financial contagion effect among the peripheral countries".

Among contagion effects, Ehrmann and Fratzscher (2017) confirm these spillover effects for Southern European countries and additionally detect fragmentation and flight-to-quality patterns. Spillover effects are not only confirmed for different countries but also for stock markets (Gnewuch, 2022). As multiple papers not only find significant drivers of spreads in Europe in general, but certain contagion effects as well (Arghyrou and Kontonikas, 2012), it is interesting to look at effects in single countries too. Therefore, this thesis performs regression analysis for the single GIIPS countries. However, it will not estimate contagion effects in particular. To predict and understand possible spillover effects, Clancy, Gabriele, and Žigraiová (2022) analyse tail-risk exposure measures as a predictor for spillover effects in Greece. They can confirm that "ex-ante measures of tail-risk exposure can provide useful real-time signals of

cross-market spillovers". Corradin and Schwaab (2023) try to understand the determinants of spreads with a focus on the COVID-19 pandemic by separating the euro sovereign bond yields into five components (short-term risk-free rates, default risk, redenomination risk premium, liquidity risk, segmentation). They find significant effects for all five components especially while controlling for monetary and fiscal announcements during the pandemic.

In conclusion, I find many papers in the literature that see significant results for various macroeconomic factors at different points in time. Apart from macroeconomic variables, the following subchapter also analyses papers focusing on the effect of ECB announcements on the spreads.

2.2 Literature on the Effects of ECB Policies and Announcements

Ghysels et al. (2017) look at the effect and effectiveness of ECB purchase programs, especially the SMP (Securities Markets Programme) and find that SMP Interventions reduce yields significantly and therefore can influence and reduce spreads.

In a very similar approach, Eser and Schwaab (2016) find a significant negative effect of the SMP on yields as well. Moreover, they see lower bond yield volatility and lower tail risk due to the SMP.

One of the biggest purchasing programs introduced after the SMP was the Asset Purchase Programme (APP). In an early assessment of the impact of this specific programme, Andrade et al. (2016) find significant and persistent results that the Asset Purchase Programme lower the yields and spreads. In line with this, De Santis (2020) examines the impact of the APP on the yields and spreads too. He does not apply an event study approach but uses an index in Bloomberg that tracks discussions about this program. His estimations suggest a significant reduction of spreads due to the program, but he points out that the reduction effect is much larger than those suggested by event studies. However, he assumes considerable limitations for the results because some details regarding the purchasing program were communicated well in advance of the "official" announcement in January 2015 and the actual implementation. When performing an event study approach in this thesis, this problem will be addressed as well.

On the other hand, Urbchat and Watzka (2020) use an event study approach to assess the impact of quantitative easing announcements on the spreads and yields and find significant results for such announcements.

Ambler and Rumler (2019) employ an event-study model as well to capture the effects of monetary announcements on the spreads as well but they measure the effect through “market-based inflation expectations, focusing on their impact on ex-ante real interest rates. Therefore, they do not only consider the announcements themselves but to which extent this was a surprise by putting it in relation to market expectations. To avoid the problem with previously published information before the actual announcement and implementation, Fanelli and Marsi (2022) are not only looking at such announcements themselves but at the surprise factor in such announcements. They want to capture any deviation in expectations regarding anticipated announcements by employing high-frequency observations of monetary surprises. They outline, that the “spread-shock”, the shock after a surprise announcement, “represents an important ingredient of the transmission mechanism of monetary policy in the Euro Area”.

Additionally, Altavilla, Carboni, and Motto (2015) analyse the effect of various ECB purchase programs not only on government bond yields but on financial markets in general. This effect on financial markets is also confirmed in another paper (Joyce et al., 2010). Multiple papers employ event-study-type regressions to measure the effect of various ECB announcements regarding monetary policy. Fendel and Neugebauer (2020) confirm decreasing spreads after such announcements after the financial crisis until 2019. Ortman and Tripier (2021) are looking at such announcements during the COVID-19 pandemic in particular and find that especially the announcement and press releases in March 2020 (with the announcement of PEPP etc.) significantly prevented rising spreads in the European sovereign debt market. They confirmed these results even for the stock market.

In a different paper, the authors try to measure not only the impact of monetary policy announcements but fiscal announcements as well. According to them, the announcement of the PEPP has the most considerable compressing effect on the spreads. Regarding fiscal policy impacts, they find that the relaxation of European fiscal rules, which enables countries to take on debt more easily than before, widens the spreads in general (Havlik et al., 2022). As fiscal announcements are not included in this thesis, the results regarding monetary policy are most relevant for this work. It still may be noted that fiscal announcements have a significant effect as well, but it is not as strong as for monetary policy announcements.

CHAPTER 3: METHODOLOGY

3.1 Research Approach

This thesis applies an event study and panel data regressions to gain insights into the macroeconomic determinants of Southern European government bond spreads. The key interest is to obtain the long-term effects of the three main macroeconomic variables inflation, GDP-growth and unemployment in different monetary policy environments while controlling for various ECB announcements and market factors. The thesis employs monthly data of 10-year government bond yields over the last ten years for the five GIIPS countries, Greece, Italy, Ireland, Portugal and Spain. The retrieved values are end-of-month values for all working days over the respective time period. As the key variable of interest is the spread of these countries, they are computed by subtracting the respective 10-year German government bond yield for each day of the countries' yield. The significance and sensitivity of the determinants on the spreads might differ over time and in different environments. Therefore, this thesis first identifies the macroeconomic variables' general effect on the spreads, before trying to capture a difference in these effects in different monetary policy environments, as specified in the research question in the introduction.

The two time periods are defined as a QE-period, ranging from 01/03/2013 until 31/01/2021, and a QT-period, ranging from 01/02/2021 until 28/02/2023. The first period is defined as the QE- period because after the OMT announcement in 2012 by Mario Draghi, the start of a further decrease in interest rates and the start of several open-market asset purchase programs by the ECB (Gibson, Hall, and Tavlas, 2016; Farinha and Vidrigo, 2021; Acharya et al., 2019), marked the beginning of the unprecedented loose monetary policy. With Covid and the introduction of PEPP, monetary conditions got eased even more (ECB, 2020b). Separating the dataset into two different periods is also used by Afonso and Tovar Jalles (2019). In this thesis the separation is supposed to control for different monetary policy environments.

With increasing inflation within the entire Eurozone at the end of 2021 and double-digit inflation numbers in 2022, the monetary policy environment changed with the first interest rate hike in almost a decade and the announcement of a TPI program by the ECB in July 2022 (ECB, 2022). Although at the beginning of 2021, the monetary policy environment had not changed that much yet and Covid restrictions along with huge government spending were still ongoing, this thesis nevertheless identifies the 1st of February 2021 as the starting point for the second

period to reach more observations and more significant data. Even with this relatively short time horizon, it is essential to get insights as quickly as possible, as the announcement of the TPI program shows the importance of the discussion around European government spreads and the question of what drives them. Therefore, it is going to be very interesting to update and confirm the results and indications from this thesis regarding the QT-period over the coming years.

To get the desired insights, this thesis primarily applies a three-step approach: i) confirm and estimate the coefficients for the macroeconomic factors determining the spreads in a panel regression for the monthly data over the whole period; ii) conduct an event study within the panel set of daily data to observe the impact of ECB decisions and announcements on the spreads and other market data; iii) conduct separate regressions with the monthly macroeconomic dataset for both the QE- and QT-period, in order to observe differences between both monetary policy environments. In all the steps, country-specific time-series regressions are performed simultaneously to observe potential differences between the respective countries.

3.2 Data and Variables

The thesis distinguishes between a monthly dataset and a daily dataset used for an event study. The first dataset consists of monthly data of account the macroeconomic variables and the end-of-month spread as the dependent variable. The second dataset consists of daily data of market data and the daily spread as the dependent variable. The data regarding the yields and market variables is retrieved from Datastream and the domestic macroeconomic variables are retrieved from the respective domestic statistical bureau. As macroeconomic data gets published at different points in time during a month, looking at the end-of-month spread is more suitable than looking at the middle-of-month spread or something comparable. As inflation and employment data do not necessarily get published on the same day, this should be kept in mind while analysing the results, because the effect of some variables might lag more than other ones.

The macroeconomic variables are *infl*, *gdpg*, *empl*, *ulcg*, *srtg*, *frtg*, *mrtg*, *sent*, *mrfr* and *m2g*, which will be used in all the steps mentioned above. Along the three focused macroeconomic variables such as inflation, GDP growth and unemployment data, this thesis includes credit ratings, unit labour cost growth (*ulcg*), Consumer and Business Sentiment (*sent*), the main refinancing operations rate (*mrfr*) and money supply M2 growth (*m2g*) as well. Afonso and

Tovar Jalles (2019) calculate their variables in relation to the German benchmark, subtracting the German inflation from the respective countries' inflation for example. The variables in this thesis are not calculated relative to the German counterparts but as absolute values. This is due to the different publishing dates for the data in different countries, which would distort the observed effects on the spreads. Further descriptions and explanations regarding the variables can be found in Appendix 1 and Appendix 2.

However, this selection of variables may induce two main problems while performing the regressions and analysis: endogeneity and multicollinearity. The results may be diluted through the correlation of the main independent variables to the error term. Moreover, and even more relevant is the multicollinearity between the variables themselves, meaning a high correlation between two independent or control variables. It is very likely that the different credit ratings are highly correlated with each other, for example. To deal with these problems I perform robustness checks by applying a differences-in-differences regression and performing additional regressions with omitted variables. Differences-in-differences regressions are a standard measure while dealing with endogeneity (Costantini and Sousa, 2022; De Santis, 2020). Nevertheless, such issues should be kept in mind while looking at the results.

The main refinancing operations rate by the ECB is supposed to control for the general interest rate environment as well as the money supply M2 growth for the amount of money and liquidity in the overall market. These are just indicators for monetary policy and are not supposed to observe short-term effects or significant conclusions regarding the effect of monetary policy itself, as this is controlled for in the second data set. The main objectives remain the three macroeconomic variables of the monthly data set. Additionally, as the influence of the interest rates on the spread mainly depends on the deviation of the expected interest rate increase or decrease (De Haan, 2008; Hubert and Labondance, 2018), the mrfr is rather included as a proxy for the general environment than as a focused variable. For example, suppose the ECB increases interest rates by 50bps but the market expected and traders already priced in a 75bps hike. In that case, the estimates and interpretation of the effect on the spreads may be misleading after the announcement is published. On the other hand, as most macroeconomic data is released on a quarterly or monthly basis, it makes it difficult and inappropriate to use daily data, although it is available for the dependent variable. This is another reason for separating the two datasets into daily and monthly data, where the observations on the daily data set should work as a control and robustness check for the focused monthly data set. Quarterly data such as GDP and Unit Labour Cost are linearly interpolated on a monthly basis in the monthly data set. Linear

interpolation is sufficient here because considering GDP for example, it is challenging to quantify monthly or even daily trends etc., making linear interpolation the more conservative and better option.

Next to the importance of the variables included, I have some expectations about their effect on the spreads as well. I expect a positive effect of inflation on the spreads as increasing inflation in a country destabilises the country and hurts the purchasing power. Therefore, this should increase a country's credit risk, leading to higher yields and spreads. Higher unemployment is a sign of an unhealthy and weaker economy, leading to more uncertainty regarding the confidence in a country to repay its debt. Again, this should lead to higher yields and spreads, which is why I also expect a positive relationship. In line with that, lower unit labour costs should help the economy and increase its competitiveness, contributing to my expectation of a positive relationship for higher unit labour costs on the government bond spreads.

On the other hand, I expect a negative relationship between the GDP-growth variable and the business sentiment variable. Higher GDP-growth indicates a stronger economy, which should lower credit risk in general and therefore bring down yields and spreads of the respective country *ceteris paribus*. Changes in credit rating should have a more direct and immediate effect on the spreads as credit risk and ratings are huge drivers for a bond's yield in general (Kenourgios, Umar, and Lemonidi, 2020; Hull, Predescu, and White, 2004). Therefore, the variables for a change in credit rating for all three major rating agencies should have a negative relationship and impact. However, if all the information leading to a change in credit rating is public and available before the actual rating change, there might be no "surprise effect" in the rating change itself. Due to this problem, the relationship might not be as significant as expected.

A similar problem regarding the "surprise effect" might occur while analysing the effect of the two dummy variables for the ECB monetary policy announcements. Nevertheless, I expect a negative relationship for QE-type announcements and a positive relationship for QT-type announcements. A looser monetary policy should ease financial conditions for a government, especially for more distressed countries like GIIPS in relation to Germany, and therefore bring down yields and spreads. I expect the opposite effect for a tighter monetary policy as financial conditions get stricter and should impact distressed countries more.

The problem with the “surprise effect” and various other limitations regarding the ECB announcements is mentioned in more detail later in this chapter.

The second dataset consists of daily data considering ECB announcements and market data such as the leading domestic equity index of the country and daily VIX data, to better understand the respective variables' effects to control for them. More details and explanations regarding the domestic equity indices can be found in Appendix 2 as well.

For the respective domestic equity index variable, I expect a negative relationship with the dependent variable as a strong stock market indicates a strong economy at that time and therefore should tend to lower yields and spreads of the respective country. The same applies to the VIX variable as higher (implied) volatility may cause more uncertainty in the stock markets, leading to more investment into bonds and ultimately bringing down yields and spreads. That’s why I expect a negative relationship as well. However, this might not be true for more extreme cases and scenarios of crisis and volatility, where fear also spreads to the bond markets.

As explained above, the main goal of the thesis is to observe the longer-term effects of the three focused macroeconomic variables on the spreads. However, we cannot neglect that short-term effects also matter, especially for monetary policy announcements, as they particularly influence spreads in the short-term straight after the announcement, for example. According to different theories we can expect that the impact of an announcement on the spread occurs immediately after the announcement (“stock effect”), as traders adjust their pricing for bonds according to the new information immediately. The subsequent implementation over time might not have the same effect anymore, as there is no new or additional information anymore which leads to a different yield or spread (“flow effect”) (Havlik et al., 2022). Taking this into account, this thesis rather looks at the announcement date than looking at the actual implementation of the announced measures. Announcements of the ECB regarding its purchasing programs account for a considerable share of the overall yield impact (Altavilla, Carboni, and Motto, 2015; Urbchat and Watzka, 2020). Therefore, it makes sense to not only control the monthly data for a subsequent daily dataset as well but to perform an event study within this panel data to observe the effects of the announcement. Daily data for the dependent variable and the independent variables are available to perform this event study within this panel data set focusing on the two dummy variables *ecbqe*, for

QE-type announcements by the ECB, and ecbqt, for QT-type announcements by the ECB. Information regarding monetary policy decisions are published in press releases after ECB Governing Council meetings or in special press releases. A list of all the included announcements and their classification can be found in Appendix 3.

Like the market's expectations for interest rate decisions, there are also expectations regarding announcements for purchasing programs and other non-standard policies. Therefore, it is crucial to include and capture possible deviations of these expectations in the analysis as well. Discussions are well-covered in the media and are highly anticipated. The announcement itself is rather the last step in an ongoing reflection phase than something new or unexpected in most cases (Havlik et al., 2022). However, economic shocks like the pandemic in 2020 or sudden events like the deterioration in government bond spreads in 2022 cause huge market uncertainty. In both cases, the ECB held emergency meetings. This increased the difficulty to predict ECB policies and was additionally fuelled by changing statements of leading persons like ECB Christine Lagarde over a short period of time. In March 2020, when nationwide lockdowns began and uncertainty was huge, many started to worry about rising spreads for some European countries too. When ECB president Lagarde was asked on March 12th, 2020, what the ECB is possibly going to do about rising spreads of government bonds she responded: “Well, we will be there, as I said earlier on, using full flexibility, but we are not here to close spreads. This is not the function or the mission of the ECB. There are other tools for that, and there are other actors to actually deal with those issues“ (ECB, 2020). Just six days later, on March 18th, 2020, the ECB announced the new purchasing program PEPP, which is a flexible tool to purchase large amounts of European government debt and therefore a tool to possibly control or influence spreads.

The ECB Governing Council meeting in June 2022 committed to a 25 bps interest rate hike for the next meeting in July 2022, which was made clear in the subsequent press conference and press release. However, with the speed of inflation and therefore pressure picking up they ultimately increased the key interest rates by 50 bps, which was not expected. After that, the ECB announced to change their forward guidance approach to a “meeting by meeting” approach, by not committing to certain decisions before the next meetings and making their decisions “data-dependent” when the meeting occurs (ECB, 2022). These are good examples of not only different expectations and anticipations regarding monetary policy by the market but for the increasing difficulty of predicting policy decisions for the future.

In conclusion, it is not easy to quantify expectations regarding such announcements. Regarding interest rate expectations, it is easy to see what traders expected in advance while looking at the respective swap rates that are priced for a respective time horizon between interest rate announcements. This is not observable for purchasing programs, etc. Therefore, quantifying such deviations from expectations or surprise factors are neglected here, but this should be kept in mind while looking at the results. As it is still possible to categorise the announcements into different types, this thesis at least separates the announcements into the two different categories QE and QT and creates two dummy variables for them to capture possible differences.

3.3 Panel Data, Event Study and QE- & QT-period

After gathering all monthly and daily data for the variables, the coefficients of the monthly macroeconomic determinants are estimated in the first step for the panel data set based model of the 5 GIIPS countries. The main regression equation is:

Equation 1:

$$sprd_{it} = \alpha + \beta_1 infl_{it} + \beta_2 gdp_{it} + \beta_3 empl_{it} + \beta_4 ulc_{it} + \beta_5 str_{it} + \beta_6 mtr_{it} + \beta_7 frt_{it} + \beta_8 sent_{it} + \beta_9 mrf_{it} + \beta_{10} m2g_{it} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (1)$$

where $sprd_{it}$ is the dependent variable and describes the government bond spread in country i in the month t with $i = 1, \dots, 5$ (the five GIIPS countries) and $t = 1, \dots, 120$ (120 months ranging from March 2013 until February 2023). The three main variables of interest are inflation, GDP growth and unemployment as these are three of the most significant and most important general macroeconomic factors. The remaining control variables are implemented to observe other effects on the spreads. The reasoning for using the respective variables and their descriptions have already been explained in Chapter 3.2. Descriptive and summary statistics for all variables of the monthly data set can be found in Appendix 4. To implement credit ratings as numerical values, the respective ratings are given values between 1 and 22. A default credit rating (D, D, D) is defined as 1 and the highest possible rating (AAA, Aaa, AAA) is defined as 22. An overview of all possible credit ratings can be found in Appendix 5. Furthermore, the work includes country fixed effects (α_i) in the OLS regression to account for country specific

characteristics. Moreover, time fixed effects (α_t) are included to account for time specific characteristics and to obtain possible monthly patterns in price movements (Szczerbowicz, U., 2015). The results for randomised effects can be found in Chapter 4. All regressions use robust standard errors.

The event study with the daily data is performed to control for factors that are not observed by the monthly data and the macroeconomic variables. Namely, these are most notably the two dummy variables for the QE- and QT-announcements by the ECB and daily market factors like the main domestic equity index and the VIX as an overall volatility measure. The respective regression equation is:

Equation 2:

$$sprd_{it} = \alpha + \beta_1 ecbqe_t + \beta_2 ecbqt_t + \beta_3 equ_{it} + \beta_4 vix_t + \alpha_i + \alpha_t + \varepsilon_{it} \quad (2)$$

where $sprd_{it}$ is the dependent variable and describes the government bond spread in country i on the day t with $i = 1, \dots, 5$ (the five GIIPS countries) and $t = 1, \dots, 2608$ (2608 days ranging from the 01/03/2013 until the 28/02/2023). In this event-study type regression the two main variables of interest are the two dummy variables $ecbqe$ and $ecbqt$ to observe the effect of the respective ECB policy announcement. An event-study approach is widely used to analyse the effects of announcements (Fendel and Neugebauer, 2020; Ortman and Tripier, 2021). The other control variables are implemented to monitor other daily market effects on the spreads and have already been explained in Chapter 3.2 and the respective tables. Descriptive and summary statistics for all variables of the daily data set can be found in Appendix 6. The coefficients of this regression are estimated both with randomised effects as well as fixed effects (country fixed effects (α_i) and time fixed effects (α_t)). All regressions use robust standard errors.

To make comparisons between the single countries, time-series regressions are performed as well for both the monthly and the daily data set. Both time-series regressions are similar regarding variables and approach to their panel regression counterparts except for the country fixed effects. The regression equation for the time-series regression of the respective countries with the monthly data set is:

Equation 3:

$$sprd_t = \alpha + \beta_1 infl_t + \beta_2 gdp_g_t + \beta_3 empl_t + \beta_4 ulc_g_t + \beta_5 str_g_t + \beta_6 mtr_g_t + \beta_7 frt_g_t + \beta_8 sent_t + \beta_9 mrfr_t + \beta_{10} m2g_t + \alpha_t + \varepsilon_t \quad (3)$$

The same regression approach applies to the daily dataset and the corresponding time-series regression equation of the respective countries is:

Equation 4:

$$sprd_t = \alpha + \beta_1 ecbqe_t + \beta_2 ecbqt_t + \beta_3 equ_t + \beta_4 vix_t + \alpha_t + \varepsilon_t \quad (4)$$

Beside these baseline regressions, I conducted an additional event study regression with the two dummy variables *ecbqe* and *ecbqt* for the monthly data set to control the effect of such announcements for the daily dataset and the monthly one. According to that, the respective regression equations equal Equation 1 and Equation 3 plus the two dummy variables.

Therefore, the regression equation for the overall data is:

Equation 5:

$$sprd_{it} = \alpha + \beta_1 ecbqe_t + \beta_2 ecbqt_t + \beta_3 infl_{it} + \beta_4 gdp_{it} + \beta_5 empl_{it} + \beta_6 ulc_{it} + \beta_7 str_{it} + \beta_8 mtr_{it} + \beta_9 frt_{it} + \beta_{10} sent_{it} + \beta_{11} mrfr_t + \beta_{12} m2g_t + \alpha_i + \alpha_t + \varepsilon_{it} \quad (5)$$

The according regression equation for the single countries is:

Equation 6:

$$sprd_t = \alpha + \beta_1 ecbqe_t + \beta_2 ecbqt_t + \beta_3 infl_t + \beta_4 gdp_g_t + \beta_5 empl_t + \beta_6 ulc_g_t + \beta_7 str_g_t + \beta_8 mtr_g_t + \beta_9 frt_g_t + \beta_{10} sent_t + \beta_{11} mrfr_t + \beta_{12} m2g_t + \alpha_t + \varepsilon_t \quad (6)$$

The separation of the data into the two periods is not done for the daily data and the event study as the number of respective announcements in the given periods is relatively low and the focus of the research ultimately lies on the macroeconomic variables and the monthly data. The regression model itself does not change and the regression equation equals Equation 1, only adjusted for the respective time periods.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Baseline panel regression on the monthly data set

This chapter presents the results of the regressions. It shows the impact and effect of the different variables on the European government bond spreads for the respective data set and time. The four main regression models include the monthly and the daily data set as well as the separation of the monthly data set into the QE- and QT-period. All four models include results with randomised and fixed effects as well as country-specific time-series regression results.

In the first step of the analysis, I look at the regression results for the monthly data set, as described in the introduction and the methodology. The results for the overall data correspond to Equation 1 and the results for the respective countries correspond to Equation 3 and the coefficients of the variables can be found in Table 1. For the overall data set there are very significant results for inflation, GDP growth, unemployment and the credit rating of S&P and Moody's. These significant results align with the expectations, except for the credit ratings. Intuitively, higher inflation in a country leads to a higher spread of the country's government bond yield against the German benchmark *ceteris paribus*, as it decreases purchasing power and can cause economic instability in the respective country. Similarly, there is a positive relationship between unemployment and the spread, as higher unemployment also indicates economic instability. This positive relationship is confirmed for all countries except Portugal while looking at the country-specific regression results. On the other hand, a negative relationship between GDP-growth and the spread can be explained because investors view a higher GDP positively as it tends to be an indicator of a more stabilised economy and therefore drives down the spread. Again, this negative relationship is confirmed by Italy, Greece and Ireland for the country-specific results.

As expected, a significant positive relationship between unemployment and the spreads is observed because high unemployment indicates a weak economy and therefore should lead to higher yields and spreads. This relationship is confirmed for all countries except Greece.

However, I find significant effects for a change in the credit rating of S&P and Moody's on the spreads, but a positive relationship for the change in the S&P rating and a negative relationship for the change in Moody's rating. The expectation for all credit ratings was a negative relationship as a higher/better credit rating suggests more confidence in the ability of the country to pay back their government bonds and therefore should bring the yields and spread

down ceteris paribus. It may be noted that the changes in the respective credit ratings occur at a similar time but not necessarily at the same time. While looking at the country specific results, the negative relation of a change in Moody's rating is confirmed by Italy, Portugal and Greece but not by the other two countries. At the same time, the positive relation of the S&P rating is also confirmed in three countries, namely Spain, Portugal and Ireland. This unexpected positive relationship of some rating increase on the spreads could have multiple reasons. The first one would be that as we are just looking at monthly data here, the short-term effect of the new credit rating announcement may not be captured enough. Analysing this short-term effect of the ratings by looking at the daily data is neglected here as the ratings are rather control variables than our main variables of interest. Moreover, the information and reasons leading to a change in the credit rating may be published or publicly in advance and the change in the credit rating itself does not bear any new information. It therefore does not really affect the yield and the spread anymore. This issue is further discussed while looking at the results for the two different periods. Still, the three main variables of interest have a very significant effect on the spreads in general for the whole period.

Table 1: Panel and time-series regression for the monthly data over the whole period.

| | (1) | (2) | (1) | (2) | (3) | (4) | (5) |
|---------|-------------------------|-------------------------|------------------------|------------------------|-----------------------|------------------------|-------------------------|
| Country | Overall | Overall | Italy | Spain | Portugal | Greece | Ireland |
| infl | -0.0494 (0.0328) | 0.0561*** (0.0189) | 0.125*** (0.0357) | 0.0620*** (0.0107) | -0.0350 (0.0752) | 0.163** (0.0721) | 0.0917*** (0.0123) |
| gdpg | -0.0217 (0.0132) | -0.0381*** (0.00816) | -0.0463*** (0.0143) | -0.00442 (0.00530) | -0.0257 (0.0157) | -0.109*** (0.0397) | -0.0235*** (0.00354) |
| empl | 0.0164 (0.0154) | 0.112*** (0.0197) | 0.356*** (0.0916) | 0.0501*** (0.0147) | 0.222*** (0.0283) | -0.240 (0.165) | 0.159*** (0.0199) |
| ulcg | -0.00794* (0.00473) | 0.00364 (0.0171) | 0.0810 (0.0500) | 0.113*** (0.0234) | 0.0516 (0.0421) | -0.0858 (0.0842) | -0.00399 (0.00479) |
| srtg | 0.709*** (0.0663) | 0.359*** (0.108) | - | 0.841*** (0.101) | 0.908*** (0.137) | -0.611 (0.469) | 0.335*** (0.0731) |
| mrtg | -0.911*** (0.110) | -0.812*** (0.0430) | -0.805*** (0.202) | 0.0118 (0.0826) | -0.445*** (0.107) | -1.302*** (0.288) | 0.230*** (0.0501) |
| frtg | -0.281** (0.115) | -0.106 (0.0910) | 0.0279 (0.148) | -0.984*** (0.103) | -0.252 (0.592) | 0.518 (0.370) | -0.443*** (0.0707) |
| sent | -0.000327 (0.000329) | 0.000719 (0.00150) | -0.0155 (0.0156) | 0.000383 (0.000641) | 0.000917 (0.00182) | -0.000442 (0.00459) | -0.00254 (0.00225) |

| | | | | | | | |
|--------------|----------------------|---------------------|---------------------|---------------------|-------------------|---------------------|---------------------|
| mrfr | 0.0967 (0.150) | -0.0766 (0.103) | 0.134 (0.161) | 0.0249 (0.0556) | 0.0260 (0.169) | -0.152 (0.410) | 0.0720 (0.0517) |
| m2g | -0.290*** (0.101) | -0.114 (0.123) | 0.0378 (0.186) | -0.0150 (0.0688) | 0.0283 (0.190) | 0.364 (0.509) | 0.117* (0.0614) |
| Constant | 7.788*** (0.567) | 7.511*** (1.003) | 8.235*** (2.582) | 2.206 (1.375) | -2.477 (6.511) | 19.40*** (5.233) | -2.295** (0.997) |
| Observations | 600 | 600 | 120 | 120 | 120 | 120 | 120 |
| R-squared | | 0.702 | 0.317 | 0.900 | 0.822 | 0.796 | 0.886 |
| Countries | 5 | 5 | 1 | 1 | 1 | 1 | 1 |
| Country-FE | no | yes | no | no | no | no | no |
| Time-FE | no | yes | yes | yes | yes | yes | yes |

*Notes: OLS regressions. The dependent variable is the government bond spread of the respective countries against the German government bond. Results correspond to Equation 1 and Equation 3. Omitted values are due to no change in the credit rating during the observed period. Robust standard errors are in parentheses. Significance level: *** $p < 0,01$, ** $p < 0,05$, * $< 0,1$.*

4.2 Controlling for ECB announcements and daily data

Although I have included control variables for the overall money supply and the central bank's main refinancing operations rate (variables m2g and mrfr) in the baseline regression with the monthly data set to control for the monetary and interest rate environment, it is not sufficient alone. As monetary policy announcements can substantially impact the yields and spreads, I created the second data set consisting of daily data to control for the short-term effects of such announcements by the ECB and other daily/short-term market factors. This is achieved by performing an event-study type regression with the two dummy variables ecbqe and ecbqt as the main variables of interest. A looser monetary policy makes it easier, especially for distressed countries, to raise new debt as it also boosts investors' confidence in the respective countries (Reis, 2017; Kyriazis, 2023). Therefore, I suggested a negative relationship between QE-type announcements and the spreads. Vice versa, this should imply a positive relationship between QT-type announcements and spreads.

My results, however, suggest different implications and relationships. Only the effect of QE-type announcements on the spreads in the fixed effects regression for the overall data is significant, but it is positive. On the other hand, most of the results and coefficients of the QT-type announcements signal negative relationships, even though none of these results is significant. These relationships and effects of ECB monetary policy announcements contradict the expectations.

Possible explanations include the surprise effect and the difficulty of capturing and quantifying the expectation of such announcements. These problems get mentioned in detail in Chapter 3.2 but the major problem is the focus on the announcement itself rather than on the surprise effect or market expectations. Due to these counterintuitive results regarding the coefficients for the announcements, I additionally control these dummy variables for the monthly data set. The results of this approach can be found in Table 3.

Looking back at the results for the other market variables in the daily data set, I observed significant results for the domestic equity index and the VIX for the overall data in the fixed effects regression. Especially the results for the VIX are confirmed as significant by every single country for the country-specific regressions. This observed negative relationship of the VIX on the spreads is in line with my expectations, as increased volatility in the equity markets leads to increased investment in bond markets and therefore tends to reduce spreads. This implied negative correlation between bond and equity markets can be found in the literature as well (Fan and Mitchell, 2017; Bansal, Connolly, and Stivers, 2014). However, there are exceptions in times of extraordinary crisis and flight to “safe haven” scenarios like during the financial crisis, the European debt crisis or the Covid-19 pandemic, which could increase spreads (De Santis, 2012; Costantini and Sousa, 2022).

Table 2: Event study type panel and time-series regression for the daily data.

| | (1) | (2) | (1) | (2) | (3) | (4) | (5) |
|--------------|----------------------|------------------------|--------------------------|-------------------------|-------------------------|------------------------|-------------------------|
| Country | Overall | Overall | Italy | Spain | Portugal | Greece | Ireland |
| ecbqe | 0.716 (0.465) | 0.716*** (0.233) | 0.0456 (0.202) | 0.202 (0.198) | 0.711* (0.391) | 2.592*** (0.979) | 0.154 (0.178) |
| ecbqt | -0.296* (0.172) | -0.296 (0.327) | 0.146 (0.283) | -0.198 (0.277) | -0.200 (0.547) | -0.913 (1.374) | -0.328 (0.248) |
| equit | -0.035** (0.0151) | -0.035*** (0.00921) | -0.0136* (0.00781) | -0.0118 (0.00871) | -0.0345* (0.0185) | -0.0699** (0.0296) | -0.00626 (0.00809) |
| vix | -0.065* (0.0355) | -0.065*** (0.00196) | -0.00536*** (0.00170) | -0.0229*** (0.00166) | -0.0814*** (0.00328) | -0.196*** (0.00824) | -0.0178*** (0.00149) |
| Constant | 3.361** (1.401) | 3.361*** (0.0409) | 1.837*** (0.0355) | 1.663*** (0.0347) | 3.511*** (0.0685) | 8.717*** (0.172) | 1.066*** (0.0311) |
| Observations | 13040 | 13040 | 2608 | 2608 | 2608 | 2608 | 2608 |
| R-squared | | 0.078 | 0.005 | 0.068 | 0.191 | 0.180 | 0.052 |
| Countries | 5 | 5 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | |
|------------|----|-----|-----|-----|-----|-----|-----|
| Country-FE | no | yes | no | no | no | no | no |
| Time-FE | no | yes | yes | yes | yes | yes | yes |

Notes: OLS regressions. The dependent variable is the government bond spread of the respective countries against the German government bond. Results correspond to Equation 2 and Equation 4. Robust standard errors are in parentheses. Significance level: *** $p < 0,01$, ** $p < 0,05$, * $< 0,1$.

As I have observed only partially significant results for the daily data set regarding ECB monetary policy announcements, I control these effects for the monthly data set as well, by using the same two dummy variables and conduct the same event-study regression approach. The respective results can be found in Table 3.

Table 3: Event study type panel and time series regression for the monthly data.

| | (1) | (2) | (1) | (2) | (3) | (4) | (5) |
|----------|-------------------------|-------------------------|------------------------|------------------------|-----------------------|-----------------------|-------------------------|
| Country | Overall | Overall | Italy | Spain | Portugal | Greece | Ireland |
| ecbqe | 0.0266 (0.155) | -0.0236 (0.155) | -0.0943 (0.207) | -0.0308 (0.0811) | -0.271 (0.223) | 0.696 (0.604) | -0.0280 (0.0798) |
| ecbqt | -0.0717 (0.0813) | 0.150 (0.185) | -0.161 (0.247) | 0.00951 (0.0991) | 0.101 (0.269) | 0.151 (0.730) | -0.0518 (0.0949) |
| infl | -0.0492 (0.0322) | 0.0567*** (0.0189) | 0.127*** (0.0361) | 0.0622*** (0.0109) | -0.0371 (0.0761) | 0.152** (0.0729) | 0.0907*** (0.0125) |
| gdpq | -0.0216* (0.0130) | -0.0383*** (0.00821) | -0.0482*** (0.0146) | -0.00457 (0.00537) | -0.0265* (0.0157) | -0.107*** (0.0399) | -0.0235*** (0.00360) |
| empl | 0.0162 (0.0155) | 0.114*** (0.0199) | 0.355*** (0.0930) | 0.0503*** (0.0150) | 0.224*** (0.0284) | -0.260 (0.167) | 0.157*** (0.0207) |
| ulcg | -0.00802* (0.00456) | 0.00399 (0.0171) | 0.0836 (0.0511) | 0.113*** (0.0236) | 0.0565 (0.0423) | -0.0892 (0.0847) | -0.00447 (0.00488) |
| srtg | 0.707*** (0.0685) | 0.364*** (0.108) | - | 0.840*** (0.104) | 0.903*** (0.137) | -0.578 (0.477) | 0.336*** (0.0742) |
| mrtg | -0.910*** (0.110) | -0.812*** (0.0430) | -0.800*** (0.205) | 0.0120 (0.0835) | -0.444*** (0.108) | -1.333*** (0.293) | 0.227*** (0.0514) |
| frtg | -0.279** (0.113) | -0.108 (0.0912) | 0.0500 (0.152) | -0.983*** (0.105) | -0.185 (0.600) | 0.481 (0.372) | -0.446*** (0.0721) |
| sent | -0.000304 (0.000345) | 0.000690 (0.00150) | -0.0150 (0.0157) | 0.000353 (0.000651) | 0.000708 (0.00183) | -0.00103 (0.00463) | -0.00250 (0.00228) |
| mrfr | 0.111 (0.165) | -0.108 (0.110) | 0.164 (0.169) | 0.0233 (0.0609) | -0.0121 (0.181) | -0.178 (0.451) | 0.0835 (0.0565) |
| m2g | -0.299*** (0.107) | -0.0990 (0.127) | 0.0453 (0.188) | -0.00872 (0.0712) | 0.0819 (0.195) | 0.297 (0.516) | 0.117* (0.0640) |
| Constant | 7.796*** | 7.435*** | 7.882*** | 2.203 | -3.198 | 20.07*** | -2.208** |

| | | | | | | | |
|--------------|---------|---------|---------|---------|---------|---------|---------|
| | (0.571) | (1.008) | (2.636) | (1.405) | (6.569) | (5.290) | (1.032) |
| Observations | 600 | 600 | 120 | 120 | 120 | 120 | 120 |
| R-squared | | 0.702 | 0.321 | 0.900 | 0.825 | 0.798 | 0.887 |
| Countries | 5 | 5 | 1 | 1 | 1 | 1 | 1 |
| Country-FE | no | yes | no | no | no | no | no |
| Time-FE | no | yes | yes | yes | yes | yes | yes |

*Notes: OLS regressions. The dependent variable is the government bond spread of the respective countries against the German government bond. Results correspond to Equation 5 and Equation 6. Omitted values are due to no change in the credit rating during the observed period. Robust standard errors are in parentheses. Significance level: *** $p < 0,01$, ** $p < 0,05$, * $< 0,1$.*

While looking at the monthly data set and the effects of the announcements on the spreads, I find no significant results at all, neither for QE-type announcements nor QT-type announcements. Looking at the R-squared values in comparison to the results without the dummy variables, there is almost no difference, leading to the conclusion that the inclusion of the dummy variable does not help to understand the determinants of the spread. The coefficients for the two dummy variables not being significant also aligns with the hypothesis that the announcement itself has an immediate daily effect at best. This refers to the statement that most of the information regarding the change in monetary policy is already priced in before the actual announcement. On the day of the announcement there is rather only a surprise effect on the spreads. As no new information is coming out after the announcement, it is not surprising not to find significant results while looking at monthly data, as we have seen in Table 3.

Regarding the other variables, I observe very similar results in comparison to the regression results without the dummy variables in terms of magnitude and significance.

4.3 Additional robustness checks

Even though I highlighted certain problems with the data selection or delayed effects of variables on the dependent variables, I still need to ensure the robustness of the data and findings for the regression model. Specifically the problem of endogeneity within the regression model and multicollinearity between the many different variables needs to be addressed to validate my conclusions regarding the significance of the three main variables of interest inflation, GDP-growth and unemployment.

I used a differences-in-differences approach with a treatment and control group to eliminate endogeneity. The most important thing about selecting the respective countries for the treatment group or the control group is that it has to be completely random. The randomised, and therefore

a quasi-experimental research design, should deal with the problem of endogeneity and tries to find or confirm the causal relationship of the independent variable(s). Therefore, I chose the Covid-19 pandemic as the “treatment” as it is a unique event in our world, where you can consider the magnitude and number of cases in each country as random, at least to a certain degree. I specifically assigned Italy, Spain and Portugal to the treatment group because within the first wave of cases, these countries got hit early and hard in comparison to other countries. Especially Italy and Spain had many deaths in the beginning. Greece and Ireland got hit as well, but not as hard in comparison and therefore belong to the control group.

The treat variable is a dummy variable that defines if the country belongs to the treatment or the control group. The time variable is also a dummy variable and indicates whether we are in the pre- or post-treatment period. I defined March 2020 as the point in time of the treatment because that was when the first wave hit the respective countries. The last new variable in this diff-in-diff regression approach is diff, which is defined as the multiplication of the treat and time variable. The remaining variables of interest and control variables are the same as before.

While running this regression, I find very significant results for inflation and GDP-growth for the regression with random effects and very significant results for all three variables of interest for the fixed-effects regression. These findings indicate that endogeneity is not a big problem in my general regression. I still consider the effects of the three main variables on the spreads as significant. The detailed results of the differences-in-differences approach can be found in Table 4.

Table 4: Diff-in-Diff regression results.

| | (1) | (2) |
|---------|-------------------------|-------------------------|
| Country | Overall | Overall |
| treat | -0.186* (0.105) | - |
| time | -1.351*** (0.138) | -1.013*** (0.162) |
| diff | 0.202 (0.158) | 0.0909 (0.184) |
| infl | 0.0504*** (0.0177) | 0.101*** (0.0184) |
| gdp | -0.0453*** (0.00785) | -0.0491*** (0.00792) |

| | | |
|--------------|-------------------------|-----------------------|
| empl | -0.00906 (0.00915) | 0.0780*** (0.0207) |
| ulcg | -0.0204 (0.0167) | -0.00867 (0.0161) |
| srtg | 0.619*** (0.0976) | 0.431*** (0.105) |
| mrtg | -0.943*** (0.0411) | -0.865*** (0.0427) |
| firtg | -0.156* (0.0865) | -0.0357 (0.0859) |
| sent | -0.0000136 (0.00147) | 0.000673 (0.00141) |
| mrfr | 0.247** (0.0999) | 0.0887 (0.0984) |
| m2g | 0.246* (0.128) | 0.248** (0.123) |
| Constant | 8.232*** (0.277) | 6.792*** (1.136) |
| Observations | 600 | 600 |
| R-squared | | 0.738 |
| Countries | 5 | 5 |
| Country-FE | no | yes |
| Time-FE | no | yes |

*Notes: OLS regressions with differences-in-differences approach. The dependent variable is the government bond spread of the respective countries against the German government bond. Omitted value for the treat variable for the fixed effects regression is due to no variable change within the respective countries over time. Robust standard errors are in parentheses. Significance level: *** $p < 0,01$, ** $p < 0,05$, * $p < 0,1$.*

Apart from the problem of endogeneity the second problem is the multicollinearity of the different variables, meaning a possible high correlation between the independent and control variables. This is especially true here due to the high number of variables. For example, the different credit rating agencies could have a very high correlation, as well as inflation to labour costs and GDP-growth, as some of these variables are very well connected. This is one of the reasons I only focus on inflation, GDP-growth and unemployment as the main variables of interest. However, the multicollinearity within the control and focused variables still needs to be addressed. To check the significance of these variables and to minimise multicollinearity, I performed the same regression approach with the monthly data set as before but omitted all the other control variables. The results for this can be found in Table 5.

Looking at the results, I can obtain very significant results for all three variables for the overall data set in both the random and fixed-effects regression. This means the significance is even higher than the result that includes all the variables, even though the R-squared values are now lower due to the omitted variables. While looking at the results for the country-specific data, these significant results get confirmed by most of the countries as well. For this regression, omitting variables does not hurt the significance of the variables of interest.

Table 5: Omitted variables regression results.

| | (1) | (2) | (1) | (2) | (3) | (4) | (5) |
|--------------|-------------------------|-------------------------|------------------------|-------------------------|----------------------|----------------------|-------------------------|
| Country | Overall | Overall | Italy | Spain | Portugal | Greece | Ireland |
| infl | 0.110*** (0.0200) | 0.136*** (0.0195) | 0.0986*** (0.0233) | 0.110*** (0.0141) | 0.0351 (0.0273) | 0.323*** (0.0667) | 0.0737*** (0.00930) |
| gdpg | -0.0271*** (0.00992) | -0.0310*** (0.00953) | -0.0506*** (0.0118) | -0.0271*** (0.00626) | 0.00845 (0.0144) | 0.00699 (0.0366) | -0.0315*** (0.00373) |
| empl | 0.299*** (0.0134) | 0.331*** (0.0142) | 0.0913** (0.0416) | 0.135*** (0.00823) | 0.290*** (0.0185) | 0.645*** (0.0404) | 0.169*** (0.00835) |
| Constant | -1.965*** (0.240) | -2.412*** (0.210) | 0.625 (0.472) | -1.361*** (0.163) | -0.977*** (0.208) | -8.621*** (0.878) | -0.375*** (0.0807) |
| Observations | 600 | 600 | 120 | 120 | 120 | 120 | 120 |
| R-squared | | 0.503 | 0.191 | 0.707 | 0.697 | 0.728 | 0.811 |
| Countries | 5 | 5 | 1 | 1 | 1 | 1 | 1 |
| Country-FE | no | yes | no | no | no | no | no |
| Time-FE | no | yes | yes | yes | yes | yes | yes |

*Notes: OLS regressions with omitted variables. The dependent variable is the government bond spread of the respective countries against the German government bond. Robust standard errors are in parentheses. Significance level: *** $p < 0,01$, ** $p < 0,05$, * $p < 0,1$.*

Both robustness checks performed in this subchapter indicate and underline the significance of the three main variables of interest observed in my main regression analysis. By ensuring that the results are not distorted or diluted by endogeneity and by trying to minimise the impact of multicollinearity, I can show that the results and findings in this thesis are robust. However, endogeneity and multicollinearity should still be kept in mind while looking at the results as well as other diluting factors during the data selection and regression models. Therefore, the data set gets split into the QT- and QE-period in the following two chapters to confirm the spread's determinants in different time periods and obtain possible differences.

4.4 Results for the QE-period

In the two previous chapters I found various significant macroeconomic determinants of the European government bond spreads for the monthly data, especially inflation, GDP-growth and unemployment, and significant market factors for the daily data, especially the VIX. However, I found no significant effects of ECB monetary policy announcements on the spread, except for QE-type announcements in the daily data set. Now I want to confirm these results for the QE- and QT- period and investigate possible differences in the determinants of the spreads in the two monetary policy environments. In this chapter, I present the results of the monthly data set for the QE-period and Chapter 4.5 covers the results for the QT-period. As mentioned earlier, the daily data set will not be split into two periods.

For the QE-period, I find almost the same significant variables as for the whole period, where inflation, GDP growth and unemployment are still the main significant determinants of the spreads in the fixed-effects regression. They all have the same positive or negative relationship as before and are in line with the expectations. However, there are huge differences when looking at the single countries. These significant results are only partially confirmed within the countries, which was not the case for the whole period. This implies that the effects of especially inflation, GDP growth and unemployment may be less significant and important within the countries in QE-times. However, they are still very significant for the overall data. The smaller number of observations, due to the split of the dataset into two periods, could partially explain this.

For the ratings, I only find a significant effect of the change in the credit rating by Moody's now, which is confirmed by three single countries. This negative relationship was observed in the results for the whole period and is also in line with expectations. The most important observation while comparing the QE-period results with the entire period of Table 1, is the observation of a significant effect of the main refinancing operations rate. This effect is significant with a 99% confidence level for every country. I expected a positive relationship, as lower interest rates in general and more loose monetary policy should bring down the yield and spread of riskier countries. The results align with this expectation for every country, except for Greece, where I observe a significant negative relationship. Intended to only control for the interest rate environment, these significant results are very interesting as I would rather expect them in a daily data set. The argument is the same as for the general monetary policy announcements analysed earlier because announcements of changes in the interest rates are

discussed quite well before an announcement. Therefore, on the day of the announcement you can only observe the “surprise effect” again, but no new information follows afterwards in general.

Table 6: Panel and time-series regressions for period 1 (QE-period).

| | (1) | (2) | (1) | (2) | (3) | (4) | (5) |
|--------------|------------------------|-----------------------|----------------------|------------------------|-----------------------|-----------------------|-------------------------|
| Country | Overall | Overall | Italy | Spain | Portugal | Greece | Ireland |
| infl | 0.197*** (0.0493) | 0.286*** (0.0539) | 0.462*** (0.0605) | 0.0637** (0.0263) | 0.159 (0.111) | 0.419* (0.240) | 0.0418 (0.0352) |
| gdp | -0.000206 (0.00874) | -0.0233** (0.0105) | 0.000946 (0.0184) | 0.00117 (0.00746) | -0.0194 (0.0198) | -0.138* (0.0712) | -0.0167*** (0.00314) |
| empl | -0.0243** (0.0104) | 0.0639** (0.0272) | 0.0395 (0.0746) | 0.0373 (0.0246) | 0.110*** (0.0384) | -0.267 (0.238) | 0.0392 (0.0240) |
| ulcg | -0.0101 (0.0197) | -0.00709 (0.0191) | -0.0381 (0.0362) | 0.0996*** (0.0308) | -0.00708 (0.0458) | -0.169 (0.109) | -0.00789** (0.00394) |
| srtg | 0.257** (0.120) | 0.191 (0.125) | - | 0.417** (0.168) | 0.805*** (0.168) | 0.876 (0.649) | 0.0436 (0.0668) |
| mrtg | -0.930*** (0.0437) | -0.920*** (0.0494) | -0.670*** (0.137) | -0.0747 (0.0882) | -0.516*** (0.135) | -2.033*** (0.402) | 0.104* (0.0526) |
| frtg | 0.137 (0.104) | 0.128 (0.102) | -0.0279 (0.140) | -0.462*** (0.152) | - | 0.00994 (0.485) | -0.173*** (0.0635) |
| sent | -0.000726 (0.00176) | 0.000262 (0.00171) | -0.00739 (0.0123) | 0.000301 (0.000736) | 0.000925 (0.00201) | -0.00243 (0.00503) | -0.000620 (0.00186) |
| mrfr | 1.897*** (0.283) | 0.620* (0.359) | 1.937*** (0.287) | 1.405*** (0.357) | 2.210*** (0.525) | -5.766*** (1.675) | 2.017*** (0.224) |
| m2g | -0.0201 (0.144) | 0.0667 (0.140) | 0.0575 (0.128) | -0.00221 (0.0733) | 0.124 (0.203) | 0.517 (0.595) | 0.0466 (0.0514) |
| Constant | 8.876*** (0.324) | 8.553*** (1.252) | 10.42*** (2.194) | 2.128 (2.111) | -2.345 (2.842) | 17.50** (7.168) | 0.920 (1.012) |
| Observations | 475 | 475 | 95 | 95 | 95 | 95 | 95 |
| R-squared | | 0.681 | 0.755 | 0.925 | 0.840 | 0.769 | 0.947 |
| Countries | 5 | 5 | 1 | 1 | 1 | 1 | 1 |
| Country-FE | no | yes | no | no | no | no | no |
| Time-FE | no | yes | yes | yes | yes | yes | yes |

*Notes: OLS regressions. The dependent variable is the government bond spread of the respective countries against the German government bond. Results correspond to Equation 1 and Equation 3. Omitted values are due to no change in the credit rating during the observed period. Robust standard errors are in parentheses. Significance level: *** $p < 0,01$, ** $p < 0,05$, * $< 0,1$.*

So far I can say that the differences between the QE-period and the whole period are not big. Most macroeconomic variables are as important and significant as in the respective period. However, this is not true while looking at the effect of the main refinancing operations rate in particular. The next chapter analyses the results for the QT-period and makes comparisons between the two different periods of monetary policy.

4.5 Results for the QT-period

Looking at the results for the QT-period, the only significant determinants for the spreads in this period are almost the same determinants as for the whole period and the QE-period once again. The significant determinants here are namely inflation, GDP-growth, unemployment and a change in the credit rating of Moody's, although GDP-growth and unemployment are not as significant as before anymore. Moreover, these results are only confirmed for inflation, while looking at the country specific results. There are only slightly significant results for Portugal and Greece regarding the GDP-growth and no significant country specific results regarding unemployment. The same applies to the credit rating of Moody's and the other variables. As the time horizon for the QT-period is so short and the number of observations so small, there was no change in credit rating for some countries, leading to the omitted coefficients and no results regarding these variables for the respective countries.

Even though R-squared is still high for this respective time period, the explanatory value might be limited due to the concise time horizon and the number of observations due to the application of monthly data. This is especially true for the country specific results as the number of observations is even smaller than for all the countries combined. Still, I can confirm that the significant results for the QT-period are like the analysed periods before and therefore the different monetary policy environments. This indicates that the main macroeconomic determinants of European government bond spreads are the same in different times and environments of monetary policy for the whole observed period. Moreover, as certain monetary policies by the ECB in the past are specifically designed to lower spreads they should be kept in mind while looking and focusing on the macroeconomic determinants. Like outlined in the literature review in Chapter 2, this effect of lower yield and spreads caused by various asset purchase programs and monetary policy announcements is very significant indeed.

Table 7: Panel and time-series regressions for period 2 (QT-period).

| | (1) | (2) | (1) | (2) | (3) | (4) | (5) |
|--------------|-------------------------|-------------------------|----------------------|-------------------------|------------------------|------------------------|------------------------|
| Country | Overall | Overall | Italy | Spain | Portugal | Greece | Ireland |
| infl | 0.0931*** (0.0226) | 0.0634*** (0.00992) | 0.141*** (0.0355) | 0.0656** (0.0271) | 0.0529** (0.0244) | 0.105*** (0.0353) | 0.0382*** (0.00973) |
| gdpg | -0.0154 (0.0143) | -0.0122** (0.00491) | -0.00313 (0.0123) | -0.00188 (0.00663) | 0.0101* (0.00555) | -0.0353* (0.0182) | 0.00611 (0.00687) |
| empl | 0.0395 (0.0362) | -0.0477* (0.0273) | 0.0519 (0.149) | 0.0343 (0.0814) | 0.0595 (0.100) | -0.0126 (0.0833) | 0.0111 (0.0371) |
| ulcg | -0.0136 (0.0126) | -0.00941 (0.0101) | 0.0197 (0.0535) | 0.0268 (0.0249) | 0.0523 (0.0369) | -0.0225 (0.0689) | -0.00505 (0.00500) |
| srtg | -0.296 (0.214) | 0.0829 (0.157) | - | - | -0.119 (0.109) | 0.0516 (0.237) | - |
| mrtg | -0.184 (0.146) | 0.163*** (0.0590) | - | - | -0.0722 (0.0815) | - | 0.0293 (0.0790) |
| frtg | 0.318 (0.246) | -0.0380 (0.171) | - | - | 0.158 (0.141) | - | - |
| sent | -0.00106* (0.000621) | -0.000668 (0.000846) | 0.00284 (0.00931) | -0.000658 (0.000620) | 0.000608 (0.000664) | -0.000708 (0.00348) | -0.00116 (0.00145) |
| mrfr | 0.00763 (0.0287) | 0.00266 (0.0344) | 0.0514 (0.0732) | 0.0633 (0.0485) | -0.0252 (0.0528) | -0.0707 (0.126) | -0.0147 (0.0201) |
| m2g | 0.00127 (0.103) | 0.00444 (0.0715) | 0.423** (0.162) | -0.0785 (0.0850) | 0.108 (0.0687) | -0.345* (0.181) | 0.0675 (0.0393) |
| Constant | 2.437* (1.340) | -1.542 (1.084) | 0.109 (1.557) | 0.0450 (1.259) | 0.504 (2.016) | 1.228 (2.386) | -0.383 (1.219) |
| Observations | 125 | 125 | 25 | 25 | 25 | 25 | 25 |
| R-squared | 0 | 0.748 | 0.920 | 0.848 | 0.938 | 0.914 | 0.869 |
| Countries | 5 | 5 | 1 | 1 | 1 | 1 | 1 |
| Country-FE | no | yes | no | no | no | no | no |
| Time-FE | no | yes | yes | yes | yes | yes | yes |

Notes: OLS regressions. The dependent variable is the government bond spread of the respective countries against the German government bond. Results correspond to Equation 1 and Equation 3. Omitted values are due to no change in the credit rating during the observed period. Robust standard errors are in parentheses. Significance level: *** $p < 0,01$, ** $p < 0,05$, * $p < 0,1$.

4.6 Discussion and comparison of the QE- and QT-period

As this thesis focuses on analysing the determinants of European government bond spreads in different monetary policy environments, the comparison between the QE- and QT-period is especially interesting. The focus hereby lies on the results of the fixed-effects regression for the overall data. First, we have seen that both periods have similar significant variables compared

to the whole period. Especially for the QE-period this is not surprising, as only the last two years of the entire period (the QT-period) are cut out. But this observation is also accurate when comparing both periods itself.

Inflation is the most significant variable and the only variable with a positive relationship with a 99% significance level in both periods. The significance of the country-specific data is even higher during the QT-period for the single countries. These results indicate that inflation is the most significant macroeconomic variable that determines spreads but is even more relevant in times of QT. However, this may be due to the relationship between inflation and QT itself as inflation data strongly influences the monetary policy decisions by the ECB. The main goal of the ECB is to maintain price stability and keep the inflation rate in the Eurozone at around 2% (ECB, 2023). Therefore, QT-type monetary policies are arguably directly influenced by high inflation. The same applies for possible QE-type policies in the case of very low inflation. Nevertheless, inflation is a very significant indicator and determinant of the spreads in both periods.

Similarly, GDP-growth has a significant negative relationship in both periods, with a 99% significance level in the QE-period and a 95% significance level in the QT-period. The significance of the country specific analysis is rather weak and on a similar level in both periods, where GDP-growth is only similar for some countries. Those are the only two variables with the same significant positive or negative relationship, which leads to the assumption that regardless of the monetary policy environment, they are very significant determinants and drivers of the spreads. Unemployment and the change in Moody's credit rating are substantial in both periods as well but have a positive relationship in one period and a negative relationship in the other one. For example, unemployment has a positive relationship during the QE-period and a negative relationship during the QT-period.

In general, I expected a positive relationship for unemployment as higher unemployment is perceived negatively for the health and growth of a country's economy, which ultimately should lead to higher yields and spreads for this country. The main limitations for both periods outlined in Chapter 3, especially the short time horizon for the QT-period, could cause misleading results or results that are not significant. Therefore, the negative impact of unemployment on the spreads has to be confirmed in the future, when more data is available, as this is different from other and longer historical observations.

In the second case, a change in the credit rating of Moody's has a significant negative relationship during the QE-period and a significant negative one during the QT-period. Now the result for the QT-period is in line with my expectations, as I expected a negative relationship, as a higher and better credit rating should boost confidence and lower yields and spreads. Therefore, the positive effect during the QE-period seems odd and has been discussed further for the results of the whole period in Chapter 4.1.

Besides those, there are no more significant differences between the periods.

In general, I can conclude that inflation and GDP-growth are significant and relevant in both periods and therefore significant regardless of the monetary policy environment. However, the significant results for unemployment and the change in Moody's credit rating suppose opposite effects. Due to the general problem of the short-time horizon of the QT-period and the small number of observations, these results and comparisons should be monitored and confirmed over the future when more data is available. In summary, the most important macroeconomic variables inflation and GDP-growth have a similar effect in both periods. There are no clear differences between the two periods that indicate completely different determinants of the spreads in different monetary policy environments.

CHAPTER 5: CONCLUSIONS AND LIMITATIONS

5.1 Main Findings & Conclusions

I have analysed the determinants of European government bond spreads for the GIIPS countries from 01/03/2013 to 28/02/2023. Before splitting the dataset into different periods and checking the variables for robustness, I estimated the significance of inflation, GDP-growth and unemployment for the whole period in general. All three of them are indeed very significant for the entire period and for most of the single respective countries as well. However, while controlling for other macroeconomic data, credit ratings also seem to have a significant effect on the spreads (especially S&P and Moody's).

In the next step, I tried to control and check the robustness of these general findings by implementing an event-study type regression model with two dummy variables accounting for QT-type- and QE-type announcements by the ECB. This was conducted for both the monthly and the daily data. I only find a significant positive relationship for the QE-type announcements on the spreads in the daily data set and no significant relationships for both dummy variables in the monthly data set. The result being insignificant for the monetary policy announcements could be explained by different expectations regarding the announcement and therefore differences in the surprise effect, as well as the relatively small number of announcements. Possible problems with endogeneity and multicollinearity have been addressed in Chapter 4.3 as well. Typically, monetary policy has a significant effect on yields and spreads as suggested by various papers (Belke and Gros, 2021; Malliaropulos and Migiakis, 2023; Acharya et al., 2019). However, while conducting the event-study regression and controlling for other market factors in the daily data set, I find the domestic equity index and especially the VIX have a significant negative effect on the spreads instead. This indicates that market factors have a significant effect next to the macroeconomic variables as well. While comparing the results within this event-study for the monthly data set to the observations in the first step, I still find the three main macroeconomic variables as significant as before.

The first steps aim to find and confirm the general significance of the three focused variables on the spreads and check for market and monetary factors. This allows me to turn to the focus of this thesis, to understand the impact and effect of the macroeconomic variables on the spreads in different points in time, leading to the main research question: "How significant are the macroeconomic variables inflation, GDP-growth and unemployment as determinants of

European government bond spreads in different monetary policy environments?” I want to confirm if the macroeconomic variables have the same significant effect for both periods and what the differences are between the two periods. While looking at these results we can differentiate between conclusions that look at i) differences and results between the single periods and the overall period for the monthly data set and ii) differences and results between the QE- and QT-period itself.

i) For the QE-period, I find the same significant positive or negative relationships for the respective variables as for the whole period (except the S&P rating). This partially confirms the significance of the variables inflation, GDP-growth and unemployment.

Regarding the QT-period I only find the same significant positive or negative relationship for inflation and GDP-growth while comparing to the results of the whole period. There are significant results for unemployment and Moody’s credit rating as well, but they are now negative and positive respectively.

ii) While ultimately comparing the QE- and QT period itself, I observe only significant positive or negative relationships for inflation and GDP-growth as well. Moreover, there are no real significant differences between the two periods, indicating that the impact and significance of the three main variables of interest is independent of the monetary policy environment.

In summary, inflation, GDP-growth and unemployment are significant determinants of European government bond spreads over the whole period. Moreover, the effects of monetary policy announcements are unclear both for the monthly and the daily data set, which is mainly caused by the limitations and problems with analysing such announcements. Finally, inflation and GDP-growth are confirmed as significant determinants for both the QE- and the QT-period, although the results for the QT-period are less significant. Adding to that there are almost no significant differences between the two periods, indicating that the significance of the macroeconomic variables is not affected by the monetary policy environment.

5.2 Limitations and Further Research

This thesis has certain limitations and implications for further research and similar works. The main limitations got explained and mentioned in Chapter 3. In summary, the main limitations are about the use of monthly data and the according lag of effects due to different publishing dates of macroeconomic data, the accuracy of determining the effect of monetary policy

announcements and the short time horizon for the QT-period. Due to the different publishing dates of macroeconomic data and their abundance of daily data, I just used the end of month spreads as a reference for the dependent variable. Therefore, the effects can lag and especially the interpolated quarterly data is not appropriate to assess short-term effects, but as this thesis rather wants to understand medium- to long-term effects than short-term effects the monthly data is still considered suitable.

The second main problem is the accuracy of the effect regarding the monetary policy announcements by the ECB because it is argued that this is heavily anticipated and discussed before the actual announcement. The announcement itself has just a “surprise effect” on the spreads. This lag in the monthly data and the surprise effect was ultimately the motivation to include an event-study regression for a daily data set as well. The last main limitation concerns the QT-period. The number of observations is rather small because soaring inflation and a tighter monetary policy just started recently. Moreover, endogeneity and multicollinearity within the data and variables can be problematic as well. This was addressed and tried to be eliminated in Chapter 4.3 by conducting a differences-in-differences approach and performing regressions with omitted variables. Even though R-squared is relatively high for almost all regressions and I found multiple significant relationships that are confirmed by the robustness checks, all these limitations should be considered while looking at the results.

Nevertheless, the QT-period is so short, it is still interesting to include the period, as it can be interesting and important to gain some early insights into possible differences in effects during this time. On the other hand, this limitation regarding the short time horizon of the QT-period makes it especially interesting for further research to confirm the early results of this thesis over time. As interest rate hikes and tighter measures by the ECB started in 2022, it will be interesting to monitor the situation and confirm the results over a longer period.

This thesis focused on macroeconomic variables as one of the main determinants of spreads next to monetary policy. But during and after the financial crisis for example, many researchers identified a “doom-loop” between a country's banking sector and the government (Capponi, Corell, and Stiglitz, 2022; Gibson et al., 2022; Acharya et al., 2019). This “doom-loop” described the close relationship between the health of the domestic banking sector and the financial trust in the according government, meaning the health and robustness of the banking sector had a significant impact on the respective country's government bond yield and therefore

the spreads. Consequently, it can be very interesting to monitor such effects again, primarily due to signs of a weaker banking sector and the fear of a new financial crisis caused by banks. This is not only true for the USA and their recent bankruptcy of SVB for example, but the recent takeover of Credit Suisse by UBS and plunging stock prices for European banks make this topic relevant for European countries again.

APPENDICES

Appendix 1: Variable overview and description.

| Variable | Description | Source |
|----------|--|-----------------------------------|
| sprd | 10-year government bond spread against German bond | Datastream, own calculations |
| infl | Monthly y/y inflation data | ECB, domestic statistical bureaus |
| gdp | Monthly linear interpolated y/y GDP growth (derived from quarterly data) | World Bank, own calculations |
| empl | Monthly unemployment rate | Datastream |
| ulcg | Monthly linear interpolated Unit Labour Cost growth (derived from quarterly data) | ECB, own calculations |
| srtg | Sovereign Credit Rating Standard & Poor's | Datastream |
| mrtg | Sovereign Credit Rating Moodys | Datastream |
| frtg | Sovereign Credit Rating Fitch | Datastream |
| sent | Relative change in biggest domestic consumer sentiment index (see Appendix 2 domestic indices) | Datastream, own calculations |
| mrfr | Main refinancing operations rate (key ECB interest rate) | Datastream |
| m2g | Monthly growth of the monetary amount M2 | Datastream |
| ecbqe | Dummy variable for major ECB announcements that easy monetary conditions (interest rate announcements not included; see announcement overview table) | ECB |
| ecbqe | Dummy variable for major ECB announcements that tighten monetary conditions (interest rate announcements not included see announcement overview table) | ECB |
| equ | Relative change in main domestic equity index (see Appendix 2 domestic indices) | Datastream, own calculations |
| vix | Relative change in the Chicago Board of Exchange Volatility Index | Datastream, own calculations |

Appendix 2: Domestic indices.

| Variable | Country | Description | Source |
|-------------|----------|--|------------------------------|
| sent | Italy | Business Confidence Index (Istat) | Datastream, own calculations |
| | Spain | Business Confidence Index (Bank of Spain) | Datastream, own calculations |
| | Portugal | Business Confidence Index (Bank of Spain) | Datastream, own calculations |
| | Greece | Business and Consumer Survey (IOBE) | Datastream, own calculations |
| | Ireland | Business Sentiment Indicator (KBC Bank and ESRI) | Datastream, own calculations |
| equ | Italy | FTSE MIB Index | Datastream, own calculations |
| | Spain | IBEX35 Index | Datastream, own calculations |
| | Portugal | Portugal Stock Index (PSI) | Datastream, own calculations |
| | Greece | Athex Composite | Datastream, own calculations |

| | | | |
|--|---------|----------------------------|------------------------------|
| | Ireland | Ireland ISEQ Overall Index | Datastream, own calculations |
|--|---------|----------------------------|------------------------------|

Note: Selection of most relevant Business and Sentiment Indices by the author.

Appendix 3: Major ECB announcements regarding purchasing programs.

| Category | Date | Description | Source |
|----------|------------|--|----------------------------|
| QE | 22/01/2015 | Introduction of PSPP | ECB, (Havlik et al., 2022) |
| QE | 03/12/2015 | Extension of APP until March 2017 and inclusion of further debt instruments issued by governments in the list of eligible assets | ECB, (Havlik et al., 2022) |
| QE | 10/03/2016 | Expansion of APP to €80 billion monthly | ECB, (Havlik et al., 2022) |
| QT | 08/12/2016 | Decrease of PSPP purchases to €60 billion monthly and decrease of minimum remaining maturity for eligible securities in PSPP from two years to one year | ECB, (Havlik et al., 2022) |
| QT | 26/10/2017 | Decrease of PSPP purchases to €30 billion monthly | ECB, (Havlik et al., 2022) |
| QT | 14/06/2018 | Decrease of PSPP purchases to €15 billion monthly until the end of 2018 and then ending purchases under APP | ECB, (Havlik et al., 2022) |
| QE | 12/09/2019 | Restart of APP at a monthly pace of €20 billion | ECB, (Havlik et al., 2022) |
| QE | 12/03/2020 | Addition of a temporary envelope of net asset purchases in the amount of €120 billion until the end of the year | ECB, (Havlik et al., 2022) |
| QE | 18/03/2020 | Launch of PEPP with an envelope of €750 billion | ECB, (Havlik et al., 2022) |
| QE | 14/06/2020 | Expansion of PEPP by €600 billion | ECB, (Havlik et al., 2022) |
| QE | 21/07/2022 | Announcement of TPI | ECB |
| QT | 27/10/2022 | Adjustment of terms and interest rates for TLTRO III | ECB |
| QT | 15/12/2022 | From the beginning of March the APP portfolio will decline at a measured and predictable pace and will not reinvest all of the principal payments from maturing securities | ECB |
| QT | 02/02/2023 | More details about the APP reduction and the principal reinvestment of other purchasing programs | ECB |

Note: Own classification into QE and QT and used accordingly for the dummy variables ecbqe and ecbqt. This list doesn't no claim to represent all ECB decisions or announcements as the selection and classification was made by the author to identify the most relevant ones.

Appendix 4: Summary statistics monthly data.

| Variable | Obs | Mean | Std. dev. | Min | Max |
|----------------|-----|-------|-----------|---------|--------|
| Overall | | | | | |
| sprd | 600 | 2,094 | 2,130 | 0,159 | 14,367 |
| infl | 600 | 1,404 | 2,875 | -2,900 | 12,600 |
| gdpg | 600 | 2,766 | 6,038 | -21,937 | 26,653 |

| | | | | | |
|-----------------|-----|--------|--------|---------|---------|
| empl | 600 | 13,307 | 6,227 | 4,200 | 28,100 |
| ulcg | 600 | -0,575 | 2,254 | -20,980 | 9,856 |
| srtg | 600 | 13,430 | 3,438 | 7,000 | 19,000 |
| mrtg | 600 | 12,597 | 3,414 | 2,000 | 17,000 |
| frtg | 600 | 13,292 | 3,396 | 7,000 | 19,000 |
| sent | 600 | 1,830 | 24,128 | -60,221 | 205,128 |
| mrfr | 600 | 0,161 | 0,443 | 0,000 | 3,000 |
| m2g | 600 | 0,435 | 0,340 | -0,503 | 2,356 |
| Italy | | | | | |
| sprd | 120 | 1,737 | 0,582 | 0,949 | 3,501 |
| infl | 120 | 1,664 | 2,898 | -1,000 | 12,600 |
| gdp | 120 | 0,576 | 4,418 | -17,767 | 16,765 |
| empl | 120 | 10,695 | 1,543 | 7,500 | 13,200 |
| ulcg | 120 | -0,357 | 0,994 | -3,344 | 3,074 |
| srtg | 120 | 14,000 | 0,000 | 14,000 | 14,000 |
| mrtg | 120 | 13,517 | 0,502 | 13,000 | 14,000 |
| frtg | 120 | 13,725 | 0,448 | 13,000 | 14,000 |
| sent | 120 | 0,214 | 3,207 | -10,320 | 11,681 |
| Spain | | | | | |
| sprd | 120 | 1,215 | 0,599 | 0,608 | 3,777 |
| infl | 120 | 1,643 | 2,783 | -1,500 | 10,700 |
| gdp | 120 | 1,474 | 5,350 | -21,937 | 17,875 |
| empl | 120 | 17,993 | 4,366 | 12,600 | 26,400 |
| ulcg | 120 | -0,153 | 1,123 | -3,583 | 4,042 |
| srtg | 120 | 15,658 | 1,134 | 14,000 | 17,000 |
| mrtg | 120 | 14,392 | 0,665 | 13,000 | 15,000 |
| frtg | 120 | 15,558 | 1,308 | 13,000 | 17,000 |
| sent | 120 | 2,901 | 30,386 | -45,283 | 203,650 |
| Portugal | | | | | |
| sprd | 120 | 1,906 | 1,223 | 0,538 | 5,144 |
| infl | 120 | 1,472 | 2,637 | -0,800 | 10,600 |
| gdp | 120 | 1,775 | 4,741 | -17,780 | 17,029 |
| empl | 120 | 9,725 | 3,658 | 5,800 | 17,900 |
| ulcg | 120 | -0,062 | 1,473 | -4,577 | 6,099 |
| srtg | 120 | 11,467 | 0,501 | 11,000 | 12,000 |
| mrtg | 120 | 11,933 | 0,905 | 10,000 | 13,000 |
| frtg | 120 | 11,092 | 0,290 | 11,000 | 12,000 |
| sent | 120 | 2,901 | 30,386 | -45,283 | 203,650 |
| Greece | | | | | |
| sprd | 120 | 4,890 | 3,101 | 1,008 | 14,367 |
| infl | 120 | 0,893 | 3,304 | -2,900 | 12,100 |
| gdp | 120 | 0,846 | 4,948 | -15,592 | 14,635 |
| empl | 120 | 20,488 | 5,042 | 10,800 | 28,100 |
| ulcg | 120 | -0,784 | 1,772 | -5,958 | 5,117 |

| | | | | | |
|----------------|-----|--------|--------|---------|---------|
| srtg | 120 | 8,317 | 1,572 | 7,000 | 11,000 |
| mrtg | 120 | 7,042 | 2,894 | 2,000 | 11,000 |
| frtg | 120 | 8,500 | 1,449 | 7,000 | 11,000 |
| sent | 120 | 2,816 | 31,572 | -60,221 | 205,128 |
| Ireland | | | | | |
| sprd | 120 | 0,723 | 0,539 | 0,159 | 2,963 |
| infl | 120 | 1,348 | 2,680 | -1,500 | 9,600 |
| gdp | 120 | 9,157 | 5,997 | -1,633 | 26,653 |
| empl | 120 | 7,636 | 2,928 | 4,200 | 14,500 |
| ulcg | 120 | -1,519 | 4,071 | -20,980 | 9,856 |
| srtg | 120 | 17,708 | 1,205 | 16,000 | 19,000 |
| mrtg | 120 | 16,100 | 0,864 | 15,000 | 17,000 |
| frtg | 120 | 17,583 | 1,406 | 15,000 | 19,000 |
| sent | 120 | 0,318 | 8,271 | -44,890 | 24,525 |

Source: own calculations

Appendix 5: Overview credit ratings.

| S&P | Moody's | Fitch | Assigned value |
|------|---------|-------|----------------|
| AAA | Aaa | AAA | 22 |
| AA+ | Aa1 | AA+ | 21 |
| AA | Aa2 | AA | 20 |
| AA- | Aa3 | AA- | 19 |
| A+ | A1 | A+ | 18 |
| A | A2 | A | 17 |
| A- | A3 | A- | 16 |
| BBB+ | Baa1 | BBB+ | 15 |
| BBB | Baa2 | BBB | 14 |
| BBB- | Baa3 | BBB- | 13 |
| BB+ | Ba1 | BB+ | 12 |
| BB | Ba2 | BB | 11 |
| BB- | Ba3 | BB- | 10 |
| B+ | B1 | B+ | 9 |
| B | B2 | B | 8 |
| B- | B3 | B- | 7 |
| CCC+ | Caa1 | CCC+ | 6 |
| CCC | Caa2 | CCC | 5 |
| CCC- | Caa3 | CCC- | 4 |
| CC | Ca | CC | 3 |
| C | C | C | 2 |
| D | D | D | 1 |

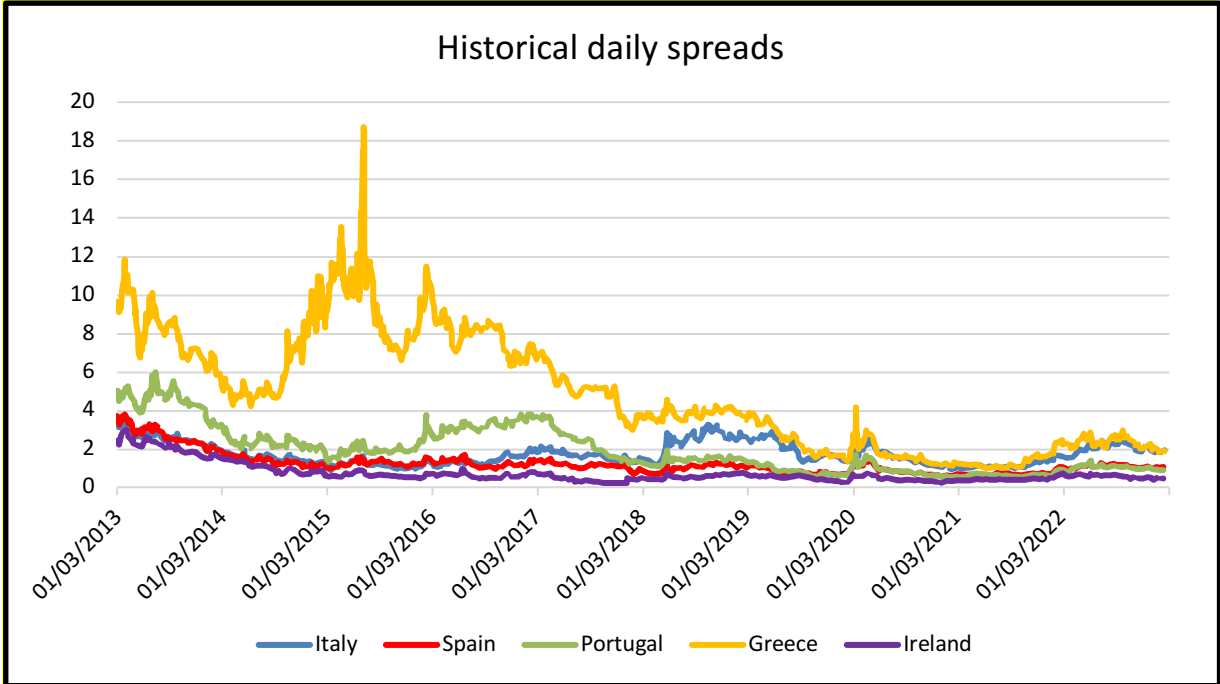
Source: Own assignment

Appendix 6: Summary statistics daily data.

| Variable | Obs | Mean | Std. dev. | Min | Max |
|-----------------|-------|--------|-----------|---------|--------|
| sprd | 13040 | 2,074 | 2,091 | 0,159 | 18,694 |
| ecbqe | 13040 | 0,003 | 0,055 | 0,000 | 1,000 |
| ecbqt | 13040 | 0,002 | 0,039 | 0,000 | 1,000 |
| equ | 13040 | 0,022 | 1,396 | -16,924 | 11,461 |
| vix | 13040 | 19,842 | 6,575 | 11,850 | 72,980 |
| Italy | | | | | |
| sprd | 2608 | 1,731 | 0,567 | 0,889 | 3,503 |
| equ | 2608 | 0,031 | 1,428 | -16,924 | 8,926 |
| Spain | | | | | |
| sprd | 2608 | 1,209 | 0,572 | 0,556 | 3,787 |
| equ | 2608 | 0,013 | 1,253 | -14,059 | 8,573 |
| Portugal | | | | | |
| sprd | 2608 | 1,898 | 1,214 | 0,494 | 5,961 |
| equ | 2608 | 0,007 | 1,161 | -9,758 | 7,823 |
| Greece | | | | | |
| sprd | 2608 | 4,823 | 3,029 | 0,976 | 18,694 |
| equ | 2608 | 0,021 | 1,822 | -16,233 | 11,461 |
| Ireland | | | | | |
| sprd | 2608 | 0,712 | 0,509 | 0,159 | 2,963 |
| equ | 2608 | 0,037 | 1,213 | -9,936 | 6,941 |

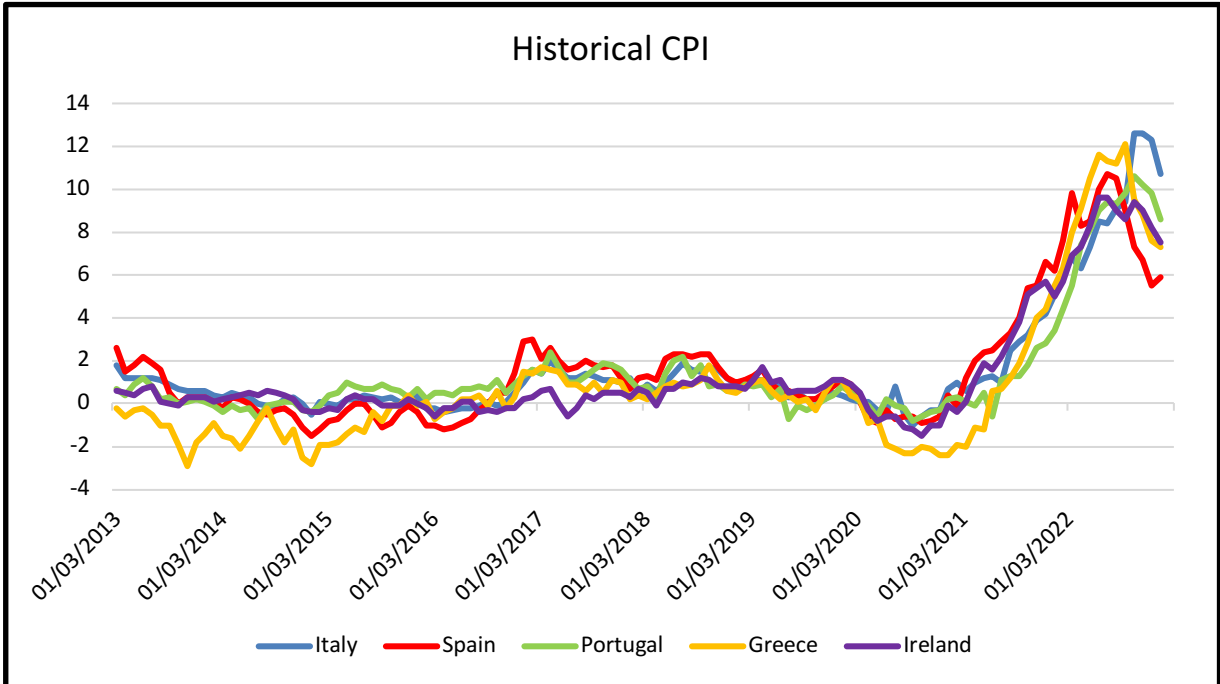
Source: own calculations

Appendix 7: Historical daily spreads.



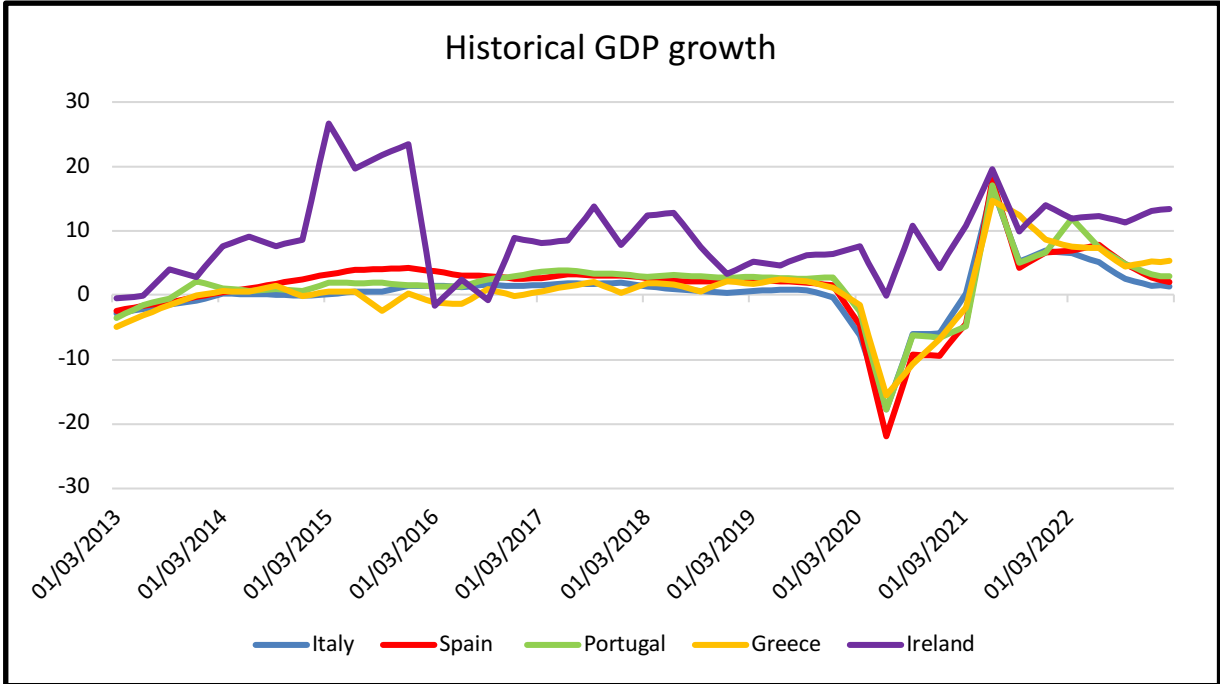
Note: Historical daily 10-year government bond spreads against the historical daily 10-year german government bond yield. Y-axis in percentage points. Source: own calculations.

Appendix 8: Historical CPI.



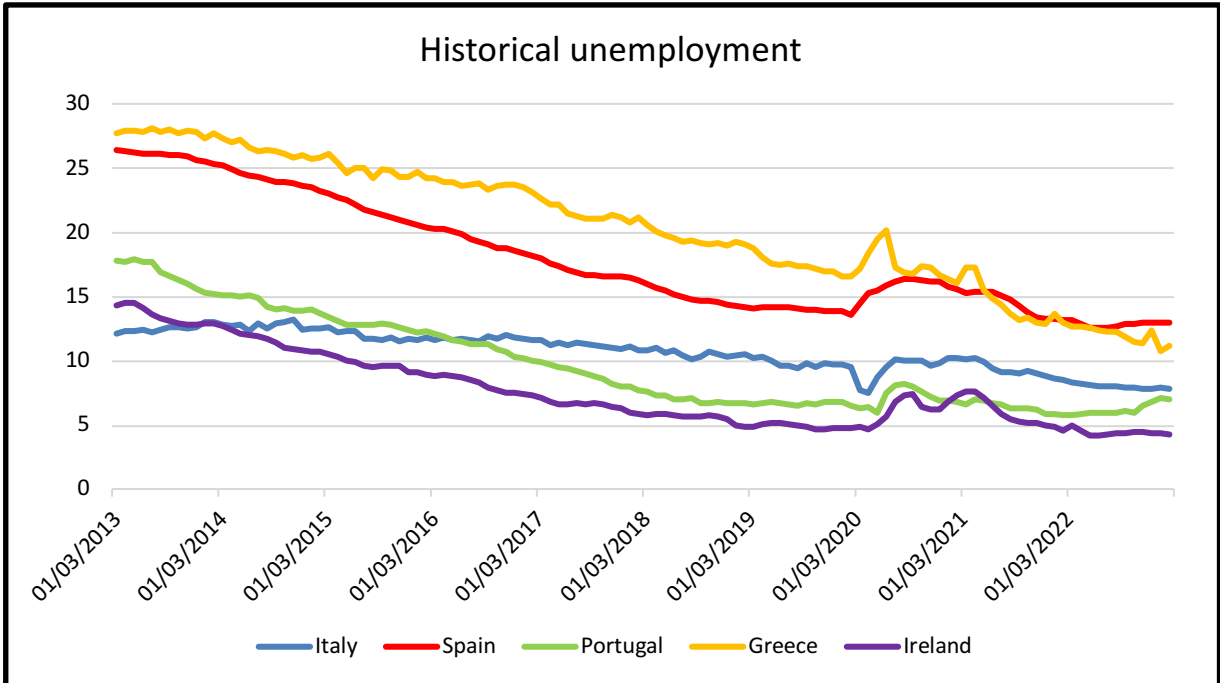
Note: monthly change of CPI in percentage with a y/y basis in percent. Graphic source: own calculations.

Appendix 9: Historical GDP growth.



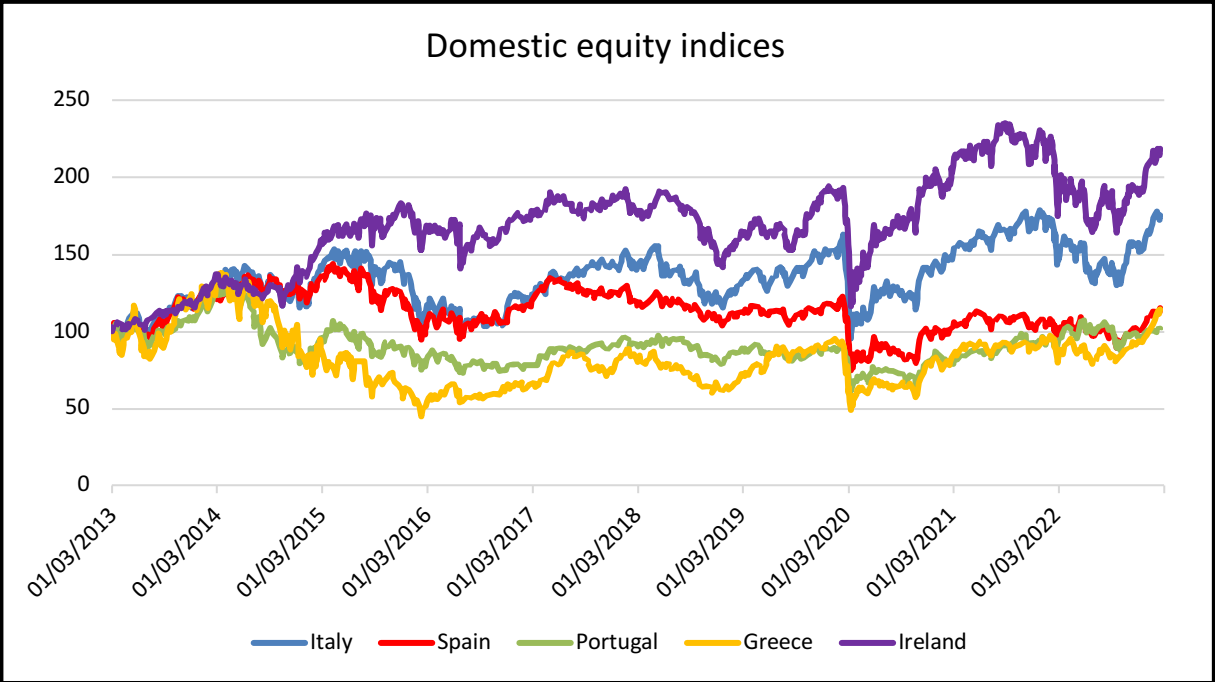
Note: monthly linear interpolated GDP growth with a q/q basis in percent. Graphic source: own calculations.

Appendix 10: Historical unemployment.



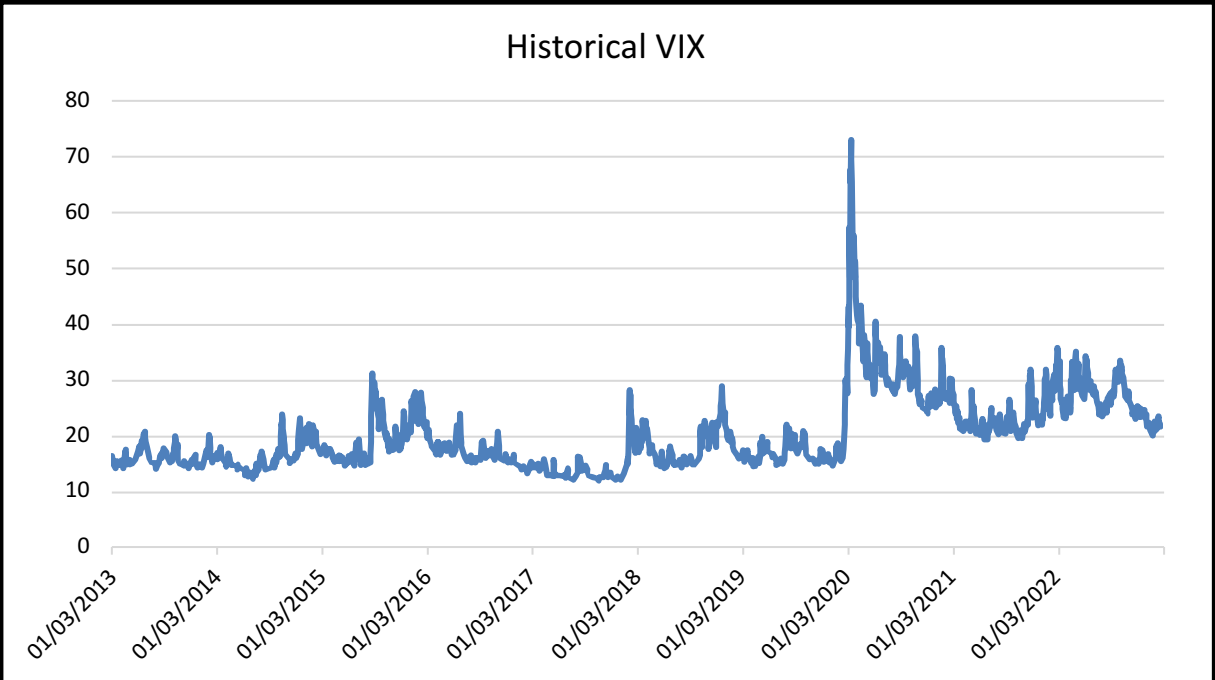
Note: monthly historical unemployment in percent. Graphic source: own calculations.

Appendix 11: Domestic equity indices.



Note: change in the main domestic equity indices with 100 as a base on the 01/03/2013 (respective names of the index can be found in Appendix 2). Source: own calculations.

Appendix 12: Historical VIX



Note: daily annualized implied volatility based on S&P 500 index options, published by the CBOE. Graphic source: own calculations.

REFERENCE LIST

- Acharya, Viral V, Tim Eisert, Christian Eufinger, and Christian Hirsch. 2019. 'Whatever It Takes: The Real Effects of Unconventional Monetary Policy'. *The Review of Financial Studies* 32 (9): 3366–3411. <https://doi.org/10.1093/rfs/hhz005>.
- Afonso, António, Michael G. Arghyrou, George Bagdatoglou, and Alexandros Kontonikas. 2015. 'On the Time-Varying Relationship between EMU Sovereign Spreads and Their Determinants'. *Economic Modelling* 44 (January): 363–71. <https://doi.org/10.1016/j.econmod.2014.07.025>.
- Afonso, António, and João Tovar Jalles. 2019. 'Quantitative Easing and Sovereign Yield Spreads: Euro-Area Time-Varying Evidence'. *Journal of International Financial Markets, Institutions and Money* 58 (January): 208–24. <https://doi.org/10.1016/j.intfin.2018.10.003>.
- Altavilla, Carlo, Giacomo Carboni, and Roberto Motto. 2015. 'Asset Purchase Programmes and Financial Markets: Lessons from the Euro Area'. *SSRN Electronic Journal*.
- Ambler, Steve, and Fabio Rumler. 2019. 'The Effectiveness of Unconventional Monetary Policy Announcements in the Euro Area: An Event and Econometric Study'. *Journal of International Money and Finance* 94 (June): 48–61. <https://doi.org/10.1016/j.jimonfin.2019.02.007>.
- Andrade, Philippe, Johannes Breckenfelder, Fiorella De Fiore, Peter Karadi, and Oreste Tristani. 2016. 'The ECB's Asset Purchase Programme: An Early Assessment'. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2839812>.
- Argyrou, Michael G., and Alexandros Kontonikas. 2012. 'The EMU Sovereign-Debt Crisis: Fundamentals, Expectations and Contagion'. *Journal of International Financial Markets, Institutions and Money* 22 (4): 658–77. <https://doi.org/10.1016/j.intfin.2012.03.003>.
- Arnold, Ivo J.M., and Beau Soederhuizen. 2018. 'Sovereign Bond Holdings and Monetary Policy Operations in the Euro Area'. *Journal of Policy Modeling* 40 (6): 1243–54. <https://doi.org/10.1016/j.jpolmod.2018.05.004>.
- Aßmann, Christian, and Jens Boysen-Hogrefe. 2012. 'Determinants of Government Bond Spreads in the Euro Area: In Good Times as in Bad'. *Empirica* 39 (3): 341–56. <https://doi.org/10.1007/s10663-011-9171-6>.

- Bansal, Naresh, Robert A. Connolly, and Chris Stivers. 2014. 'The Stock-Bond Return Relation, the Term Structure's Slope, and Asset-Class Risk Dynamics'. *The Journal of Financial and Quantitative Analysis* 49 (3): 699–724.
- Beetsma, Roel, Massimo Giuliadori, Frank de Jong, and Daniel Widijanto. 2013. 'Spread the News: The Impact of News on the European Sovereign Bond Markets during the Crisis'. *The European Sovereign Debt Crisis: Background & Perspective* 34 (April): 83–101. <https://doi.org/10.1016/j.jimonfin.2012.11.005>.
- Belke, Ansgar, and Daniel Gros. 2021. 'QE in the Euro Area: Has the PSPP Benefited Peripheral Bonds?' *Journal of International Financial Markets, Institutions and Money* 73 (July): 101350. <https://doi.org/10.1016/j.intfin.2021.101350>.
- Bernoth, Kerstin, and Burcu Erdogan. 2012. 'Sovereign Bond Yield Spreads: A Time-Varying Coefficient Approach'. *Financial Stress in the Eurozone* 31 (3): 639–56. <https://doi.org/10.1016/j.jimonfin.2011.10.006>.
- Capponi, Agostino, Felix Corell, and Joseph E. Stiglitz. 2022. 'Optimal Bailouts and the Doom Loop with a Financial Network'. *Journal of Monetary Economics* 128 (May): 35–50. <https://doi.org/10.1016/j.jmoneco.2022.03.004>.
- Clancy, Daragh, Carmine Gabriele, and Diana Žigraiová. 2022. 'Sovereign Bond Market Spillovers from Crisis-Time Developments in Greece'. *Journal of International Financial Markets, Institutions and Money* 78 (May): 101558. <https://doi.org/10.1016/j.intfin.2022.101558>.
- Corradin, Stefano, and Bernd Schwaab. 2023. 'Euro Area Sovereign Bond Risk Premia before and during the Covid-19 Pandemic'. *European Economic Review* 153 (April): 104402. <https://doi.org/10.1016/j.euroecorev.2023.104402>.
- Costantini, Mauro, and Ricardo M. Sousa. 2022. 'What Uncertainty Does to Euro Area Sovereign Bond Markets: Flight to Safety and Flight to Quality'. *Journal of International Money and Finance* 122 (April): 102574. <https://doi.org/10.1016/j.jimonfin.2021.102574>.
- D'Agostino, Antonello, and Michael Ehrmann. 2014. 'The Pricing of G7 Sovereign Bond Spreads – The Times, They Are a-Changin'. *Journal of Banking & Finance* 47 (October): 155–76. <https://doi.org/10.1016/j.jbankfin.2014.06.001>.
- De Haan, Jakob. 2008. 'The Effect of ECB Communication on Interest Rates: An Assessment'. *The Review of International Organizations* 3 (4): 375–98. <https://doi.org/10.1007/s11558-008-9048-z>.

- De Santis, Roberto A. 2012. ‘The Euro Area Sovereign Debt Crisis: Safe Haven, Credit Rating Agencies and the Spread of the Fever from Greece, Ireland and Portugal’. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1991159>.
- . 2020. ‘Impact of the Asset Purchase Programme on Euro Area Government Bond Yields Using Market News’. *Economic Modelling* 86 (March): 192–209. <https://doi.org/10.1016/j.econmod.2019.06.011>.
- Dewachter, Hans, Leonardo Iania, Marco Lyrio, and Maite de Sola Perea. 2015. ‘A Macro-Financial Analysis of the Euro Area Sovereign Bond Market’. *Journal of Banking & Finance* 50 (January): 308–25. <https://doi.org/10.1016/j.jbankfin.2014.03.011>.
- ECB. 2012. ‘Whatever It Takes’. 26 July 2012. <https://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html>.
- ECB, 2020. ‘Transcript of the Questions and Answers, ECB Press Conference’. 12 March 2020. <https://www.ecb.europa.eu/press/pressconf/2020/html/ecb.is200312~f857a21b6c.en.html>. last accessed: 16 March 2023.
- . 2020b. ‘Meeting of 18 March 2020, Press Release’. 18 March 2020. https://www.ecb.europa.eu/press/accounts/2020/html/ecb.mg200409_1~baf4b2ad06.en.html.
- ECB, 2022. ‘Monetary Policy Decisions’. 21 July 2022. <https://www.ecb.europa.eu/press/pr/date/2022/html/ecb.mp220721~53e5bdd317.en.html>. last accessed: 16 March 2023.
- . 2023. ‘Monetary Policy Principles’. 31 March 2023. <https://www.ecb.europa.eu/ecb/tasks/monpol/html/index.en.html>.
- Ehrmann, Michael, and Marcel Fratzscher. 2017. ‘Euro Area Government Bonds – Fragmentation and Contagion during the Sovereign Debt Crisis’. *Journal of International Money and Finance* 70 (February): 26–44. <https://doi.org/10.1016/j.jimonfin.2016.08.005>.
- Eser, Fabian, and Bernd Schwaab. 2016. ‘Evaluating the Impact of Unconventional Monetary Policy Measures: Empirical Evidence from the ECB’s Securities Markets Programme’. *Journal of Financial Economics* 119 (1): 147–67. <https://doi.org/10.1016/j.jfineco.2015.06.003>.
- Fan, Jack, and Marci Mitchell. n.d. ‘Equity-Bond Correlation: A Historical Perspective’.

- Fanelli, Luca, and Antonio Marsi. 2022. 'Sovereign Spreads and Unconventional Monetary Policy in the Euro Area: A Tale of Three Shocks'. *European Economic Review* 150 (November): 104281. <https://doi.org/10.1016/j.euroecorev.2022.104281>.
- Farinha, Jorge Bento, and José Vidrigo. 2021. 'The Impact of the ECB's Asset Purchase Programme on Core and Peripheral Sovereign Yields and Its Transmission Channels'. *The Journal of Economic Asymmetries* 24 (November): e00213. <https://doi.org/10.1016/j.jeca.2021.e00213>.
- Favero, Carlo, Marco Pagano, and Ernst-Ludwig von Thadden. 2010. 'How Does Liquidity Affect Government Bond Yields?' *Journal of Financial and Quantitative Analysis* 45 (1): 107–34. <https://doi.org/10.1017/S0022109009990494>.
- Fendel, Ralf, and Frederik Neugebauer. 2020. 'Country-Specific Euro Area Government Bond Yield Reactions to ECB's Non-Standard Monetary Policy Program Announcements', *German Economic Review*, 21 (4): 417–74. <https://doi.org/10.1515/ger-2018-0094>.
- Georgoutsos, Dimitris A., and Petros M. Migiakis. 2013. 'Heterogeneity of the Determinants of Euro-Area Sovereign Bond Spreads; What Does It Tell Us about Financial Stability?' *Journal of Banking & Finance* 37 (11): 4650–64. <https://doi.org/10.1016/j.jbankfin.2013.07.025>.
- Ghysels, Eric, Julien Idier, Simone Manganelli, and Olivier Vergote. 2017. 'A High-Frequency Assessment of the ECB Securities Markets Programme'. *Journal of the European Economic Association* 15 (1): 218–43. <https://doi.org/10.1093/jeea/jvw003>.
- Gibson, Heather D., Stephen G. Hall, Pavlos Petroulas, and George S. Tavlas. 2022. 'An Investigation into Feedback and Spatial Relationships between Banks' Share Prices and Sovereign Bond Spreads during the Euro Crisis'. *Journal of Financial Stability* 63 (December): 101056. <https://doi.org/10.1016/j.jfs.2022.101056>.
- Gibson, Heather D., Stephen G. Hall, and George S. Tavlas. 2016. 'The Effectiveness of the ECB's Asset Purchase Programs of 2009 to 2012'. *What Monetary Policy Can and Cannot Do* 47 (March): 45–57. <https://doi.org/10.1016/j.jmacro.2015.09.006>.
- Gnewuch, Matthias. 2022. 'Spillover Effects of Sovereign Debt-Based Quantitative Easing in the Euro Area'. *European Economic Review* 145 (June): 104133. <https://doi.org/10.1016/j.euroecorev.2022.104133>.
- Gómez-Puig, Marta, Simón Sosvilla-Rivero, and María del Carmen Ramos-Herrera. 2014. 'An Update on EMU Sovereign Yield Spread Drivers in Times of Crisis: A Panel Data

- Analysis'. *The North American Journal of Economics and Finance* 30 (November): 133–53. <https://doi.org/10.1016/j.najef.2014.09.003>.
- Havlik, Annika, Friedrich Heinemann, Samuel Helbig, and Justus Nover. 2022. 'Dispelling the Shadow of Fiscal Dominance? Fiscal and Monetary Announcement Effects for Euro Area Sovereign Spreads in the Corona Pandemic'. *Journal of International Money and Finance* 122 (April): 102578.
- Hubert, Paul, and Fabien Labondance. 2018. 'The Effect of ECB Forward Guidance on the Term Structure of Interest Rates'. *International Journal of Central Banking* 14 (5).
- Hull, John, Mirela Predescu, and Alan White. 2004. 'The Relationship between Credit Default Swap Spreads, Bond Yields, and Credit Rating Announcements'. *Recent Research on Credit Ratings* 28 (11): 2789–2811. <https://doi.org/10.1016/j.jbankfin.2004.06.010>.
- Joyce, Michael, Ana Lasasoa, Ibrahim Stevens, and Matthew Tong. 2010. 'The Financial Market Impact of Quantitative Easing'. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1638986>.
- Kenourgios, Dimitrios, Zaghum Umar, and Paraskevi Lemonidi. 2020. 'On the Effect of Credit Rating Announcements on Sovereign Bonds: International Evidence'. *International Economics* 163 (October): 58–71. <https://doi.org/10.1016/j.inteco.2020.04.006>.
- Klose, Jens, and Benjamin Weigert. 2014. 'Sovereign Yield Spreads During the Euro Crisis: Fundamental Factors Versus Redenomination Risk: Sovereign Yield Spreads During the Euro Crisis'. *International Finance* 17 (1): 25–50. <https://doi.org/10.1111/inf.12042>.
- Kyriazis, Antzelos. 2023. 'Quantitative Easing and Fiscal Policy Effectiveness'. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4371287>.
- Malliaropulos, Dimitris, and Petros Migiakis. 2023. 'A Global Monetary Policy Factor in Sovereign Bond Yields'. *Journal of Empirical Finance* 70 (January): 445–65. <https://doi.org/10.1016/j.jempfin.2022.12.011>.
- Manganelli, Simone, and Guido Wolswijk. 2009. 'What Drives Spreads in the Euro Area Government Bond Market?' *Economic Policy* 24 (58): 191–240. <https://doi.org/10.1111/j.1468-0327.2009.00220.x>.
- Ortmans, Aymeric, and Fabien Tripier. 2021. 'COVID-Induced Sovereign Risk in the Euro Area: When Did the ECB Stop the Spread?' *European Economic Review* 137 (August): 103809. <https://doi.org/10.1016/j.eurocorev.2021.103809>.

- Paniagua, Jordi, Juan Sapena, and Cecilio Tamarit. 2017. 'Sovereign Debt Spreads in EMU: The Time-Varying Role of Fundamentals and Market Distrust'. *Journal of Financial Stability* 33 (December): 187–206. <https://doi.org/10.1016/j.jfs.2016.06.004>.
- Reis, Ricardo. 2017. 'QE in the Future: The Central Bank's Balance Sheet in a Fiscal Crisis'. *IMF Economic Review* 65 (1): 71–112. <https://doi.org/10.1057/s41308-017-0028-2>.
- Szczerbowicz, U. 2015. 'The ECB Unconventional Monetary Policies: Have They Lowered Market Borrowing Costs for Banks and Governments?' *Int. J. Central Bank.* 11 (4): 91–127.
- Urbschat, Florian, and Sebastian Watzka. 2020. 'Quantitative Easing in the Euro Area – An Event Study Approach'. *The Quarterly Review of Economics and Finance* 77 (August): 14–36.