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The PEPP's Effect on Euro Area Bond Spreads

Master's Final Assignment in Academic Context presented to Universidade Católica Portuguesa in order to obtain the Master's degree in Finance

by

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Resumo

Esta dissertação visa estudar o impacto do Programa de Compra de Emergência Pandémica, do Banco Central Europeu, nos spreads das obrigações emitidas por empresas localizadas na zona euro. Foram utilizadas quatro amostras na análise de regressão, constituídas por 8.655 obrigações de empresas não financeiras, 2.523 obrigações soberanas, 4.177 covered bonds, e 3.721 asset-backed securities, emitidos entre 1 de Janeiro de 2000, e 31 de Janeiro de 2023.

Constata-se que o PEPP reduziu com sucesso os spreads das obrigações de empresas não financeiras, das covered bonds e das obrigações soberanas durante os períodos de compra. Os spreads das obrigações de empresas não financeiras também foram reduzidos no período de anúncio. No entanto, esta foi a única amostra em que o efeito de sinalização foi sentido, ao contrário do que se esperava. Para títulos garantidos por ativos, não se nota qualquer efeito estatisticamente significativo.

Palavras-chave: quantative easing; BCE; PEPP; custo do empréstimo; spreads; políticas monetárias não convencionais; obrigações de empresas; obrigações soberanas; obrigações cobertas; valores mobiliários garantidos por activos.

Número de palavras: 8058

Abstract

This thesis aims to study the impact of the European Central Bank's Pandemic Emergency Purchase Programme on euro area bonds. Four samples were used on the regression analysis, constituted by 8,655 corporate bonds, 2,523 sovereign bonds, 4,177 covered bonds, and 3,721 asset-backed securities issued between January 1st, 2000, and January 31st, 2023.

It's observed that the PEPP successfully reduced corporate, covered, and sovereign bond spreads during the purchasing periods. Spreads for Corporate bonds also reduced in the announcement period. However, this was the only sample where the signaling effect was observed, contrary to what was expected. For asset-backed securities, no statistically significant effect is verified.

Keywords: quantitative easing; ECB; PEPP; cost of borrowing; spreads; unconventional monetary policies; corporate bonds; sovereign bonds; covered bonds; asset-backed securities.

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Introduction

Quantative Easing (QE) is by no means a novelty in central banks' strategy, regarding monetary policy. It first started in the aftermath of the 2008 financial crisis. The FED implemented it with the aim of helping in the economic recovery and stabilizing the financial markets. The main goal was to increase the FED's balance sheet, purchasing assets related to the housing credit market, which was at the center of the 2008 crisis (Federal Reserve Bank, 2009).

The ECB also approached QE policies in 2009 with the launch of the first Covered Bond Purchase Programme (CBPP1). The programme would be replicated two more times with the CBPP2 and CBPP3, in 2011 and 2014, respectively. Later, the ECB expanded its purchases to asset backed securities in 2014 with the Asset Backed Securities Programme (ABSPP). In 2015, the central bank stated that it would start purchasing sovereign debt via the public sector purchase programme (PSPP). The main objective was to fight deflationary pressures felt at the time (European Central Bank, 2015).

With the Corporate Sector Purchase Programme (CSPP), launched in 2016, the ECB expanded their asset purchases to investment-grade corporate bonds denominated in euros. The main prerogative was still to reach the 2% inflation target. Nonetheless, this new programme aimed at doing so by reducing the cost of borrowing for companies in the Euro Zone.

This Programmes has been studied by multiple authors and the major conclusion is that the QE policies from the ECB were successful in reducing the cost of debt. For example, Zaghini (2019) concludes that CSPP had the expected effects in the yields both for bonds targeted by the purchases and the ones that

weren't targeted. The increase in demand for investment grade bonds by the central bank pushed other investors to other non-investment grade assets. The author also points out that for targeted bonds the effects were felt even before the purchases started rolling out due to a signaling effect. Abidi & Miquel-Flores (2016) on the other hand, state that the impact was mostly felt in yields from targeted bonds. The excess in liquidity and the market effects of the asset purchases done by the ECB led to a reduction in the cost of borrowing. However, the CSPP and other asset purchase programmes from the ECB, although active until June 2022, were announced in a low inflation environment. The pandemic emergency purchase programme was launched in a different scenario, with the emergence of a global pandemic.

The Pandemic Emergency Purchase Programme (PEPP) was announced in March 2020 as an instrument to impede an impending financial and economic crisis in Europe provoked by the Covid 19 pandemic. The pandemic brought major supply chain problems. The aggressive deflationary pressures were felt even harder. The threat of large-scale unemployment was looming. Sovereign debt was increased and there were fears of a stock market crash. Given the eminent context PEPP was announced as an expansion to APP. The goal was to assure that all institutions would be protected by the Euro Zone monetary policy. The criteria for assets eligible was made looser to increase its effect around the economy of the EU. To that effect, the ECB announced that it would be aiming to improve financing conditions to every institution: "The Governing Council of the ECB is committed to playing its role in supporting all citizens of the euro area through this extremely challenging time. To that end, the ECB will ensure that all sectors of the economy can benefit from supportive financing conditions that enable them to absorb this shock. This applies equally to families, firms, banks and governments." (European Central Bank, 2020).

The PEPP was launched as an asset purchase programme for both private and public sector securities with a €750 billion envelope in March 2020. Later a €600 billion increase was announced in June 2020 and another of €500 billion in December 2020. It worked in parallel with the APP, its purchases could include every asset eligible by the APP plus Greek bonds that were given a special exemption. It was supposed to remain active until the end of the COVID-19 crisis. Nonetheless, although the GDP stats seemed to bounce back in 2021, it remained active until March 2022.

PEPP seems very similar to other asset purchase programmes, structurally wise. One could assume that the effects of these type of policy have already been intensively studied. On the contrary, I believe that there are still some gaps in the literature. Quantative Easing policies were, mainly, used within a prolonged low inflation and high unemployment environment. Although, the PEPP was announced in a period where a recession was looming, it was mainly due to a very unique health crisis and social situation (i.e. Busineses closing down mandated by the governments). This meant that after the period of confinement a V shape recuperation was expected (Pierpaolo Benigno et al., 2022b). The supply chain problems, on the other hand, were expected to continue, which would end up creating booming inflation by the end of 2021 and beginning of 2022. Hence, I believe that studying this programme is of interest due to the specific situation it was launched at and due to the inflationary pressures present at the end of the programme. Furthermore, to the best of my knowledge, there isn't any extensive research to document the effects of PEPP in the four asset types that the programme includes, i.e., corporate bonds, sovereign bonds, covered bonds and asset backed securities. In this paper I analyze all the asset classes at their issuance in the primary market. Comparing the results within different types of bonds allows me to better study the PEPP range of action. So,

in this paper I answer the following question: "What was the impact of PEPP on the spread of Euro Area bonds?".

To do so, firstly, I give an overview the current literature on the effects the PEPP in the cost of debt and relating it with other QE measures and then move to an empirical study observing four data sets with corporate, sovereign, covered bonds, and asset-backed securities issued in Euros, from January 2000 to January 2023.

Regarding methodology, looking at related literature, a lot of authors seem to approach these studies with an event study methodology. These is effective in capturing the signaling effect and how the market responds to each announcement. Nonetheless, it does a poor job of capturing the liquidity effect and quantifying it. Hence, I conduct OLS regressions for each bond type based on cross-sectional data, to study the impact of the PEPP on bond spreads. The spread to benchmark is used as a proxy for the cost of debt. Regarding, explanatory variables, for each type of bond, I run two different models. One with a dummy variable, to signal when the PEPP is active and a second model with two independent variables: the average monthly purchases under the programme; and a dummy variable to analyze the impact in spreads within seven days of the PEPP launch announcement. This is to avoid any collinearity problems. In all regressions I control for other asset purchases related to other QE programmes from the ECB, as well as macroeconomic factors and contractual factors.

The implementation of the PEPP seems to decrease spreads for corporate, sovereign and covered bonds. On the contrary, the asset backed securities sample doesn't present any statically significant relation with the programme.

Looking at the corporate bonds sample, when using the regression with PEPP Active as the explanatory variable, it's clear that spreads decrease 25.3289 bps if the bond was issued when the PEPP is active. On the other hand, the PEPP

announcement seems to have a larger impact with a reduction of 122.06 bps on spreads from bonds issued between the 18th of March 2020 and the 25th of March 2020. Finally, we can conclude with high degree of confidence that spreads were decreased close to 0.008 bps per million of euros in monthly purchases under PEPP.

When testing for sovereign bonds, the effects were similar although smaller. Bonds' spread decreased 12.3311 bps when the PEPP was active. Taking volume into account, spreads decreased 0.0002 bps per million of euros in PEPP purchases. On the contrary, the announcement period didn't have any significant effect.

Covered bonds' spreads were less impacted during the PEPP implementation period with a reduction of 10.4634 bps. Nonetheless, when considering the volume of purchases, the effect was actually the highest with a decrease of 0.0146 bps per million of euros purchased.

Asset backed securities are the main outlier in the four samples. I couldn't find any effects from PEPP. This could be because there weren't any purchases of asset backed securities during under the PEPP. Nonetheless, it is evidence that the rebalancing effect was not enough to affect assets that weren't included in the implementation of the programme.

So, answering my research question, the cost of debt in bonds in the euro area decreased significantly due to the PEPP. Corporate bonds seem to be the most affected when compared to other bond types. This could be because corporate bonds start with a higher spread pre-PEPP. Furthermore, when looking at sovereign debt we must consider the fact that low debt countries react worse to expansionary monetary policies from the ECB, which can skew the results downwards. That isn't a problem for non-financial firms as they can usually allocate efficiently higher levels of capital.

To add to this analysis, I also found that the signaling effect was only statically significant for the corporate bonds sample. Therefore, one can argue that the market and liquidity channels were the main cause that led to a reduction in spreads for sovereign and covered bonds while still having an impact, albeit lower than the signaling effect, in corporate bonds. I did not find any evidence for any effects from the portfolio rebalancing channel, as the asset backed securities were not affected by the programme.

In the following sections, I further go into detail about the points raised in this section. In the "Theoretical Framework" section I have analyzed multiple papers about the PEPP and other ECB quantative easing programmes. In "Hypothesis and Methodology "I go into detail about the hypothesis being tested and further explain the models I created, and the variables used to test them. Followed by the "Results" section, where I analyze the results of each regression while comparing them to past results and theorize about reasonable explanations to justify them. Finally, I present the main conclusions in the last section of the paper.

Chapter 1
Literature Review

1.1. The PEPP

In this chapter, I start by looking at several papers that analyze the PEPP and other monetary policies taken by the ECB in response to Covid-19, and its impact on cost of debt.

In 2020 the Spanish central bank released a paper evaluating the ECB monetary response to Covid. The focus of Hurtado et al. (2020) is the PEPP and its impact on financing costs and economic indicators.

The authors start by theorizing that one of reasons the PEPP reduces the cost of borrowing for firms is because it reduces duration risk premium. The ECB's purchases push other investors into more risky assets. Firms are, therefore, allowed to issue more bonds and with longer maturity and with more favorable rates for the firm. They go on to prove with an event study that the costs of financing were reduced following the first ECB announcement in March and the reinforcement announcement in June. Nonetheless, they note that the effects on the second event were lower, presumably, due to different macro-economic conditions. The authors also mention that there may have been some possible anticipation effects that skew the results.

The theory that economic conditions affect the results of APP policies is backed up by other authors as well. Capolongo & Gros (2020) theorizes about the effect quantitative easing measures may have with different economic conditions, namely in a sectorial recession.

The authors point out that every similar instrument was successful in decreasing costs of borrowing by providing extra liquidity to the markets and

sending a positive signal to investors. Even so, they believe that the PEPP could be less successful because the interest rate can only get so low, and the economic scenario is very different. They don't go on to test this theory and prefer to focus on analyzing previous studies by other authors to complement their analysis, so this seems to still be a gap in the area literature. The authors also present the most common methodology used in these kinds of studies, mentioning that event studies seem to be the most used one.

Moessner & de Haan (2022) offer a different perspective, focusing on sovereign debt. The authors establish that this instrument is not a novelty in the ECB monetary policies portfolio and had a significant signaling effect in the past. They also analyze the market response to multiple announcements from the ECB regarding the pandemic crisis combat policies.

The authors note that in March 2020 one announcement was made mentioning that the ECB's objective did not consist of closing spreads and facilitating financing through debt. This was perceived as a negative signal for investors, and it led to an increase in rates, mainly due to the term premia, for countries with a higher level of sovereign debt. On the other hand, they note that for countries like Germany, Finland and the Netherlands not only did the rates not increase but they even decreased in some cases. This shows that investors also look at how the policies impact the countries' economic position and that might lead them to decrease their demand even with the excess in liquidity provided by the programme.

Benigno et al., (2021), analyzes both corporate and sovereign bonds, coming to similar conclusions as Moessner & de Haan (2022). The spreads for Italian bonds fell more than German bonds after the PEPP was announced. Providing evidence that high debt countries were more dependent on the programme. On the contrary, the authors don't find any significant effect in corporate bonds. They theorize that this should be due to corporate bonds being more affected by

the implementation of the programme rather than its announcement. They go on to conclude that PEPP was successful in providing liquidity to families, firms and heavily indebted countries. While alerting that monetary policies, normally, have more of a short term effect that should disappear in the long term.

Looking at a paper with a different methodology, Nelimarkka & Laine, (2021) uses a SVAR model. Creating scenarios, with predictions on how the economy would react without PEPP and other programmes established by the ECB. They provide a good explanation into how PEPP and other QE programmes work. Stating that these policies, through the portfolio rebalancing channel and the reduction of duration risk, increase the price of assets and, consequently, reduce bond yields and in times of uncertainty help stabilize the markets.

Focusing on the PEPP, the authors explain how the programme allows for more flexibility than the APP. They theorize that without the PEPP the markets would end up stabilizing. Bond yields, on the contrary, would increase without the programme. While spreads between sovereign bonds of low debt countries and high debt countries would continue to increase as they were before the first announcement on March 18th.

In Benigno et al. (2022a), the authors implement an event study methodology, focusing on the impact of various announcements from the ECB. They analyze both corporate, sovereign rates and expectations on inflation, within different scenarios. They conclude that the announcement of Lagarde that the ECB´s goal was not to close spreads did not have an effect on corporate bonds yields. Theorizing that this was due to other monetary instruments like the LTRO, being enough to offset the negative signaling from the ECB. However, this is not the case for sovereign debt, as the interest rates increased after the announcement. Additionally, authors also find that the announcements that send a positive signal to the markets did have a significant effect in the sovereign interest rates and that this effect was bigger in countries like Italy with more debt. Corporate

bonds seem to be more affected by the actual implementation of projects rather than their announcement. This could mean that this market is more volatile to changes in liquidity levels and the rebalancing portfolio effect rather than the signaling effect.

Alberola et al. (2022) offers a vision on refinancing risk and how the PEPP impacts sovereign debt sustainability. To do so, authors build a macroeconomic framework to develop a DSA model and test what debt levels different countries would need to achieve and in what timeframe to achieve sustainability in the future. They show that the PEPP is crucial in minimizing refinancing risk. It allows the countries to extend their debt maturity and hence expand the timeframe in which they're able to sustain high debt levels. In short, Alberola et al., (2022) points out that the PEPP helped countries increase their debt maturity by reducing the term premia and, consequently, improving the tradeoff between financing cost and refinancing risk.

Finally, Benigno et al., (2022b) focus on exploring how the PEPP works through the different transmission channels. The authors point to three channels responsible for transmitting the effects of the PEPP.

With the interest rate channel, the interest rate decreases for assets included in PEPP, due to the increase in demand in the market. This pushes the investor to rebalance their portfolio, creating spillover effects to assets not included in PEPP, decreasing financing costs all around.

In relation to the credit easing channel, ECB purchases assets from financial intermediaries, capitalizing them further and thus increasing their liquidity to lend to non-financial firms.

Finally, the implicit-guarantee channel, by buying risky assets the ECB is implicitly guaranteeing the solvency of those assets, and hence reducing solvency risks making them more attractive to investors.

The authors also have theorized about the risks that the APP brings to the economy. On the one hand, low interest rates may affect bank profitability, but this seems to be offset by the increased liquidity due to the programme. On the other hand, there are some risks related to the end of the APP. The authors mention that these policies can create a financial bubble due to making risk less relevant. They also theorize that the end of implicit guarantee can have a negative signaling effect. They do present some arguments as to why these risks could not be confirmed but fail to have any empirical evidence of that.

1.2. Other Asset Purchase Programmes

This section presents the historical context of the ECB unconventional monetary policies, to deliver a better notion of what we should expect of the results of Quantative Easing through different time frames and economic scenarios.

Markmann & Zietz, (2017) focus on Covered Bond Purchase Programmes. The programmes were active during an economic turmoil in Europe in the years following the 2008 global financial crisis and during the European sovereign debt crisis. The authors start by mentioning that the investors were taken by surprise with the announcement of the CBPP1, which could translate into a stronger signaling effect.

The authors study the effects on the economy CBPP1, CBPP2 and CBPP3, with a structural time series model. They find that the purchase of the assets within the CBPP1 in the primary and secondary markets reduced the yields in the Eurozone's countries. The effects are larger on countries like Germany while Spain had a smaller decrease and Ireland is a big outlier with an increase on cost of debt. This could mean that in 2009 the investors were expecting long lasting

effects from the Economic crisis and that the size of the programme wasn't enough to offset that. CBPP2 and CBPP3, on the other hand, were announced at a time the general investor felt the covered bond market was already healthy. Investors shifted their investment to peripheral countries, expecting them to outperform the "safer" options. So, Spain and Italy saw a decrease in their cost of debt while France and German Bonds yields increased.

From what I have mentioned in the last subsection, PEPP seems to have a similar behavior to CBBP2 and CBPP3. Even with the pandemic investors, seem to believe the countries with low debt countries don't benefit as much from QE measures as the high indebted countries.

Gibson et al., (2016), expands its focus to both the CBPP and SMP. The authors note that these programmes are used as auxiliary tools to other monetary policies. With the CBPP, the ECB buys covered bonds eligible to use as collateral in credit operations within the euro area. The SMP, on the other hand, appears to be closer to the PEPP, consisting in the purchase of bonds to make sure the ECB monetary policy stance is affecting the real economy.

The authors note that the cost of default on debt held by an official creditor is higher than the cost of default on debt held by private investors. The official creditors like the ECB, may use harsher tools to punish default. The authors seem to believe that by purchasing assets in the secondary markets the ECB is reducing the solvency risk and hence the probability of default. They focus more in sovereign bonds but I believe that the logic can be applied to other types of assets as well. Gibson et al., (2016) goes on to find that the SMP was successful in moderately reducing the spread on the sovereign bonds. Concluding that the ECB's unconventional monetary policies are capable of intervening in the markets, especially, if the market is malfunctioning. Nevertheless, they do admit that the "whatever it takes" announcement from Draghi had an even stronger effect on yields. This should be pretty in line to what is expected from PEPP.

Yields both for covered bonds and sovereign bonds are expected to decrease both at the announcement of the programme and its implementation.

Abidi & Miquel-Flores, (2016) , further expands on programmes closer to the SMP, focusing on the CSPP. Contrary to the SMP, the CSPP was designed to be the main monetary policy instead of being an auxiliary one. The authors point out that these programmes were launched mainly to further combat the deflationary pressures.

In this paper, the authors focus on the wedge between the eligibility criteria and the bond rating. They note that there is a subset of bonds that is slightly below investment grade rating but still eligible for the CSPP. Theorizing that this will lead investors to rebalance their portfolio including these bonds. Furthermore, liquidity effects should also affect the higher yield bonds. They go on to prove that the yields were reduced all around. However, the impact in the subset of bonds eligible for the programme but below the BBB- rating was bigger. On the other hand, they also demonstrate that the spillover effect was enough to also impact the high yield non eligible bonds. The spillover effect should be very similar in PEPP. So it's expected that the programme can be effective both for eligible and non-eligible corporate bonds.

Zaghini, (2019), also focus its study on CSPP. They note that the ECB expects this programme to affect the eligible assets and impact the non-eligible. With a linear regression model the authors observe that the CSPP had a significant signaling effect in the market with 30 basis point reduction. However, in the first six months the programme was active the effect was mainly felt on bonds eligible for the ECB purchases. Nonetheless, after six months, presumably, due to the scarcity imposed in the market by the programme, non-eligible bonds would also see their yields decrease. This seems to be in line with goal of the ECB of having the rebalancing channel work towards reducing financing costs of non-financial firms. The slight delay is attributed to the homogeneity of the market. The eligble

and non eligble bonds were being priced the same way (Vayanos et al., 2008; Gambetti & Musso, 2017) and, according to the authors, the rebalancing channel works better when there's more market segmentation. With no surprise, the CSPP seems to be very much in line with PEPP, this is expected, as the two programmes are very similar and were both launched in a low inflation environment. So, it's expected that both investment grade and high yield bonds' spreads decrease with the implementation of PEPP.

Kanda et al., (2022), analyzes the CSPP while also analyzing how the APP affects the syndicated loans and the choice of funding. By running linear regression models, the authors find that there is a significant spread reduction for bonds after the announcement of the CSPP. This was then reinforced during its implementation, although, it seems that the effect of the announcement was larger than the implementation. There's also was some spillover of this extra liquidity, affecting the spreads for syndicated loans. Overall, the cost of borrowing declined as expected.

Chapter 2
Hypothesis and Methodology

2.1. Hypotheses

Following extant literature (Benigno et al. 2022a; Hurtado et al. 2020) I would argue that the PEPP led to a significant reduction in bond spreads. I extend this literature by studying the effects of PEPP in a longer time period that includes the final quarter of 2021 and first quarter 2022 in which the ECB was actively buying assets in different macroeconomic conditions. Furthermore, I analyze every type of bond that can be purchased under PEPP, comparing the effects between, corporate, sovereign, ABS, and covered bonds.

So, in this paper I test the following hypotheses:

- H1 – The PEPP led to a significant reduction in corporate bond spreads.
- H2 – The PEPP led to a significant reduction in sovereign bond spreads.
- H3 – The PEPP led to a significant reduction in covered bond spreads.
- H4 – The PEPP led to a significant reduction in ABS spreads.

2.2. Methodology

2.2.1. Data Selection

I study four samples of bonds issued between January 2000 and January 2023. All of them extracted from the DCM Analytics database. In DCM Analytics provides the necessary information related to spread, contractual characteristics and credit ratings for every bond in my analysis. The four samples contain the four asset types studied in this paper, corporate bonds,

sovereign bonds, covered bonds and asset backed securities. For the corporate bonds sample, I use the assets with deal-type code "Corporate Bond High Yield" or "Corporate Bond Investment Grade" in the DCM database. For sovereign and covered bonds, I filter by the code "sovereign bond" and "covered bond", respectively. Finally, the sample with asset backed securities is extracted using the code "asset-backed securities" in the database. Furthermore, I only use non perpetual bonds: issued in countries within Euro Area; with Euro as the currency and with information available about: spread to benchmark; firm's industry and country; and deal value. In table 1, I summarize the total number of observations and the number of observations with complete information that are used in the empirical testing.

The data related to the PEPP and APP volume of purchases, PEPP implementation dates and the PEPP launch announcement date was extracted from the ECB's website.

Finally, to control for macroeconomic factors I use the difference between Euribor 5y and Libor 3m and the VIX index within the same timeframe, so from January 2000 to February 2023.

Table 1 *– Number of Observation*

Corporate Bonds	Total number of observations	32,618
	Observations with complete information	13,274
Sovereign Bonds	Total number of observations	13,847
	Observations with complete information	2,975
Covered Bonds	Total number of observations	17,136
	Observations with complete information	4,908
Asset backed Securities	Total number of observations	13,389
	Observations with complete information	8,820

2.2.2. Univariate Analysis

In this section, I do a descriptive analysis on the variables chosen for my models.

In table 2, I compare the number of observations, mean and median of each continuous variable within my four samples.

Looking at the spread to benchmark, corporate bonds and asset backed securities seem to have on average a higher spread when compared to the other asset classes, with a mean spread of 202.7435 bps and 173.3582 bps, respectively. Compared to the average spread of 50.2423 bps for sovereign bonds and 51.4747 bps for covered bonds. This could indicate that corporate bonds and asset backed securities will be more impacted by PEPP as it is reasonable that high spread bonds will have an absolute reduction in spread higher than bonds with lower spreads.

Number of tranches should be positively correlated to spread. So, it is not surprising, that the average number of tranches is also higher for corporate bonds and asset backed securities when compared with the other two samples. Corporate bonds have on average 18.8293 tranches and asset backed securities have 5.3173, while sovereign and covered bonds seem have a mean number of tranche close to 1. Nonetheless, the median number of tranches in corporate bonds is 1, the same as the covered and sovereign bonds, showing that there might be some outliers in the sample pushing the average up, this could be because we are considering both investment grade and high yield bonds in the sample.

Similar to number of tranches, when looking at the rating*rated variable, Corporate bonds and asset backed securities have a mean of 8.4055 and 7.0569 respectively, which means that, according, to the rating scale used to create this variable corporate bonds have a rating of BBB+ on

average, meaning that the sample could be skewed to investment grade bonds ,awhile asset backed securities have an A- rating. The average ratings for Sovereign and Covered bonds are A+ and AA, respectively. This indicates that corporate bonds are seen as riskier assets and helps explain the difference on the average spread.

Rating and number of tranches seems to be the main factor that pushes spreads higher for corporate bonds. But for asset backed securities maturity may also play a big part as this asset type is by far the one with the higher average maturity (17.3756 years). Deal value, on the other hand, seems to not influence spread much as sovereign bonds have the higher average and median deal value while keeping the lowest average and median spread.

Taking a look at the main explanatory continuous variables, it's clear that the focus of the ECB both for PEPP and APP was the sovereign debt. Throughout our time period, the monthly average volume purchased under PEPP was 6450.8971 millions of euros, fifty times larger than the second higher average of 124.7859 millions of euros for corporate bonds. Regarding APP the difference is not as big, but the sovereign bonds were still the main focus of ECB purchase with an average of 12612.3025 millions of euros. This seems to point that the lowest spread for Sovereign debt was in part due to these programmes. On the other hand, asset backed securities were not the focus of PEPP at all, no purchases of these type of asset occurred within the programme.

In table 5 I am analyzing the number dummy variables and the frequency in which they are equal to 1. In this table, the main variables I chose to focus are PEPP announcement and PEPP active. In the sovereign bonds sample, it can be observed that 0.3171% of the bonds were issued within the PEPP announcement period, this is higher than any other asset

class and might indicate that the signaling effect is stronger for sovereign debt. On the other hand, asset backed securities had the highest percentage of bonds issued during the time period in which the PEPP is active, taking into account, that there weren't any purchases for this type of asset within the PEPP sphere, this could point out to the PEPP affecting assets even outside of its own range of action.

Tables 3 and 4 show the distribution of the four samples of bonds within country and year. The distribution per country seems to indicate that the data might be a bit skewed towards some countries. France and Germany, for example, have more than 10% representation within all asset classes. In the empirical part of this thesis, I am controlling for country specific risks to minimize the effects of this, but I believe that having this skewness in the samples might interfere with the effectiveness of PEPP as investor perceive the programme in different ways considering the country's economic conditions. Sovereign bonds from Germany, for example, should react less positively to this type of policy as Germany has, typically, low debt ratios.

Table 2 *– Continuous Variables*

	Corporate Bonds	Sovereign Bonds	Covered Bonds	Asset Backed Securities
Continuous Variables				
Spread (bps)				
Number	8,723	2,271	3,625	4,196
Mean	202.7436	50.2423	51.4747	173.3582
Median	143.0000	30.0000	36.9000	80.0000
Yield Curve				
Number	23,684	12,537	14,929	5,649
Mean	75.2785	71.9664	89.9515	65.0188
Median	67.7000	62.0000	87.3250	59.2000
VIX				
Number	24,551	13,157	16,023	6,051
Mean	18.5267	20.2770	21.6917	19.7638
Median	16.0000	17.6700	19.7900	17.0800
Banks				
Number	24,551	13,157	16,023	6,051
Mean	3.1012	1.9734	1.9725	1.9294
Median	1.0000	1.0000	1.0000	1.0000
PEPP Amount				
Number	24,551	13,157	16,023	16,023
Mean	124.7859	6450.8971	4.2144	0.0000
Median	0.0000	0.0000	0.0000	0.0000
Deal Value				
Number	17,752	13,130	16,015	5,432
Mean	572,460,468.1574	1,297,939,991.3254	253,874,677.6487	539,940,831.9264
Median	300,000,000.0000	650,000,000.0000	100,000,000.0000	404,870,000.0000
Maturity				
Number	23,892	13,156	16,021	6,039
Mean	5.5931	10.5779	6.0942	17.3756
Median	4.9800	7.5300	5.0000	12.0000
Tranche Rated * Rating				
Number	24,551	13,157	16,022	6,051
Mean	8.4055	5.1827	2.5894	7.0569
Median	7.0000	4.0000	1.0000	6.0000
Tranches				
Number	24,551	13,157	16,023	6,051
Mean	18.8293	1.0430	1.0237	5.3173
Median	1.0000	1.0000	1.0000	5.0000
App Amount				
Number	24,551	13,157	16,023	6,051
Mean	937.0478	12612.3025	404.4454	118.4289
Median	0.0000	0.0000	0.0000	0.0000

Table 3 - Bonds Issued per country

Panel A:	Corporate Bonds			Sovereign Bonds		
Geographic location of issuer	**Number of Observations**	**Total value [€ Million]**	**% of total value**	**Number of Observations**	**Total value [€ Million]**	**% of total value**
Germany	10,716	2,658,830.8463	26.1518%	4,256	3,818,961.6317	22.4075%
Netherlands	1,316	1,089,885.8591	10.7199%	337	691,709.0423	4.0586%
Luxembourg	253	94,782.8582	0.9323%	15	25,950.0000	0.1523%
Finland	458	159,386.0598	1.5677%	170	215,480.0000	1.2643%
Ireland	314	201,965.5842	1.9865%	187	247,887.6500	1.4545%
Slovakia	14	5,007.7000	0.0493%	240	73,316.6493	0.4302%
France	3,791	2,678,556.6224	26.3459%	2,127	3,352,867.8828	19.6727%
Croatia	22	3,092.5000	0.0304%	41	29,050.6920	0.1705%
Italy	2,744	1,308,594.0049	12.8711%	1,798	4,371,221.1808	25.6478%
Spain	1,617	1,068,015.3192	10.5048%	1,688	1,964,127.2468	11.5244%
Portugal	671	158,608.7441	1.5601%	271	295,058.0000	1.7312%
Greece	248	108,656.9979	1.0687%	180	386,865.5833	2.2699%
Slovenia	76	5,675.5150	0.0558%	94	71,422.6841	0.4191%
Belgium	626	343,848.7403	3.3820%	875	773,918.3500	4.5409%
Austria	1,581	262,606.3970	2.5830%	535	649,941.6430	3.8135%
Latvia	20	1,178.1700	0.0116%	95	18,285.1800	0.1073%
Lithuania	20	4,257.5000	0.0419%	215	28,555.9000	0.1675%
Estonia	29	6,870.0000	0.0676%	8	2,695.7100	0.0158%
Cyprus	22	5,830.9960	0.0574%	25	25,935.0000	0.1522%
Malta	13	1,247.5000	0.0123%	0	0.0000	0.0000%
Total	24,551	10,166,897.9145	100.0000%	13,157	17,043,250.0261	100.0000%

Table 3 *- Bonds Issued per country*

(continued)

Panel A:	**Covered Bonds**			**Asset-Backed Securities**		
Geographic location of issuer	**Number of Observations**	**Total value [€ Million]**	**% of total value**	**Number of Observations**	**Total value [€ Million]**	**% of total value**
Germany	12,296	1,842,461.3498	45.3161%	1,256	676,089.1602	23.0514%
Netherlands	252	142,850.2000	3.5135%	509	297,751.7232	10.1519%
Luxembourg	138	28,088.8000	0.6909%	57	10,536.9500	0.3593%
Finland	150	93,253.5000	2.2936%	62	31,127.9000	1.0613%
Ireland	123	80,052.3000	1.9689%	1,234	472,932.9322	16.1248%
Slovakia	23	6,679.8536	0.1643%	0	0.0000	0.0000%
France	1,513	713,878.9280	17.5581%	768	317,294.0619	10.8182%
Croatia	0	0.0000	0.0000%	0	0.0000	0.0000%
Italy	236	211,378.1500	5.1989%	801	512,758.9085	17.4827%
Spain	691	711,115.6000	17.4902%	915	447,151.1674	15.2457%
Portugal	67	50,316.5500	1.2376%	199	71,136.6257	2.4254%
Greece	39	36,215.6000	0.8907%	47	25,297.8000	0.8625%
Slovenia	1	2.5000	0.0001%	0	0.0000	0.0000%
Belgium	89	46,528.0000	1.1444%	136	50,360.8400	1.7171%
Austria	397	98,281.6311	2.4173%	59	17,268.4500	0.5888%
Latvia	0	0.0000	0.0000%	0	0.0000	0.0000%
Lithuania	0	0.0000	0.0000%	0	0.0000	0.0000%
Estonia	5	2,000.0000	0.0492%	0	0.0000	0.0000%
Cyprus	3	2,700.0000	0.0664%	0	0.0000	0.0000%
Malta	0	0.0000	0.0000%	8	3,252.0800	0.1109%
Total	16,023	4,065,802.9625	100.0000%	6,051	2,932,958.5990	100.0000%

Table 4 - Bonds Issued per Year

Panel A: Geographic location of issuer	Corporate Bonds			Sovereign Bonds		
	Number of Observations	Total value [€ Million]	% of total value	Number of Observations	Total value [€ Million]	% of total value
Panel B: Year						
2000	920	194,782.7858	1.9159%	406	454,083.0939	2.6643%
2001	690	282,430.7766	2.7779%	371	498,862.5141	2.9270%
2002	779	216,965.8067	2.1340%	401	566,578.2250	3.3244%
2003	1,442	309,423.0132	3.0434%	388	627,121.6650	3.6796%
2004	1,514	267,807.2217	2.6341%	365	616,936.9760	3.6198%
2005	2,136	266,666.9479	2.6229%	437	616,819.8970	3.6191%
2006	2,273	409,262.2628	4.0254%	395	591,627.3000	3.4713%
2007	2,818	333,067.9856	3.2760%	351	575,902.4768	3.3791%
2008	847	327,990.9096	3.2261%	476	665,999.4440	3.9077%
2009	950	639,079.0812	6.2859%	750	966,362.3347	5.6701%
2010	871	395,673.7587	3.8918%	792	1021,963.5604	5.9963%
2011	695	284,371.5119	2.7970%	715	881,305.2364	5.1710%
2012	996	408,112.7696	4.0141%	749	878,884.3997	5.1568%
2013	765	380,619.8048	3.7437%	717	927,827.8430	5.4440%
2014	782	454,951.3581	4.4748%	726	962,320.5730	5.6463%
2015	702	387,249.3357	3.8089%	753	922,593.5490	5.4132%
2016	774	561,217.9849	5.5201%	737	857,816.5100	5.0332%
2017	744	535,113.4995	5.2633%	744	863,949.8280	5.0692%
2018	704	612,458.8922	6.0240%	717	816,582.1720	4.7912%
2019	847	741,975.6076	7.2980%	675	841,081.3241	4.9350%
2020	814	853,606.6860	8.3959%	880	1102,329.0880	6.4678%
2021	801	658,133.6420	6.4733%	379	464,289.7500	2.7242%
2022	578	525,700.5521	5.1707%	206	254,428.2660	1.4928%
2023	109	120,235.7204	1.18%	27	67,584.0000	0.40%
Total	**24,551**	**10,166,897.9145**	**100%**	**13,157**	**17,043,250.0261**	**100%**

Table 4 *- Bonds Issued per Year*

(continued)

Panel A:	**Covered Bonds**			**Asset-Backed Securities**		
Geographic location of issuer	**Number of Observations**	**Total value [€ Million]**	**% of total value**	**Number of Observations**	**Total value [€ Million]**	**% of total value**
Panel B: Year						
2000	1,011	212,977.4174	5.2383%	169	71,569.7570	2.4402%
2001	1,082	206,421.9308	5.0770%	268	146,203.6865	4.9849%
2002	1,280	217,143.2969	5.3407%	283	107,668.8465	3.6710%
2003	1,571	258,324.5012	6.3536%	297	148,671.2308	5.0690%
2004	1,356	236,067.3300	5.8062%	321	190,397.4207	6.4917%
2005	1,373	258,933.9500	6.3686%	294	272,294.9110	9.2840%
2006	998	269,313.2285	6.6239%	522	364,673.8640	12.4337%
2007	796	213,356.1100	5.2476%	418	264,841.2279	9.0298%
2008	1,028	210,946.7258	5.1883%	365	64,578.4236	2.2018%
2009	1,388	205,514.0435	5.0547%	250	24,643.8800	0.8402%
2010	806	219,197.7784	5.3913%	122	27,925.1500	0.9521%
2011	560	246,407.2000	6.0605%	166	37,836.1000	1.2900%
2012	400	181,034.7000	4.4526%	154	40,269.9000	1.3730%
2013	280	86,231.3000	2.1209%	152	63,377.0600	2.1609%
2014	246	90,423.5500	2.2240%	149	75,827.6960	2.5854%
2015	254	120,687.4500	2.9684%	205	105,821.8300	3.6080%
2016	216	100,108.2500	2.4622%	253	153,988.9131	5.2503%
2017	246	109,372.5000	2.6901%	301	120,740.8512	4.1167%
2018	280	121,666.0000	2.9924%	349	162,147.0130	5.5284%
2019	263	121,433.7000	2.9867%	286	147,118.8479	5.0161%
2020	165	91,527.5000	2.2512%	160	69,245.9480	2.3610%
2021	120	70,355.0000	1.7304%	425	203,851.4880	6.9504%
2022	252	172,244.5000	4.2364%	142	69,264.5539	2.3616%
2023	52	46,115.0000	1.13%	0	0.0000	0.00%
Total	**16,023**	**4,065,802.9625**	**100%**	**6,051**	**2932958.5990**	**100%**

Table 5 - Dummy Variables

Variable of Interest	Type of Bond			
	Corporate Bonds	**Sovereign Bonds**	**Covered Bonds**	**Asset Backed Securities**
Fixed Rate				
Number of Observations	8,655	2,523	4,177	3,721
Number of Observations with d=1	6,719	1,697	2,671	717
% of total	77.6314%	67.2612%	63.9454%	19.2690%
Tranche Rated				
Number of Observations	8,655	2,523	4,177	3,721
Number of Observations with d=1	7,333	1,763	2,944	3389
% of total	84.7256%	69.8771%	70.4812%	91.0777%
PEPP Announcement				
Number of Observations	8,655	2,523	4,177	3,721
Number of Observations with d=1	13	8	2	0
% of total	0.1502%	0.3171%	0.0479%	0.0000%
Callable				
Number of Observations	8,655	2,523	4,177	3,721
Number of Observations with d=1	3,543	12	97	2,979
% of total	40.9359%	0.4756%	2.3222%	80.0591%
Company Rated				
Number of Observations	8,655	2,523	4,177	3,721
Number of Observations with d=1	5,362	1,701	2,299	35
% of total	61.9526%	67.4197%	55.0395%	0.9406%
PEPP Active				
Number of Observations	8,655	2,523	4,177	3,721
Number of Observations with d=1	1,201	355	194	581
% of total	13.8764%	14.0706%	4.6445%	15.6141%

2.2.3. Econometric models

To answer the questions raised in the last section, I intend on creating econometric models, using an OLS Estimation model, to find the effects of PEPP in the interest rate of corporate bonds, sovereign bonds, covered bonds, asset back securities.

Similar to Branco et al., (2020), I use a reduced form-pricing model, with "Spread to benchmark" as the dependent variable. As for the independent variables I use a dummy variable to check if PEPP is active; the monthly average of purchased amounts under PEPP; another dummy variable to identify the seven days after the PEPP was first announced. I add multiple variables to control for the economic situation and contractual factors. I also control for the effects of other ECB programmes with the variable APP Amount.

After running the correlation matrix, I chose to run two models for each data panel, one with the PEPP Active as the explanatory variable, to avoid collinearity problems:

$$Spread_{i,t} = \alpha_0 + \beta_1\, PEPP\ Active\ _{i,t} + \beta_2\, APP\ Amount_{i,t} + \gamma\, Contractual\ characteristics_{i,t} + \varphi\, Macroeconomic\ factors_t + \varepsilon_{i,t}$$

And another with PEPP Amount and PEPP Announcement as the explanatory variables:

$$Spread_{i,t} = \alpha_0 + \beta_1\, PEPP\ Amount_{i,t} + \beta_2\, PEPP\ Announcement_{i,t} + \beta_3\, APP\ Amount_{i,t} + \gamma\, Contractual\ characteristics_{i,t} + \varphi\, Macroeconomic\ factors_t + \varepsilon_{i,t}$$

Furthermore, I use robust standard errors of the HC1 type to avoid any heteroscedasticity problems.

These models will be run for the 4 data panels that I mentioned in the first topic of this section. This will allow me to compare the impact of the PEPP in the cost of debt of non-financial firms not only with the results obtained from past programmes ran by the ECB but also to the effect of the programme in other types of bonds, namely, sovereign, covered and asset backed securities.

2.2.4. Variables

In table 6 I describe all the variables I use in my regressions and added the source for each of them. In the rest of this section, I go on to further explain how I use each variable and what signal I expect from them.

Table 6 *- Variable Definition and Source*

Variable name	Variable Definition	Source
Dependent variables:		
Spread	For bonds, spread represents the margin yielded by the security at issue above a corresponding currency treasury benchmark with a comparable maturity.	DCM Analytics
Independent variables:		
Core variables		
PEPP Active	Indicator variable equal to 1 if the bond issuance or loan closing date belongs to the period where the PEPP was active (March 18, 2020 - March 31, 2022), and 0 otherwise.	ECB
PEPP announcement	Indicator variable equal to 1 if the bond issuance or loan closing date belongs to the CSPP announcement period (March 18, 2020 - March 25, 2020), and 0 otherwise.	ECB
PEPP Amount	Average monthly volume of purchases of assets in millions of euros as part of the PEPP.	ECB
Contractual controls		
APP Amount	Average monthly volume of purchases of assets in millions of euros as part of the APP.	ECB
Company Rated	Indicator variable equal to 1 if the company issuing the bond has a credit rating, and 0 otherwise.	DCM Analytics
Tranche Rated	Indicator variable equal to 1 if the bond has a credit rating, and 0 otherwise.	DCM Analytics
Rating*Rated	Rating based on the S&P rating at the bond issuance or loan closing date, with AAA=Aaa=1, AA+=Aa1=2, and so on until D=RD/D=22; the average is considered if the ratings differ among rating agencies.	DCM Analytics
Maturity	Bond maturity in years.	DCM Analytics
Transaction size	Bond transaction size in Euro million.	DCM Analytics
Callable	Indicator variable equal to 1 if the bond has a call option, and 0 otherwise.	DCM Analytics
Fixed rate	Indicator variable equal to 1 if the bond has a fixed rate, and 0 otherwise.	DCM Analytics
Number of banks	Number of financial institutions participating in the bond deal.	DCM Analytics
Number of tranches	Number of tranches of the transaction per bond deal.	DCM Analytics

2.2.4.1. Dependent Variables

2.2.4.1.1. Spread

My dependent variable is the credit spread to benchmark, so I analyze the effect of the programme on the difference between the yield to maturity of each bond issued and the risk-free rate at the time of issuance. Similarly, to Branco et al., 2020 and Kanda et al., 2022.

2.2.4.2. Explanatory Variables

2.2.4.2.1. PEPP Active

This variable is binary and equal to 1 if the PEPP is active at the issuance date or 0 if the PEPP is not active. With this I intend to find if the programme is effective in reducing the cost of debt and if it alters in anyway the choice of debt. My expectation is that the effect is negative, so the PEPP being active should contribute to the spread decreasing.

2.2.4.2.2. PEPP Amount

I use an average of the monthly asset purchased amount as an explanatory variable. With this variable I hope to be able to quantify the impact of the PEPP volume of purchases in the spread of bonds.

The ECB only shares a split of the purchases per asset type every two months. To estimate how much was purchased from every asset type per month I use the total amount purchased per month and multiply it by the relative distribution of the purchases within that time period. So, for example, in January

2021 the total amount purchased was 53046 million of euros. In the period from December 2020 and January 2021, the purchases of corporate bonds represent 1.4251% of the total amount purchased. Therefore, I estimate that in January 2021 the volume of corporate bonds purchased was 756.15 million of euros. Furthermore, I only take into account net purchase until the end of the programme in March 2022.

Similar to the previous variable, I expect this variable to influence the spread negatively.

2.2.4.2.3. PEPP Announced

To complement my analysis, I also analyze investor's reactions to the announcement of PEPP. To do so I use a dummy variable that will be 1 if the bond issuance date is between the 18th of March 2020 and the 25th of March 2020. I expect this to also have a negative effect on spreads, proving that the signaling effect impacted the cost of debt.

2.2.4.3. Control Variables

2.2.4.3.1. Other APP Programmes

In my models I control for the effects that other ECB's programmes might have in the spread of the bond.

To do so, I add a continuous variable with the average amount of purchases per month within the PSPP, CSPP, CBPP or ABSPP, depending on the type of asset, within the period of my sample. Furthermore, I only take into account net purchases until the end of the programmes in June 2022.

2.2.4.3.2. Macroeconomic Indicators

Following Kanda et al., (2022), Abidi & Miquel-Flores (2016) and Zaghini, (2019), I also consider how the debt markets tend to be affected by macroeconomic conditions. Credit spreads can be affected by sovereign risk, volatility in the market and the slope of the yield curve. (Kleimeier & Megginson, 2000; Campbell & Taksler, 2003; Qian & Strahan, 2007 ; Bae & Goyal, 2009; Marques & Pinto, 2020).

So, in my models I include variables to control for interest rates' term structure with using the difference between the five-year Euro Swap and the 3-month Libor rate as proxy (Marques and Pinto, 2020) and the CBOE Volatility Index to control for market volatility.

2.2.4.3.3. Contractual Characteristics

Literature about how a loan's maturity, deal value, firm credit rating, covenants or callable options for bonds, collaterals for bank loans, number of tranches and number of banks involved affect the credit spread is extensive (Campbell & Taksler, 2003; Gabbi & Sironi, 2005 ; Carey & Nini, 2007; Chen et al., 2007; Bharath et al., 2011; Marques et al., 2020). So, I believe it's clear, I need to include variables to control for these in my tests.

According to Zaghini (2019), maturity is expected to have a positive effect on credit spread so I use the years to maturity of each bond to control for this effect.

Looking at transaction size, I use the deal value of the bond as a variable, because according to Gabbi & Sironi (2005), Chen et al. (2007) and Zaghini, (2019),

the bigger the size of the deal the more probable it is for it to have less uncertainty and provide more liquidity, so I expect lower spreads.

Regarding credit risk, I use a proxy to measure the impact of credit rating, while also taking into account that not all financing instruments have a rating assigned. So, like Kanda et al., 2022, I include two dummy variables, one that returns 1 if there is an S&P credit rating for the tranche and 0 if not and another with the same logic but to check if the company who issued the bond is rated. To control for the rating, I include a variable that returns 1 if the tranche rating is AAA and keep adding 1 for the next rating until we reach D=22. To increase the sample of observations with complete information I calculate the median of the rated bonds rating and use it as the rating for the bonds whose rating is not in the DCM database.

Regarding, callable options, I use a dummy variable that returns 1 if any of these options are present in the instrument. With this I intend to control for the fact that these instruments normally facilitate credit and hence reduce the spreads.

2.2.4.3.4. Industry and Country Specific Risks

To control for industry and country specific risks I created sets of auxiliary dummy variables to codify each country and industry in the model.

Chapter 3
Results

3.1. Effects of the PEPP Implementation

Using PEPP Active as the primary explanatory variable, in Table 7 column 1a, containing the corporate bonds sample, it is observable that the spread of the bonds decreases by 25.3289 basis points when PEPP is active. This result is highly significant and consistent with most of the literature in this area, such as Hurtado et al. (2020) or Benigno et al. (2022a), while also disproving some of the concerns raised by Capolongo & Gros (2020), as the PEPP remains effective despite challenging economic conditions.

Column 2a of table 8 shows that sovereign bond spreads were 12.3311 basis points lower during periods when PEPP was active. Similarly, the spreads for covered bonds (column 3a in Table 9) decreased by 10.4634 basis points. However, asset-backed securities (column 4a in Table 10) did not show any significant effect due to PEPP being active.

These results allow me to conclude that corporate bonds are more affected by the implementation of PEPP when compared to other types of assets. This may be because, as Capolongo & Gros (2020) suggests, interest rates can only get so low. We can see that covered bonds, which typically have lower spreads than corporate bonds, are not as affected. The same logic applies to asset-backed securities and sovereign debt. Regarding the latter, I would like to add that Benigno et al. (2022a) also explains that rates for countries with low debt are less affected by this type of policy than those with high debt, which may explain why sovereign bonds, in general, are less affected by the implementation of PEPP. Our

sample includes countries with low debt, which may be pushing the average effect down.

3.2. Signaling Effect and Volume analysis of PEPP impact

With the second set of regression analyses, I investigated how the monthly volume of purchases made by the ECB under the PEPP affected spreads in the ten days following the announcement of the launch of the program or the following renewals and increases in spending limit.

Regarding the volume analysis, the results were similar to those observed in the first set of tests. In Table 7 column 1b, it can be observed that the spreads of corporate bonds decreased by 0.0087 bps per million euros of assets purchased by the ECB during the month of issuance. In contrast, the decrease in spreads for sovereign bonds was only 0.0002 bps (Table 8 column 2b). Covered bonds' spreads decreased by 0.0146 bps per million euros in ECB purchases, indicating that the programme was more efficient in covered bonds as the reduction in spread was higher per million of purchases, although, this might also be because other assets respond more to signaling effect than liquidity and market effects.

When comparing the effect of PEPP Amount to APP Amount, it is clear that PEPP Amount had a greater impact than APP Amount on corporate and covered bonds. In contrast, sovereign bonds seem to be more affected by other ECB programs, but in the opposite way.

Additionally, I study how spreads were affected by the announcement of the PEPP launch within a seven days interval from the announcement date. Only the sample containing corporate bonds showed the presence of a statistically significant signaling effect. According to Table 7 column 1b, corporate spreads decreased by 122.060 bps in the days following the PEPP launch announcement.

The results seem to differ from those of Benigno et al. (2022a), with the impact on corporate bonds being lower during the implementation of the program (25.3289 bps) than on the announcement date, indicating that the market and liquidity effects were lower than the signaling effect. I believe it's important to note that the implementation period includes the last quarter of 2021 and first quarter of 2022 while the announcement period only includes one week in March 2020. This could mean that the signaling effect appears to be higher due to the period of the announcement being the peak of the pandemic when firms were more in need of support. Furthermore, the last six months of the programme were active during a period with high inflation expectations. This could have scared investors and pushed the spreads up negating the effects of the PEPP being active.

For sovereign bonds, covered bonds, and asset-backed securities, no significant relation between spreads and the PEPP announcement dates was found. These findings go somewhat against the results encountered during the literature review; for example, Benigno et al. (2022a) found that the signaling effect for sovereign debt is usually higher than for the rest of the transmission channels.

Table 7 *- OLS Corporate Bonds*

Dependent variable:	Corporate Bonds			
Spread (bps)	[1a]		[1b]	
Independent variables:				
PEPP Active	−25.3289	***		
	(0.000)			
PEPP Amount			-0.0087	***
			(0.000)	
PEPP Annoucnment date			-122.0600	***
			(0.000)	
APP Amount	-0.0045	***	-0.0049	***
	(0.000)		(0.000)	
Log Transaction size	-2.5701		-2.6554	
	(0.168)		(0.154)	
Maturity	0.0819		0.0826	
	(0.763)		(0.761)	
Company Rated	-0.4807		-0.3559	
	(0.901)		(0.927)	
Tranche Rated	6.3658		7.0107	
	(0.236)		(0.191)	
Tranche Rating*Rated	14.3842	***	14.3703	***
	(0.000)		(0.000)	
Number of tranches	0.5971		0.8460	
	(0.786)		(0.699)	
Number of banks	-1.9016	***	-1.9059	***
	(0.000)		(0.000)	
Callable	96.5185	***	95.8205	***
	(0.000)		(0.000)	
Fixed rate	92.7681	***	92.1730	***
	(0.000)		(0.000)	
Volatility	3.3195	***	3.4251	***
	(0.000)		(0.000)	
EUSA5y-Libor3M	0.1026	***	0.1017	***
	(0.000)		(0.000)	
Country fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Number of observations	8,655		8,655	
R^2	0.4326		0.4330	
Adjusted R^2	0.4287		0.4289	

Table 8 *– OLS Sovereign Bonds*

Dependent variable:	Sovereign Bonds			
Spread (bps)	[2a]		[2b]	
Independent variables:				
PEPP Active	−12.3311	***		
	(0.000)			
PEPP Amount			-0.0002	***
			(0.000)	
PEPP Annoucnment date			-6.4224	
			(0.564)	
APP Amount	0.0003	***	0.0003	***
	(0.000)		(0.000)	
Log Transaction size	1.1353		1.0660	
	(0.369)		(0.399)	
Maturity	0.2503	*	0.2412	*
	(0.068)		(0.079)	
Company Rated				
Tranche Rated	3.2559		3.4691	
	(0.122)		(0.102)	
Tranche Rating*Rated	0.6037	***	0.6027	***
	(0.000)		(0.000)	
Number of tranches	-2.1118		-2.1417	
	(0.498)		(0.493)	
Number of banks	-2.0839	***	-2.0679	***
	(0.000)		(0.000)	
Callable	-38.1006		-37.9142	
	(0.106)		(0.108)	
Fixed rate	25.7624	***	25.6344	***
	(0.000)		(0.000)	
Volatility	0.5997	***	0.5736	***
	(0.000)		(0.000)	
EUSA5y-Libor3M	0.0871	***	0.0869	***
	(0.000)		(0.000)	
Country fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Number of observations	2,523		2,523	
R^2	0.3747		0.3743	
Adjusted R^2	0.3669		0.3663	

Table 9 *- OLS Covered Bonds*

Dependent variable:	Covered Bonds			
Spread (bps)	[3a]		[3b]	
Independent variables:				
PEPP Active	-10.4634	***		
	(0.000)			
PEPP Amount			-0.0146	***
			(0.001)	
PEPP Annoucnment date			-11.6555	
			(0.148)	
APP Amount	−0.00277969	***	-0.0027	***
	(0.000)		(0.000)	
Log Transaction size	3.5986	***	3.5047	***
	(0.001)		(0.001)	
Maturity	0.0070		-0.0374	
	(0.976)		(0.869)	
Company Rated	6.8216	***	6.8177	***
	(0.000)		(0.000)	
Tranche Rated	-2.9360	*	-2.6065	*
	(0.057)		(0.091)	
Tranche Rating*Rated	1.9131	***	1.9139	***
	(0.000)		(0.000)	
Number of tranches	-0.2289		-0.6440	
	(0.956)		(0.877)	
Number of banks	-3.6364	***	-3.5894	***
	(0.000)		(0.000)	
Callable	25.8613	***	25.9809	***
	(0.008)		(0.008)	
Fixed rate	43.6033	***	43.0807	***
	(0.000)		(0.000)	
Volatility	1.0198	***	1.0161	***
	(0.000)		(0.000)	
EUSA5y-Libor3M	0.1056	***	0.1092	***
	(0.000)		(0.000)	
Country fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Number of observations	4,177		4,177	
R^2	0.4347		0.4340	
Adjusted R^2	0.4308		0.4300	

Table 10 *– OLS Asset Backed Securities*

Dependent variable:	Asset Backed Securities			
Spread (bps)	[4a]		[4b]	
Independent variables:				
PEPP Active	-13.8326			
	(0.799)			
PEPP Amount				
PEPP Annoucnment date				
APP Amount	0.0240		0.0248	
	(0.504)		(0.523)	
Log Transaction size	-20.7799	***	-21.0112	***
	(0.000)		(0.000)	
Maturity	-1.0237	*	-1.0072	
	(0.093)		(0.067)	
Company Rated	91.1612	**	92.1777	**
	(0.013)		(0.013)	
Tranche Rated	13.6725		13.9172	
	(0.734)		(0.735)	
Tranche Rating*Rated	20.1240	***	20.1321	***
	(0.002)		(0.002)	
Number of tranches	23.7438	**	23.6868	***
	(0.011)		(0.009)	
Number of banks	-9.2703	***	-9.1976	***
	(0.000)		(0.000)	
Callable	50.1387	**	48.5308	***
	(0.017)		(0.001)	
Fixed rate	81.4340	*	82.7557	*
	(0.069)		(0.076)	
Volatility	0.3768		0.2912	
	(0.785)		(0.864)	
EUSA5y-Libor3M	0.2334	*	0.2514	
	(0.084)		(0.196)	
Country fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Number of observations	3721		3721	
R^2	0.0188		0.0188	
Adjusted R^2	0.0076		0.0078	

Conclusion

In this work I contributed for the discussion regarding the effects of PEPP in the euro area firms' cost of debt. I add to the existing literature by running tests for four types of bonds: corporate, sovereign, covered and asset backed securities. This allows me to not only reach conclusions about the effectiveness of PEPP in reducing spreads considering all the asset under purchase, but also to compare the results between every type of bond.

To examine this financial economic issue, data from January 2020 to January 2023 is used: 8,655 corporate bonds, 2,523 sovereign bonds, 4,177 covered bonds, and 3,721 asset-backed securities.

I ran OLS regressions for each data sample. My dependent is the spread to benchmark. For independent variables I used a dummy variable to signal when the PEPP is active. To avoid collinearity problems, I created separate regressions where the independent variables are the average of PEPP purchases on the month of issuance of each observation and a dummy for the announcement period. I also add a continuous variable with the average monthly volume of purchases from other ECB programmes to control for effects derived from them.

The results obtained were, mostly, in line with previous literature regarding PEPP and other APP. There was a reduction in spreads for corporate bonds, sovereign bonds, and covered bonds during the PEPP implementation, while asset-backed securities do not seem to be affected by either the PEPP or the APP. Our results show that corporate bonds were the asset classe more affected by the PEPP, followed by the sovereign bonds and lastly covered bonds. I believe that this may be due to covered and sovereign bonds having a lower spread

before the programme starts. Which could make it harder to be effective as the rates are already low. Adding to that, the sample of sovereign bonds is slightly skewed to low debt countries that appear to be less affected by these types of policies.

It can also be concluded that the PEPP average purchases per month affected the spreads of corporate, sovereign and covered bonds with asset backed securities, once again, being the outlier. The PEPP seems to be more effective in reducing spreads than the APP. With corporate, covered bonds having higher reductions in spread per million of Euros in assets purchased under PEPP, when compared to the amounts purchased under CSPP and CBPP. Sovereign bonds, on the other hand, have a very slight decrease per million of euros purchased under PEPP compared to a small increase due to purchases under the PSPP.

Overall, it is reasonable to affirm that the market and liquidity channels seem to be effective in reducing spreads in almost all the samples studied, except for asset-backed securities. The same cannot be said for the signaling effect. Corporate bonds' spreads were affected by the announcement and the effect was larger than in the period of implementation. But, in all other asset types, spreads do not show any impact derived from the announcement.

Overall, I believe PEPP was successful in reducing cost of debt for all types of bonds, with more success than previous Asset Purchase Programmes were able to achieve. We can conclude that the ECB was, therefore, successful in reducing the cost of financing during the pandemic period, therefore helping with a quicker economic recovery. Nonetheless, there are still topics that could be studied further in this area. This thesis does not study the spillover effects in depth. Therefore, I believe that splitting the samples of corporate bonds in high yield and investment grade bonds could add value to the literature. Furthermore, I don't study the differences in effects to sovereign bonds form high debt countries and low debt countries. So, running some additional tests with the two

samples separated could help in defining future policies from central banks. Finally, I believe that studying the effects that the end of the programme had in spreads of all four asset types will also be crucial to understand the full consequences of like programmes similar to PEPP.

References

Abidi, N., & Miquel-Flores, I. (2016). Working Paper Series Who benefits from the corporate QE? A regression discontinuity design approach. https://doi.org/10.2866/35784

Alberola, E., Cheng, G., Consiglio, A., & Zenios, S. A. (2022). BIS Working Paper 1034: Debt sustainability and monetary policy: the case of ECB asset purchases. www.bis.org

Bae, K.-H., & Goyal
, V. K. (2009). Creditor Rights, Enforcement, and Bank Loans. The Journal of Finance, 64(2), 823–860. https://doi.org/https://doi.org/10.1111/j.1540-6261.2009.01450.x

Benigno, P., Canofari, P., Bartolomeo, G. DI, & Messori, M. (2021). The ECB's Measures in Support of the COVID-19 Crisis.

Benigno, P., Canofari, P., Di Bartolomeo, G., & Messori, M. (2022a). The European Monetary Policy Responses During the Pandemic Crisis. Open Economies Review. https://doi.org/10.1007/s11079-022-09665-7

Bharath, S. T., Dahiya, S., Saunders, A., & Srinivasan, A. (2011). Lending Relationships and Loan Contract Terms. The Review of Financial Studies, 24(4), 1141–1203. http://www.jstor.org/stable/20869267

Branco, R., Pinto, J., & Ribeiro, R. (2020). The Pricing of Bank Bonds, Sovereign Credit Risk and ECB's Asset Purchase Programmes *,,,. https://www.sifma.org/.

Campbell, J. Y., & Taksler, G. B. (2003). Equity Volatility and Corporate Bond Yields. The Journal of Finance, 58(6), 2321–2350. https://doi.org/https://doi.org/10.1046/j.1540-6261.2003.00607.x

Capolongo, A., & Gros, D. (2020). This Time is Different: The PEPP Might Not Work in a Sectoral Recession.

Carey, M., & Nini, G. (2007). Is the Corporate Loan Market Globally Integrated? A Pricing Puzzle. The Journal of Finance, 62(6), 2969–3007. https://doi.org/https://doi.org/10.1111/j.1540-6261.2007.01298.x

Chairman Ben S. Bernanke. (2009, February 18). Federal Reserve Policies to ease credit and their implications for the Fed's balance sheet. Board of Governors of the Federal Reserve System. Retrieved March 29, 2023, from https://www.federalreserve.gov/newsevents/speech/bernanke20090218a.htm

Chen, L., Lesmond, D. A., & Wei, J. (2007). Corporate Yield Spreads and Bond Liquidity. The Journal of Finance, 62(1), 119–149. https://doi.org/https://doi.org/10.1111/j.1540-6261.2007.01203.x

European Central Bank. (2015, January 22). ECB announces expanded Asset Purchase Programme. European Central Bank. Retrieved March 29, 2023, from https://www.ecb.europa.eu/press/pr/date/2015/html/pr150122_1.en.html

European Central Bank. (2020, March 18). ECB announces €750 billion pandemic emergency purchase programme (PEPP). European Central Bank. Retrieved March 29, 2023, from https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200318_1~3949d6f266.en.html

Gabbi, G., & Sironi, A. (2005). Which factors affect corporate bonds pricing? Empirical evidence from Eurobonds primary market spreads. European Journal of Finance, 11, 59–74. https://doi.org/10.1080/1351847032000143422

Gambetti, L., & Musso, A. (2017). Working Paper Series No 20. https://ssrn.com/abstract=2985385

Gibson, H. D., Hall, S. G., & Tavlas, G. S. (2016). The effectiveness of the ECB's asset purchase programs of 2009 to 2012. Journal of Macroeconomics, 47, 45–57. https://doi.org/10.1016/j.jmacro.2015.09.006

Hurtado, S., de España, B., & Thomas, C. (2020). The ECB Monetary Policy Response To The COVID. https://www.researchgate.net/publication/344748163

Kanda, J. F., Pinto, J. M., & Silva, B. P. (2022). The CSPP impact on non-financial firms' cost of borrowing and debt choice.

Kleimeier, S., & Megginson, W. L. (2000). Are Project Finance Loans Different From Other Syndicated Credits? Journal of Applied Corporate Finance, 13(1), 75–87. https://doi.org/https://doi.org/10.1111/j.1745-6622.2000.tb00043.x

Markmann, H., & Zietz, J. (2017). Determining the effectiveness of the Eurosystem's Covered Bond Purchase Programs on secondary markets. Quarterly Review of Economics and Finance, 66, 314–327. https://doi.org/10.1016/j.qref.2017.04.005

Marques, M. O., & Pinto, J. M. (2020). A comparative analysis of ex ante credit spreads: Structured finance versus straight debt finance. Journal of Corporate Finance, 62. https://doi.org/10.1016/j.jcorpfin.2020.101580

Marques, M. O., Pinto, J. M., Alves, P., Black, J., Bliss, R., Emery, G., Esty, B., Ferreira, M., Gatti, S., Hofmann, R., Kleimeier, S., Linciano, N., Megginson, W., Nascimento, Á., Ribeiro, R., Roberts, G., Saito, R., San Pietro, F., Santos, J., … Zhang, S. (2020). A Comparative Analysis Of Ex Ante Credit Spreads: Structured Finance Versus Straight Debt Finance https://www.sifma.org/

Moessner, R., & de Haan, J. (2022). Effects of monetary policy announcements on term premia in the euro area during the COVID-19 pandemic. Finance Research Letters, 44. https://doi.org/10.1016/j.frl.2021.102055

Nelimarkka, J., & Laine, O.-M. (2021). The effects of the ECB's pandemic-related monetary policy measures. www.suomenpankki.fi

Pierpaolo Benigno, Paolo Canofari, Giovanni Di Bartolomeo, & Marcello Mesori. (2022b). The ECB's asset purchase programme: Theory, effects and risk.

Qian, J. U. N., & Strahan, P. E. (2007). How Laws and Institutions Shape Financial Contracts: The Case of Bank Loans. The Journal of Finance, 62(6), 2803–2834. https://doi.org/https://doi.org/10.1111/j.1540-6261.2007.01293.x

Vayanos, D., Vila, J.-L., Brunnermeier, M., Buraschi, A., Collin-Dufresne, P., Demarzo, P., Fossi, G., Garbade, K., Greenwood, R., Islam, M., Krishnamurthy, A., Liu, J., Naik, V., Pavlova, A., & Stein, J. (2008). Brazilian Finance Association. In NBER Asset Pricing. http://www.nber.org/papers/w15487

Zaghini, A. (2019). The CSPP at work: Yield heterogeneity and the portfolio rebalancing channel. Journal of Corporate Finance, 56, 282–297. https://doi.org/10.1016/j.jcorpfin.2018.12.004