UNIVERSIDADE CATÓLICA PORTUGUESA

The impact of the Eurosystem's covered bond purchase programs on firms' cost of borrowing

by

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Católica Porto Business School
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by

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Resumo

O objetivo da minha tese é avaliar o impacto dos programas de compra de títulos cobertos do Banco Central Europeu (CBPP1, CBPP2 e CBPP3) sobre o custo de financiamento das empresas na zona euro.

Para esta análise utilizo uma amostra de 2644 obrigações corporativas emitidas na zona euro durante o período de 2000-2019, de forma a medir os efeitos destes três programas do Banco Central Europeu no spread das obrigações corporativas. Os resultados demonstram que: (1) CBPP1 e o CBPP3 concluíram com o seu objetivo de diminuir o custo de financiamento das empresas da zona euro, ao reduzir o spread das obrigações corporativas, no entanto o CBPP2 não obteve o mesmo resultado tendo aumentado esse mesmo spread, (2) o efeito destes programas foi consistente entre países, na medida em que, nos três programas, o efeito no spread das obrigações corporativas teve a mesma direção para os "GIIPS" (Grécia, Itália, Irlanda, Portugal e Espanha) e para os restantes países da zona euro e (3) nos três programas houve um impacto mais acentuado nos "GIIPS", sugerindo que estes programas de compra de títulos cobertos tem mais relevância sobre o custo de financiamento das empresas de países com maior risco de crédito.

Palavras-chave: Banco Central Europeu, políticas não convencionais, programa de compra de títulos cobertos, obrigações corporativas

Abstract

The purpose of my thesis is to test the impact of the three covered bond purchase programs made by the European Central Bank (CBPP1, CBPP2 and CBPP3) on the cost of financing of eurozone companies.

For this analysis I use a sample of 2644 corporate bonds issued in the eurozone during the 2000-2019 period, in order to measure the effects of these three European Central Bank programs on the spread of corporate bonds.

The results show that (1) CBPP1 and CBPP3 concluded with their objective of reducing the cost of financing companies in the eurozone, by reducing the spread of corporate bonds. However, CBPP2 did not obtain the same result having increased this spread, (2) the effect of these programs was consistent between countries, as the bond spread had the same direction both in the "GIIPS" (Greece, Italy, Ireland, Portugal and Spain) as in the rest of the eurozone countries and (3) in the three programs, there was a more pronounced impact on the "GIIPS", suggesting that these covered bond purchase programs have more relevance on the financing cost of companies in countries with higher credit risk.

Keywords: European Central Bank, unconventional policies, covered bond purchase programs, corporate bonds

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Introduction

In 2007-08 a global financial crisis occurred. Excessive risk-taking by banks combined with the bursting of the United States housing bubble caused a long sequence of market crashes (Zaghini 2014). This crisis created a lack of confidence in the banking system, which raised concern about their liquidity risk (Beirne, Dalitz, Ejsing, Grothe, Manganelli, Monar, Sahel, Sušec, Tapking, and Vong 2011). The crisis spread across the globe, Greece defaulted on its international debt, Portugal and Spain suffered from extreme levels of unemployment (Szczerbowicz 2015).

To minimize the effects of the crisis, several central banks lowered their interest rate to their lower bound of zero. This measure was insufficient to combat this global recession, and, to further improve demand and liquidity in the market, central banks began to elaborate quantitative easing programs. Late 2008, the Federal Reserve began a large-scale asset purchase program, with the buying of enormous quantities of securities (Gagnon, Raskin, Remache and Sack 2010). The European Central Bank also began a quantitative easing program, utilizing asset purchase programs with the objectives of promoting liquidity, encouraging credit institutions to maintain and expand their lending to clients and lowering cost of borrowing of states, banks and corporates in the euro area (Beirne et al. 2011).

The literature review addresses essentially 4 parts. Firstly, it indicates the main reasons that led to the financial and Sovereign debt crisis. Secondly, it defines the role of a central bank, the main objectives and how it generally acts during a recession. Thirdly, it investigates the main determinants of bond pricing. And finally, the literature review indicates why the covered bond market was chosen

to be financed by the European Central Bank, the main objectives of all three programs and previous research on the impacts of these programs.

Covered bonds are a safer security, crucial to the funding of banks, especially during a recession, as the financial crisis led to a higher demand for safer investments. The volume of the covered bonds market in the Eurozone had reached 2.4 trillion euros by the end of 2008 (Beirne et al. 2011).

According to Beirne et al. (2011), covered bonds became a more reliable source of funding for the banks and were proven to be relatively resilient during the 2008 financial crisis and, therefore, the ideal market for the European Central Bank to invest and create demand.

The European Central Bank announced the first covered bond purchase program in May 2009, purchasing up to the nominal value of 60 billion euros, from 6/7/2009 to the end of June 2010 (Beirne et al. 2011).

As the Sovereign crisis deepened, in October 2011, it was announced the second covered bond purchase programme which consisted of a purchase of 40 billion dollars' worth of euro-dominated covered bonds in both primary and secondary markets. At its completion, the ECB had only purchased 16.4 billion euros worth of covered bonds, not reaching the previously settled goal of 40 billion (Markmann 2018).

In October 2014, from a bank funding perspective, the spreads were mostly trading as tightly as in pre-crisis levels. However, in order to accomplish macroeconomic goals, such as credit provision and inflation management, the third covered bond purchase program was announced, with no specific volume specified (Markmann 2018).

All three programs had the objective of facilitating credit to the euro area, which in turn would generate positive spillovers to other markets, easing funding conditions for enterprises (Markmann 2018).

This research seeks to test the effects of the three covered bond purchase programs (CBPP1, CBPP2 and CBPP3) on the cost of borrowing of eurozone companies.

This thesis contributes to the study of quantitative easing. There is a growing body of literature focused on the impact of these measures on financial firms, however, little research has been done on this same topic regarding nonfinancial firms and so I wanted to further investigate the effects of these programs. Another main reason that this area of research is relevant is that we are now facing a global pandemic. A large number of nonfinancial firms have been inactive for months and will need financial support. Interest rates are already low in the eurozone, therefore, a monetary policy that further improves liquidity and demand after interest rates become obsolete is now a crucial subject of discussion.

In line with Beirne et al. (2011), Szczerbowicz (2015) and Correia and Pinto (2020) that find that there was a narrowing of covered bonds spreads due to the CBPP1, results suggest that this program had positive effects on the narrowing of corporate bond spreads, suggesting a correlation between both spreads, aligning with the objective of the ECB of facilitating credit to the euro area, which in turn would generate positive spillovers to other markets

Contrary to Szczerbowicz (2015) and Gibson, Hall, and Tavlas (2015) but in parallel with Markmann (2018) and Correia et al. (2020), CBPP2 lowered corporate bond spread while the latter two found that the spread widened, results show that the corporate bond spread increased with the CBPP2.

For the CBPP3, results are contrary to Markmann (2018) and aligned with the findings of Branco, Pinto and Ribeiro (2020) that find a negative impact of the CBPP3/ABSPP on covered bond spreads, my results suggest a narrowing of corporate bond spreads.

Finally, my study also concludes that the direction of the spread of corporate bonds, on all three covered bond purchase programs, were consistent between

Greece, Ireland, Italy, Portugal and Spain (GIIPS) and the rest of the eurozone countries. Also, the impact of all three programs was bigger in the GIIPS, in parallel with Szczerbowicz (2015), Gibson et al. (2016), Markmann and Zietz (2017) and Markmann (2018), suggesting that these covered bond purchase programs have more relevance on the financing cost of companies in countries with higher credit risk.

The remainder of this paper is organized as follows. Chapter 2 reviews the literature and describes the research hypotheses. Chapter 3 describes the methodology and data used. Chapter 4 outlines the empirical approach, examining the determinants of credit spread for corporate bonds. It also analyzes the determinants of credit spreads for GIIPS and non-GIIPS. Chapter 5 concludes this paper.

Chapter 1
Literature review

1.1 Financial and Sovereign debt crisis

In the first decade of the 21st century, there was a growing volume of "shadow banking", an unregulated financial system that facilitates credit, Bernanke (2013) stated that this facilitated the creation of subprime loans, which are loans, usually given at high interest rates, to borrowers with poor or insufficient credit history. Concluding, Bernanke indicated that the main economic vulnerability at the time was this "shadow banking system", where short-term wholesale funding and excessive leverage went largely unchecked by regulators and by the firms themselves.

In the United States, the low interest rates, combined with the growing unregulated lending, led to a continuous increase in housing prices, beyond their intrinsic value. As the housing prices kept on growing, it was considered a low-risk investment, borrowers took advantage of the low mortgage rates. Even subprime borrowers were able to get credit in order to buy a house. The banks then sold these loans to Wall Street banks which packaged them into mortgage-backed securities (MBS) and collateralized debt obligations (CDO) and then sold to investors. Agencies were rating these mortgage bundles as top investment bundles. Credit ratings are generally constructed calculating only physical default probabilities (S&P) or expected losses (Moody's), neglecting the systematic risks that are inherent on mortgage-backed securities and collateralized debt obligations. Raymond Daniel (2008), chairman of Moody's, said: "What happened in 2004 and 2005 with respect to subordinated tranches is

that our competition, Fitch and S&P, went nuts. Everything was investment grade…".

Gabbi and Sironi (2005) concluded that the spread between a yield to maturity of a bond and an equivalent Treasury security is mainly explained by the rating of the corporate bonds. Warning already, in this paper, the bank regulators, that as the pricing of bonds was largely defined by their credit rating it gave a lot of power to these credit rating companies, when their evaluations are fairly limited, stating: "Finally, the empirical findings of this paper are relevant for bank regulators. More specifically, the result concerning the increasing reliance of bond investors on ratings must be carefully evaluated given the weakness of rating agencies evaluations highlighted by recent empirical studies.".

As previously mentioned, these bundles ratings didn't take into account the systemic risk between all these securities. When the housing bubble burst, housing prices went down, the systemic risk that correlated the borrowers from mortgage-backed securities and collateralized debt obligations, leading to subprime borrowers not being able to pay these loans, along with several other borrowers that were paying loans associated with overpriced houses as the value of that asset was going down. The investors of these bundles were now holding securities with little to no value.

The global financial crisis erupted in 2007 with the failure of the U.S subprime market and then intensified in September 2008 with the collapse of Lehman Brothers (Markmann 2018). This led to a sharp deterioration of the financial market conditions across the globe because of the close interconnection that the banks have between continents.

In Europe, the crisis caused the collapse of financial institutions, high government debt and rising yield spreads in Sovereign bonds. It began with the failure of the Iceland's banking system, spreading to other countries. Mainly Portugal, Italy, Ireland, Greece and Spain were affected by the crisis

(Szczerbowicz 2015), later known as “GIIPS”, due to their financial struggles. The lack of confidence of investors on these countries paying their government securities and the rating agencies downgrading several Eurozone countries debts led to the demand from investors to a higher yield on bonds, the Sovereign debt crisis in Europe increased the default risk in the Sovereign bond market as they were rated as a high probability of default and there was even a high probability that some member states would exit the euro area, this in turn made it harder for governments to finance their budget deficits, leading to a self-fulfilling prophecy (Szczerbowicz 2015). Eurozone banks were heavily exposed to Sovereign debt. The European Central Bank faced a difficult task on supporting the economy, in order to restore trust in the financial markets (Beirne et al. 2011).

1.2 Role of a central bank

Generally, the role of a central bank is to maintain price stability by issuing currency and setting interest rates on loans and bonds. Most central banks set an inflation target of around 2% annual inflation as it is believed that this will raise the interest rate and give sufficient margin for the central bank, in times of financial crisis, to have an impact on the economy, when reducing the interest rate. They also have the power to regulate the banking system, such as dictate capital and reserve requirements.

However, in times of financial distress the European Central Bank must have some extraordinary measures to minimize the effects of the crisis. Generally, during a recession, as previously mentioned, central banks cut interest rates in order to stimulate the economy, encouraging borrowing and investing and avoiding deflation, this monetary policy can be sufficient in a minor recession.

However, if the interest rate reaches zero this measure becomes obsolete and therefore is, unfortunately, limited with recessions of higher magnitudes.

Szczerbowicz (2015) indicated that during the financial crisis there was a liquidity shortage, which had a negative effect on the financial institutions lending capacities. Banks with low liquidity are incentivized to proceed to fire sales of their assets for precautionary reasons, affecting negatively their prices. In order to promote banks' lending to each other the European central bank lowered its deposit rate to 0% on July 5, 2012. Szczerbowicz (2015) stated that it was expected a cut in the deposit rate but the move to its lower bound of 0 was unanticipated. To further improve the liquidity of banks there are some unconventional policies that could be taken in place, the central bank can modify the composition of its assets by purchasing securities from the real market.

Collin-Dufresne, Goldstein, and Martin (2001) found, through regression analysis calculations, that only 24% of the spread changes can be explained by default probability and changes in the recovery rate. The results from this research suggested that monthly credit spread changes are principally driven by local supply and demand, independent of credit-risk factors and liquidity measures. It was based on this study that central banks, as the traditional policy instruments reached effectively their lower bound, began big projects of government purchases on bank bonds to counter the distortions of the financial market.

Quantitative easing is the execution of this premise, it is a monetary policy in which a central bank purchases a high proportion of securities from the open market, raising demand while reducing the quantity of available assets, this can further increase the money supply and encourage borrowing and investing by providing government and banks with more liquidity and lower cost of borrowing. The effectiveness of this policy is based on the "portfolio rebalancing effect": when the assets are not perfect substitutes, reducing the quantity of

selected assets available for private investors increases their prices and diminishes yields by suppressing the risk premia (Bernanke 2010). This topic is fairly controversial as theoretically, a representative-agent model of Eggertsson and Woodford (2003) predicts no effect for such operations on price level or output. "However, this result holds only under the following assumptions: (1) all investors can purchase and sell unlimited quantities of these assets, and (2) the assets being bought and sold are valued only for their pecuniary returns. However, the first assumption is likely not to hold during a crisis as there are imperative constraints on participation in some markets (Szczerbowicz 2015).

A quantitative easing program was executed in the United States with a large-scale asset purchase program. Late 2008, the Federal Reserve had effectively reached its lower bound of 0 in its interest rate and, to further promote liquidity and investing, the Federal Reserve executed a program in which there was a purchase of substantial quantities of assets with medium and long maturities, Gagnon et al. (2010). This purchase program was divided into two stages, in November of 2008, the Federal Reserve announce purchases of housing agency debt and agency mortgage-backed securities, as the housing sector was one of the most affected by the financial crisis, of up to 600 billion dollars, this program was also expanded in March of 2009, with the purchasing of agency-related securities and longer-term Treasury securities, with total asset purchases reaching up to 1.75 trillion dollars (Gagnon et al. 2010).

Gagnon et al. (2010) did an empirical analysis examining the effects of large-scale asset purchase program. It was concluded that the Federal Reserve's program was successful at lowering longer-term private borrowing rates, "the reduction in the 10-year term premium appears to be somewhere between 30 and 100 basis points" and had even a greater impact in reducing the term premium in longer-term interest rates on agency debt and agency mortgage-based securities "by improving market liquidity and by removing assets with high

prepayment risk form private portfolios". The Federal Reserve's large-scale asset purchase programs were successful in stimulating economic activity, setting a benchmark for implementing monetary policies at the zero bound in the future.

1.3 Determinants of bond pricing

Collin-Dufresne et al. (2001) investigated credit spread changes on bond yields. Obtaining several results such as: the default risk and changes in the recovery rate explains only about one quarter in the variation of the credit spread and that there is an unknown systemic factor that captures about 76% of the remaining variation. The results also suggest that aggregate factors are much more relevant on credit spread changes than firm-specific factors, "in contrast to the predictions of structural models of default". Surprisingly, the results also suggested that changes in credit spreads are not, to a great extent, related to either equity or Treasury markets.

Gabbi et al. (2005) did a research study focused on testing the relevance of different variables in determining corporate bonds issuance spreads on the first market. There are several pros of testing on the first market such as: yields on new issues reflect actual transaction prices and as such, they provide a more accurate measure of the actual risk premium demanded by investors. Also, primary markets spreads represent the actual cost of debt faced by bond issuers. The main conclusion was that the main variable of spreads between a yield to maturity of a bond and an equivalent Treasury security is the rating of the corporate bonds, and as previously mentioned the rating of bonds is calculated only taking into consideration physical default probabilities (S&P) or expected losses (Moody's). It is also concluded that the bond's expected tax treatment represents also a relevant variable in their pricing.

Marques and Pinto (2020) find similar evidence supporting that credit ratings are a major pricing determinant for corporate bonds and adding that the same principle happens with asset securitization. Along with other features that are relevant for both corporate bonds and asset securitization such as: country risk, legal enforcement, market volatility and time to maturity. Therefore, this test also suggests that credit quality is not perfectly evaluated by ratings, as the pricing of securities incorporates several variables that are not estimated by rating. It also indicates that the spread on asset-backed securities, mortgage-based securities and collateralized debt obligations transactions' is similar or lower than of corporate bonds.

There is a wide variety of macro variables that are also relevant to corporate bond risk premia, such as taxes, interest rates, market volatility or systematic risk (Chen, Lesmond, and Wei 2007). There are two main theories in the relation between macroeconomic conditions and the structure and availability of security issues, (1) based on the supply of capital and (2) based on the demand for capital. The one based on the supply of capital (1) refers to how the firm's demand for certain types and quantities should change over a business cycle (Erel, Julio, Kim and Weisbach 2012). And indicates how this demand is typically based on changes in information asymmetries. If there is asymmetric information between investors and firms, poor macroeconomic conditions will lead firms to issue less information-sensitive securities, shifting from equity to convertibles and from convertibles to debt. The one based on the demand of capital (2) refers to how economic downturns can lead to a shortage of availability of capital, especially for firms with low credit ratings, and the type of securities that investors demand. As the volatility of markets and economic uncertainty increases investors become more risk averse, leading them to sell their riskiest assets and purchase safer assets, highly increasing the yield of the former. This occurrence is known as "Flight-to-quality", the allocation away from riskier investments and into safer

ones, usually due to uncertainty in the financial markets. As Erel et al. (2012) stated: "These explanations are not mutually exclusive, so it is possible that as macro-economic conditions could affect both (or neither) the demand and supply of capital. Both demand and supply of capital-based arguments could conceivably affect the quantity of capital raised by firms, the type of securities they use to raise this capital, and how these securities are structured". Quantitative easing measures have as an objective to alleviate this effect by raising demand and diminishing the quantity of assets available, with the previously mentioned "portfolio rebalancing effect".

Erel et al. (2012) tested these theories gathering a sample of private placements of equity and debt between 1971 and 2007, the results suggest that both the ability to raise capital and how they raise capital are affected by macroeconomic conditions. The capital raising for non-investment-grade borrowers is procyclical and so, not only their rating significantly affects their ability to raise capital but has an even greater effect during macroeconomic downturns. In contrast, for investment-grade borrowers, the number of public issuances grows in moments of financial stress. It was also found that the sum of the issuances of public equity over time is procyclical but due predominately to non-investment grade borrowers. "The capital raising for non-investment grade borrowers was procyclical, while for investment-grade borrowers, it is countercyclical. Meaning that poor market conditions, such as a financial crisis, would lead to a larger demand on shorter maturities with more security.". These findings are difficult to associate with the demand-based theory, as they are more consistent with the supply-based theory, by switching the supply of capital towards safer securities. The findings of this research also ally with the prediction of the flight-to-quality hypothesis that, in an event of a financial downturn, the increasing demand for safer securities will make issuing them really attractive and, therefore, the firms with a higher credit rating will issue securities and keep proceeds as cash, while

firms with a lower rating will spend more of the capital they raise and keep less as cash. The results show that during recessions, investment-grade firms hold a higher percentage of their raised capital in the form of cash comparing to regular times. Suggesting that is the change in the price of high-quality bonds that drives the issuing decisions of a firm with a high credit rating.

In addition to this, the results also indicate that the structure of debt contracts changes in recessions, as it decreases the expected maturity of public bonds and private loans and investors favor that these loans are secured. Showing that there is also a flight-to-liquidity phenomenon, in the case of a financial downturn, investors sell less liquid securities and purchase more liquid investments such as short-term treasuries. This finding is consistent with both the supply-based theory and the demand-based theory, as the recession could lead firms to structure securities in order to lessen their information sensitivity or an increase in investor demand for safer securities could lead firms to issue securities with shorter maturities and more security.

A covered bond is a series of similar loans that were issued by a bank and then sold to a financial institution for resale. The individual loans that make up this package remain in the books of the banks and therefore banks serve as collateral to ensure the payment of these loans. Covered bonds are really safe as they have this extra layer of protection.

Correia et al. (2020) did a study on the pricing of issued bonds in European banks in the 2000-2016 period, for covered bonds and found that investors place more importance in (1) macroeconomic characteristics such as market volatility, yield curve slope, level of creditor, legal protection, country risk and legal enforcement, (2) contractual characteristics, such as maturity, transaction size, number of banks involved and their reputation and (3) banks' characteristics rather than rating.

1.4 Covered Bond Purchase Programs

As previously mentioned, covered bonds are dual-recourse bonds, they distinguish themselves from asset-backed securities as the claim on the loans remain in the books of the banks and therefore banks serve as collateral to ensure the payment of these loans (Beirne et al. 2011).

Covered bonds were a key source of funding for euro area banks even before the financial crisis. The market for this security had grown to over 2.4 trillion euros by the end of 2008 (Beirne et al. 2011).

As Erel et al. (2012) indicated, recessions lead to an increased demand for safer securities which makes issuing them relatively attractive. This was also empirically proven during the financial crisis by Beirne et al. (2011). The risk appetite, during the financial crisis, of investors shifted towards less risky assets. Similarly to the situation in the United States, Beirne et al. (2011) states that the financial crisis led to a lack of confidence between banks. Leading to a liquidity risk of a large number of banks and consequently their solvency. Therefore, as the demand for safer options got higher, covered bonds became a more reliable source of funding for the banks.

In the eurozone, the central bank announced the first covered bond purchase program in May of 2009, purchasing up to the nominal value of 60 billion euros, from July 2009 to the end of June 2010. Focusing on increasing banks' access to long-term funding, reducing liquidity risks.

The CBPP1 was made with four objectives: (a) a way to promote the ongoing decline in money market term rates; (b) easing funding conditions for credit institutions and enterprises; (c) encouraging credit institutions to maintain and expand their lending to clients, (d) improving market liquidity in important segments of the private debt securities market (Beirne et al. 2011).

Beirne et al. (2011) did a study that empirically confirms (a) the narrowing of covered bond yield swaps, (b) the increase of issuance of covered bonds (although there was no overall effect on the amount of uncovered and covered effects, which points to a substitution effect in the issuing of the banks) and (d) improved market liquidity in the covered bonds market. Szczerbowicz (2015), Markmann (2018) and Correia et al. (2020) findings were in parallel with Beirne et al., as their results suggest that the CBPP1 led to a narrowing of covered bonds spreads.

Encouraging credit institutions to maintain and expand their lending to clients (c) is the one objective that had less evidence towards its success: "For objective (c), anecdotal evidence from market participants in conjunction with the quantitative findings relating to objectives (a) and (b)" (Beirne et al. 2011).

Boesel, Kool and Lugo (2017) added that this substitution effect from (b) acted to the detriment of the asset-backed security market, which the European Institutions such as the ECB and the European Banking Association (EBA) have considered a pivotal market in providing small and medium enterprises with credit and banks with a diversified source of funding and therefore may have harmed this small and medium sized firms financing.

In order to complement these studies and to further investigate how these programs affect the lending of banks to their clients, the main ambition of my research is to empirically test how did the CBPP1, CBPP2 and CBPP3 impact firms' cost of borrowing in the eurozone.

In June 2010, the ECB stopped the covered bond purchasing, however, as the Sovereign crisis deepened in late 2011, in October 2011 it was announced the second covered bond purchase programme (CBPP2). The purchase of 40 billion dollars' worth of euro-dominated covered bonds in both primary and secondary markets, mainly focusing on covered bonds with a residual maturity of 10.5 years (Markmann 2018). At its completion, the ECB had only purchased 16.4 billion

euros worth of covered bonds, not reaching the previously settled goal of 40 billion. The second covered bond purchase program was implemented with similar objectives of easing funding conditions for credit institutions and enterprises and encouraging credit institutions to maintain and expand lending to their clients (Markmann 2018).

The CBPP2 had mixed results, Szczerbowicz (2015) and Gibson et al. (2015) found that the spread of covered bonds decreased with this program however Markmann (2018), Branco et al. (2020) and Correia et al. (2020) results suggest that this spread widened. The mixed results may have occurred due to being announced "simultaneously with other monetary policy measures that have reduced interest and/or investors already knew the effects of outright covered bond purchases (Branco et al. 2020).

Gibson et al. (2015) raised a theoretical explanation for the lowering of Sovereign spread on these European Central Bank purchase programs. The basic idea is that the cost of defaulting on debt held by official creditors is greater than the cost of defaulting against debt held by private creditors. This happens because the official creditors have larger enforcement powers than private creditors. If a country defaults against debt by private creditors, the country may be excluded from credit markets and/or be unable to obtain credit to finance imports. If it defaults against official creditors, the punishments are greater, it could lead to an exclusion from the euro-area or even the exclusion from the European Union. By possessing those larger enforcement powers, they are able to lend at lower rates compared to private lenders since the risk of default is lower and, consequently, leading to a decline in the spread to benchmark on Sovereign debt.

In October 2014, the European central bank announced the third covered purchase program, even though, from a bank funding perspective, the spreads were mostly trading as tightly as in pre-crisis levels (Markmann 2018). The

objectives were similar as the previous two, to further enhance the transmission of monetary policy, facilitate credit provision to the euro area economy, generate positive spillovers to other markets and, as a result, ease the ECB's stance, and contribute to a return of inflation rates to levels closer to 2% (Markmann 2018). Nevertheless, Markmann and Zietz (2017) examined all three covered purchase programs with different methodology. They compared the spread tightening of euro-denominated covered bonds with those issued by British banks, which do not benefit from the program. The results from this study indicated that the CBPP1 did lead to a reduction of the spread of the covered bond, however, the CBPP2 and CBPP3 widened that gap but were in line with the Eurosystem's objective on liquidity. This result for the CBPP3 may be due to, as pointed out by Bernanke (2020), the fact that the effectiveness of the purchase programs is dependent on the exceptional dysfunction in the financial markets. As previously mentioned, the banks' funding conditions were already at a pre-crisis level before the CBPP3, therefore the effectiveness of the program may not have been fulfilled. However, Branco et al. (2020) results suggest that the CBPP3 led to a narrowing of the corporate bond market spread.

In October 2008, there was a government guarantee feature introduced on bank bonds that ensured investors that, in the case of a default by the bank, there will be a public bail-out. This measure was implemented by almost all advanced economies and Zaghini (2014) points out that this proved effective in restoring bank funding as it reassured investors that the money they invested would be returned. However, they were also responsible for the "weak" banks from countries with a high credit rating having access to cheaper funding than strong banks from countries with low credit rating. This may also lead to firms from low credit rating countries to have higher spread, as the banks from these low credit countries had higher cost of borrowing compared to banks from countries with higher credit ratings. This fits in with the research done by Branco et al. (2020)

that concluded that Sovereign credit risk is an important determinant of banks' cost of borrowing, especially in crisis periods. This raises another point to my research question, what are the effects of the CBPP1, CBPP2 and CBPP3 in the corporate bond spread to benchmark of firms from lower credit rating countries comparing to firms from higher credit rating countries?

Szczerbowicz (2015), Gibson et al. (2016), Markmann et al. (2017) and Markmann (2018) find that the impact of these programs was bigger in the GIIPS than on non-GIIPS, suggesting that the effect of the covered bond purchase programs has more significance in low credit rating countries.

Chapter 2
Methodology

2.1 Introduction

In the previous chapter, it was defined the objective of empirically testing the CBPP1, CBPP2 and CBPP3 effect on firms' cost of borrowing in the eurozone. To investigate this topic, I raise the following question (Question 1): "What was the impact of the CBPP1, CBPP2 and CBPP3 on the credit spread of corporate bonds in the eurozone?".

My interest in this research question has several reasonings.

Firstly, these three programs were one of the main actions by the European Central Bank to minimize the effects of the financial and Sovereign debt crisis and so it is important to test their effect on firms.

Secondly, we are currently facing a global pandemic, a significant number of nonfinancial firms have been closed for months and will need financial support to survive this pandemic. Policymakers have to define which monetary policy tools they should embrace, in response to the COVID-19 pandemic in order to offer that financial support. The studies of these unconventional monetary policies are now really useful because the interest rates are already low in the eurozone. If lowering the interest rate to its lower bound does not capture enough traction, quantitative easing may be a resourceful tool to fight a potential crisis.

Thirdly, one of the main objectives of the covered bond purchase programs was to lower the firms' cost of borrowing (Markmann 2018). The idea was that the purchase of covered bonds would increase its number of issuances and reduce the yield, leading to a lower cost of financing for banks. This,

consequently, would encourage credit institutions to expand their lending to clients at a lower yield, which would lead to a reduced cost of borrowing for firms (Beirne et al. 2011).

Finally, there is a growing body of literature, focused on financial firms, examining the impact of the covered bond purchase programs on bond credit spreads. However, little research has been done on this same topic regarding nonfinancial firms.

I also mentioned how "weak" banks from countries with a high credit rating had access to cheaper funding than strong banks from countries with low credit rating (Zaghini 2014). This may lead to firms from low credit rating countries to have higher spread, as the banks from these low credit countries had higher cost of borrowing compared to banks from countries with higher credit ratings. This condition is especially relevant in crisis periods, as the financial and Sovereign debt crisis led to a higher cost of financing for countries with low credit rating (Szczerbowicz 2015). This led me to the following question (Question 2): "What are the effects of the CBPP1, CBPP2 and CBPP3 on the corporate bond credit spread of firms from lower credit rating countries comparing to firms from higher credit rating countries?"

2.2 Empirical analysis

To answer my research question, I gathered a sample of bonds extracted from the DCM analytics utilizing the software Dealogic, covering the 2000-2019 period in the eurozone. I solely focused on bonds from nonfinancial firms with a deal-type code of "corporate bond investment-grade" and "corporate bond high-yield". I also required that my selected sample had all the necessary information to compute the spread. I included only bonds that had the transaction size, rating and maturity available since these were powerful indicators to price corporate

bonds (Marques et al. 2020). The credit rating agency I used was Moody's corporation, one of the most prestigious bond rating agencies in the world. Moody's uses expected losses to measure credit ratings. Expected losses is the sum of the values of all possible values, each multiplied by the probability of that loss occurring. I extracted 2644 bond issues, of which 2030 are investment grade and 614 are non-investment grade according to Moody's (Figure 1), with a total volume worth over 400 billion euros.

Firstly, it is important to note that these programs were a way to respond to the financial crisis of 2008 and the Sovereign debt crisis, the cost of borrowing for banks was increasing and removing their liquidity (Beirne et al. 2011). As the banking system was plummeting the corporate bond market of the eurozone was following the same direction, there was a profound increase in the spread of corporate bonds leading to a rise in their cost of financing, as you can see in the following table 1:

Table 1 – Descriptive statistics of the financial and Sovereign debt crisis on corporate bond credit spreads

Period of analysis	Number	Mean	Median	Std. Dev.	Max	Min
Before financial crisis	415	143.56	103.00	126.10	752.00	2.50
During financial crisis	280	299.32	248.00	186.93	980.50	37.50
During Sovereign debt crisis	1948	223.36	152.35	179.31	1303.00	-11.00

This table presents the descriptive statistics for credit spreads of corporate bonds in the eurozone in three sub-samples: Before financial crisis: January 01 2000 - September 14 2008; During the financial crisis: September 15 2008 - April 23 2010; During the Sovereign debt crisis: April 24 2010 - December 31 2019. Information of bond issuances was obtained from DCM Analytics.

Table 1 shows, as expected, that the average corporate bond spread to the benchmark is statistically higher within the financial crisis (155.76 bps),

comparing to before the financial crisis, with the average spread more than doubling.

On the other hand, with the Sovereign debt crisis the average spread to benchmark lowered (75.96 bps), comparing to the financial crisis, but it still has a higher spread than before the financial crisis (79.80 bps) which suggests that these crises have increased the cost of borrowing for firms.

Both findings are in parallel with those of Beirne et al. (2011), Szczerbowicz (2015) and Marques et al. (2020).

The standard deviation also grew with these crises which suggests that the gap between investment-grade and high-yield corporate bonds spreads may have widened, consistent with the findings of Beirne et al. (2011) and Erel et al. (2012).

To get a closer look at specifically the impact of the covered bond purchase programs I reported the summary statistics of the corporate bond yields during the financial and Sovereign debt crisis without the CBPP and during each CBPP.

Table 2 shows that during all the covered bond purchase programs the median and average corporate bond has lowered its spread, comparing to a period of crisis without any corporate bond purchase program. This is my first impression on researching for the answer to my Question 1**,** suggesting that these programs all have a positive effect in lowering the spread to benchmark and therefore the cost of financing for firms. CBPP3 is the program that this summary statistic suggests having the most impact in lowering the spread of corporate bonds and the CBPP2 the least.

Beirne et al. (2011), Szczerbowicz (2015), Markmann et al. (2017) and Branco et al. (2020) results all indicate that the CBPP1 had lowered the covered bond market.

The CBPP2 and CBPP3 have a more divided opinion on their results for the corporate bond market. Szczerbowicz (2015) indicates that the spread for

corporate bonds lowered with the CBPP2. However, Markmann (2018) and Correia et al. (2020) indicate that the second covered purchase program did not have the impact intended and raised the spread. For the CBPP3, Markmann (2018) results suggest that there was an increase in spread, contrarily, Branco et al. (2020) indicates that there was a decrease in spread for the corporate bond market in the eurozone.

Table 2 – Descriptive statistics of the three Covered Bond Purchase Programs on corporate bond credit spreads

Period of analysis	Number	Mean	Median	Std. Dev.	Max	Min
During financial or Sovereign debt crisis without CBPP active	604	276.68	229.50	190.56	977.00	-11.00
During CBPP1	172	258.78	176.25	200.60	980.50	38.00
During CBPP2	230	275.88	207.45	205.71	1149.00	25.00
During CBPP3	1222	199.54	136.30	162.49	1303.00	20.00

This table presents the descriptive statistics for corporate bond credit spreads in the eurozone in four sub-samples: During the financial crisis or Sovereign debt crisis without any CBPP active: 15 September 2008 – 06 May 2009 / 01 July 2010 – 05 October 2011 / 01 November 2012 – 03 September 2014 / 01 April 2017 – 31 Dec 2019; During the CBPP1: 07 May 2009 – 30 June 2010; During the CBPP2: 06 October 2011 – 31 October 2012; During the CBPP3: 04 September 2014 – 31 December 2019. Information of bond issuances was obtained from DCM Analytics.

To get closer to the answer to my Question 2, "What are the effects of the CBPP1, CBPP2 and CBPP3 on the corporate bond spread of firms from lower credit rating countries comparing to firms from higher credit rating countries?", It is important to get information on how different countries have firms with different corporate bond spreads:

Table 3 – Descriptive statistics distributed geographically

Country	Number	Mean	St. Dev	Median	Max	Min
Austria	40	222.29	152.11	197.75	727.00	34.00
Belgium	100	194.62	142.29	136.20	741.00	30.00
Finland	59	240.00	171.80	193.70	980.50	66.89
France	725	213.87	178.47	143.00	1303.00	14.00
Germany	724	187.08	153.67	125.70	940.00	23.00
Greece	23	396.24	234.98	409.00	853.00	106.20
Ireland	44	335.58	174.83	310.50	836.00	74.70
Italy	249	261.19	168.82	200.20	929.00	36.00
Luxembourg	81	237.23	151.71	190.00	727.70	20.00
Netherlands	354	206.47	195.70	122.40	1149.00	-11.00
Portugal	47	252.86	163.06	206.30	636.10	2.50
Slovenia	1	234.20	.	234.20	234.20	234.20
Spain	196	266.00	215.17	182.15	1133.00	28.00

This table presents the descriptive statistics for credit spreads of corporate bonds in thirteen countries of the eurozone issued during the 2000-2019 period. Information of bond issuances was obtained from DCM Analytics.

The five countries which have the highest average corporate bond spread are: Greece, Italy, Ireland, Portugal and Spain. The "GIIPS", which is the acronym for these five countries that were the weakest economies in the eurozone during the European debt crisis (Szczerbowicz 2015). As previously mentioned, there were several doubts about these nations' abilities to pay back bondholders.

The results suggesting that the corporate bond credit spread is higher specifically in these countries suggests that there is a correlation between the corporate bond yields of firms from a country and the probability of default of the Sovereign bonds of that country. One explanation for this finding may be that there are more low rated corporate bonds from countries with high risk of default and that there is no direct relationship between one and another, the firm paying higher yields due to the country's high probability of default, but merely firms from these lower credit rating countries also have a low rating score on their corporate bonds. To test this, I reported, in table 4, the summary statistics.

This table demonstrates that only the average Aa2, A2, B2, B3 and Caa1 rated bonds have a lower spread to benchmark for GIIPS than for non-GIIPS. The average Aaa, Aa3, A1, A3, Baa1, Baa2, Baa3, B1 and Caa2 all have lower spread with non-GIIPS and therefore raises the suspicion that, as good banks from bad credit rating countries had a higher cost of borrowing compared to bad banks from good credit rating countries (Zaghini 2014), the corporate bonds spread may be inflated due to the credit rating of their countries/cost of borrowing of their banks.

To further respond my Question 2, I also reported, table 5, the summary statistics of the spreads between GIIPS and non-GIIPS without the CBPP programs but within either the financial crisis or the Sovereign debt crisis and with the CBPP programs. This table shows that both groups have lowered their average corporate bond with the covered bond purchase programs, but the reduction has been more significant in the GIIPS, (93.92 bps), than in the non-GIIPS, (49.71 bps), suggesting that these programs have reduced the gap between the corporate bond spreads of firms from bad credit rating countries and firms from good credit rating countries, in line with the findings of Szczerbowicz (2015), Gibson et al. (2016), Markmann et al. (2017) and Markmann (2018).

Table 4 – Descriptive statistics distributed by rating and GIIPS and non-GIIPS

	Total		GIIPS		Non-GIIPS	
Rating	Number of issuances	Mean (St. Dev)	Number of issuances	Mean (St. Dev)	Number of issuances	Mean (St. Dev)
Aaa	27	83.03	1	111.00	26	81.95
		(60.79)		.		(61.73)
Aa1	159	96.68	0	.	159	96.68
		(55.96)		.		(55.96)
Aa2	70	109.42	2	70.10	68	110.58
		(75.21)		(95.60)		(75.11)
Aa3	92	154.51	8	223.66	84	147.92
		(105.09)		(129.77)		(100.91)
A1	213	110.06	12	138.90	201	108.34
		(78.73)		(58.63)		(79.55)
A2	227	138.11	31	135.72	196	138.49
		(99.15)		(85.65)		(101.51)
A3	337	149.47	36	192.75	301	144.29
		(89.75)		(131.57)		(82.17)
Baa1	381	161.76	86	188.61	295	153.93
		(91.95)		(105.34)		(86.30)
Baa2	390	200.67	160	210.15	230	194.08
		(128.37)		(131.20)		(126.22)
Baa3	133	227.43	66	228.74	67	226.14
		(124.49)		(136.40)		(112.56)
Ba1	181	282.66	33	319.15	148	274.52
		(130.75)		(98.05)		(135.92)
Ba2	99	334.12	25	348.98	74	329.10
		(137.33)		(114.56)		(144.57)
Ba3	59	397.37	14	462.00	45	377.26
		(124.06)		(187.51)		(90.32)
B1	92	514.64	18	551.94	74	505.57
		(163.04)		(226.66)		(144.04)
B2	99	621.98	28	620.76	71	622.46
		(175.22)		(145.41)		(186.62)
B3	55	537.19	29	481.46	26	599.36
		(198.95)		(217.81)		(157.31)
Caa1	18	590.94	3	479.33	15	613.27
		(180.58)		(212.02)		(173.12)
Caa2	9	618.67	5	671.40	4	552.75
		(163.70)		(136.21)		(190.52)
Ca	2	671.00	2	671.00	.	.
		(57.98)		(57.98)	.	

This table presents the descriptive statistics for credit spreads of corporate bonds in GIIPS and non-GIIPS during the 2000-2019 period. Information of bond issuances was obtained from DCM Analytics. The rating of the corporate bonds was gathered by Moody's.

Table 5 – Descriptive statistics of the Covered Bond Purchase Programs during the financial or Sovereign debt crisis distributed by GIIPS and non-GIIPS

Period of analysis		GIIPS	Non-GIIPS
CBPP not active during financial or Sovereign debt crisis	Mean	366.68	251.75
	Median	328.00	207.00
	Std. Dev.	191.93	182.69
	Max	853.00	977.00
	Min	50.00	-11.00
Any CBPP active	Mean	272.76	202.04
	Median	200.00	137.60
	Std. Dev	189.11	169.50
	Max	1133.00	1303.00
	Min	28.00	20.00

This table presents the descriptive statistics for credit spreads of corporate bonds in GIIPS and non-GIIPS distributed in two sub-samples: During the financial crisis or Sovereign debt crisis without any CBPP active: 15 September 2008 – 06 May 2009 / 01 July 2010 – 05 October 2011 / 01 November 2012 – 03 September 2014 / 01 April 2017 – 31 Dec 2019; During any CBPP: 07 May 2009 – 30 June 2010 / 06 October 2011 – 31 October 2012 / 04 September 2014 – 31 December 2019. Information of bond issuances was obtained from DCM Analytics.

2.3 Methodology and variables

To examine empirically the research question presented above I will employ a linear regression, an Ordinary Least Squares (OLS) regression, due to cross-country differences (Branco et al. 2020) my regression includes country fixed effects and estimate standard errors clustered by country similarly to Correia et al. (2020) and due to industry varying risk premia I introduce industry fixed effects, utilized in Marques et al. (2020). OLS is a method for estimating the unknown parameters by minimizing the sum of the squares of the differences between the observed dependent variable in the given dataset and those predicted by the linear function of the independent variable. I will employ the model described in the following Eq. (1) to test the impact of the covered bond

purchase programs and other variables on the spread to the benchmark of corporate bonds, in order to answer my Question 1.

$$Credit\ Spread_i = \alpha_0 + \sum_{n=1}^{19} \beta_n\ Rating_i + \beta_{20} Maturity_i + \beta_{21} Financial\ Crisis_i + \beta_{22} Sovereign\ Debt\ Crisis_i + \beta_{23} Shape\ of\ the\ Swap\ Curve_i + \beta_{24} Country\ Risk_i \beta_{25} CBPP1_i + \beta_{26} CBPP2_i + \beta_{27} CBPP3_i + \varepsilon_i$$

Where $Credit\ Spread_i$ denotes the spread between the coupon rate of the security at issue and a US treasury or Benchmark, expressed in basis points issued in country i and day t. $Rating_i$ denotes a series of dummy variables, each representing a specific rating from Moody's (for example, dummy Aaa that takes the value of 1 if a bond has an Aaa Moody's rating and 0 otherwise) to a bond issued in country i and day t. $Maturity_i$ denotes the number of years from settlement date to legal maturity date in country i and day t. $Financial\ Crisis_i$ denotes a dummy variable that takes the value of 1 if the bond issued in country i at the day t was issued within the financial crisis of 2008, since Lehmann Brothers bankruptcy filing date, 15th of September 2008, to the 23rd of April 2010, and 0 otherwise. $Sovereign\ Debt\ Crisis_i$ denotes a dummy variable that takes the value of 1 if the bond issued in country i at the day t was issued within the Sovereign debt crisis, from the 24th of April 2010 to the 31st of December 2019 (last day of my sample), and 0 otherwise. $CBPP1_i$ denotes a dummy variable that takes the value 1 if the bond issued in country i at the day t was issued between the 07th of May 2009, the announcement of the covered bond purchase program, and 30th of June 2010, the last day that the program was active, and 0 otherwise. $CBPP2_i$ denotes a dummy variable that takes the value 1 if the bond issued in country i at the day t was issued between the 06th of October 2011, the announcement of the second covered bond purchase program, and 31st of October 2012, the last day that the program was active, and 0 otherwise. $CBPP3_i$

denotes a dummy variable that takes the value 1 if the bond issued in country i at the day t was issued between the 04th of September 2014, the announcement of the third covered bond purchase program, and 31st of December 2019, and 0 otherwise. $Shape\ of\ the\ Swap\ Curve_i$ denotes the difference between the five-year U.S. government bond rate and the 3-month U.S. treasury bill rate at the day t that the bond was issued. $Country\ Risk_i$ denotes a series of dummy variables each representing a specific S&P's country credit rating at closing date. Finally, ε_i denotes the error term associated to a bond issued in country i at the day t.

This Ordinary Least Squares regression is focused on my Question 1 as it will help me understand how did the CBPP1, CBPP2 and CBPP3 affect the spread of corporate bonds in the eurozone. The estimate of β_{48}, β_{49}, β_{50} will allow me to examine the impact of the CBPP1, CBPP2 and CBPP3, respectively.

Based on the previous summary statistics and my literature review, I indicate each variable expected impact on spread, their definition and the empirical literature supporting these variables.

The results of my regression (table 7) suggest that all variables had the impact expected on credit spread, besides the CBPP2 and the shape of the swap curve.

This table also suggests that the spread for corporate bonds raises as the rating grade was riskier, although this growth in spread as the rating was riskier was not linear, similarly to Marques et al. (2020).

This test indicates that the spread raises as the time to maturity increases, in parallel with Branco et al. (2020) and Marques et al. (2020), on average if a bond maturity raises one year to maturity the spread would rise 3.15 basis points, demonstrating that investors value the liquidity of the bonds they purchase.

As expected, this test suggests that the financial crisis had a devastating impact on corporate bonds spread, raising on average 228.31 basis points, similarly found on Beirne et al. (2011) and Marques et al. (2020).

Table 6 – Definition of variables, empirical literature support, source and expected impact on credit spread

Variable Name	Variable Definition	Empirical Literature	Source	Expected impact on credit spread
Dependent Variable: Credit Spread	Spread between coupon rate of security and US treasury or Benchmark, expressed in basis points.	Collin-Dufresne (2001) | Chen et al. (2007)	DCM Analytics	
Independent Variables: Rating	Series of dummy variables, each representing a specific Moody's rating.	Collin-Dufresne (2001) | Marques et al. (2020)	DCM Analytics	+
Maturity	Number of years from settlement date to legal maturity date.	Branco et al. (2020) | Marques et al. (2020)	DCM Analytics	+
Financial crisis	Dummy variable that takes the value of 1 if the bond was issued between the financial crisis period (since Lehmann Brothers bankruptcy filing date, 15th of September 2008, and 23rd of April 2010) and 0 otherwise.	Beirne et al. (2011) | Marques et al. (2020)	DCM Analytics	+
Sovereign debt crisis	Dummy variable that takes the value of 1 if the bond was issued between the financial crisis period (24th of April 2010 and 31st of December 2019) and 0 otherwise.	Beirne et al. (2011) | Szczerbowicz (2015) | Marques et al. (2020)	DCM Analytics	+
Shape of the Swap Curve	The difference between the five-year U.S. government bond rate and the 3-month U.S. treasury bill rate	Branco et al. (2020) | Marques et al. (2020)	Datastream	-
Country risk	Series of dummy variables each representing a specific S&P's country credit rating at closing date.	Zaghini (2014) | Gibson et al. (2016) | Marques et al. (2020) | Correia et al. (2020)	S&P Global Rating	+
CBPP1	Dummy variable that takes the value of 1 if the bond was issued between the announcement of the CBPP1, 07th of May 2009, and the end of the program, 30th of June 2010, and 0 otherwise.	Beirne et al. (2011) | Szczerbowicz (2015) | Markmann (2018) | Branco et al. (2020)	DCM Analytics	-
CBPP2	Dummy variable that takes the value of 1 if the bond was issued between the announcement of the CBPP2, 06th of October 2011, and the end of the program, 31st of October 2012, and 0 otherwise.	Szczerbowicz (2015) | Gibson et al. (2015) | Markmann (2018) | Correia et al. (2020)	DCM Analytics	-
CBPP3	Dummy variable that takes the value of 1 if the bond was issued between the announcement of the CBPP3, 04th of September 2014, and the end of the program, 31st of December 2019, and 0 otherwise.	Markmann (2018) | Correia et al. (2020)	DCM Analytics	-

The following characters indicate: – = negative impact on the credit spread \| + = positive impact on the credit spread

The following table indicates that the Sovereign debt crisis did not have such an impact but still, on average, raised the risk premium for corporate bonds in 37.95 basis points, similar to what is found on, in parallel with the results found on Beirne et al. (2011), Szczerbowicz (2015) and Marques et al. (2020).

Contrarily to what is presented by Marques et al. (2020) and Branco et al. (2020), my results suggest that the swap of the curve rate has a positive impact (4.14 bps) for the spread of corporate bonds.

Table 7 also indicates, in parallel with Marques et al. (2020) and Correia et al. (2020), the country risk is positively related to the risk premium for corporate bonds (2.63 bps).

This test also suggests that the CBPP1 lowered the risk premiums for corporate bonds by 131.81 basis points, this result is in line with Beirne et al. (2011), Szczerbowicz (2015), Markmann (2018) and Correia et al. (2020), who find a narrowing of covered bond spreads due to this program.

The results also suggest that the CBPP2 did not accomplish the same goal as, on average, it raised the spread to the benchmark of about 83.95 basis points, in line with Markmann (2018) and Correia et al. (2020) but contrary to Szczerbowicz (2015) and Gibson et al. (2015), as the former found that the spread for covered bonds widened while the latter two found that the spread of covered bonds lowered with this second program. As mentioned by Branco et al. (2020), this may have happened as a lot of European central programs were simultaneous with this program, for example the long-term refinancing operation, reducing its efficiency.

This test also indicates that the CBPP3 did lower the spread to the benchmark, not at the rate that the CBPP1 achieved, but it still reduced the average corporate bond by 34.07 basis points. My results for this program are parallel with the findings of Branco et al. (2020) that find a negative impact of the CBPP3/ABSPP on covered bond spreads, but contrary to Markmann (2018) whose results find a

positive effect on covered bond spreads. The mixed results may be due to the fact that, from a bank funding perspective, the spreads before the announcement of the CBPP3 were trading as tightly as in pre-crisis levels (Markmann 2018). As pointed out by Bernanke (2020), the effectiveness of the purchase programs is dependent on the exceptional dysfunction in the financial markets.

Therefore, my results suggest that the CBPP1 and the CBPP3 had the effects that were desired by the Eurosystem's objectives, of lowering firms' cost of financing, but the CBPP2 had the opposite impact, widening corporate bond credit spreads.

My results allied with the ones of Branco et al. (2020), suggest that the lowering of the cost of borrowing for banks leads to the reduction of the cost of borrowing for firms, as when the covered bond spread decreased (increased) the corporate bonds also decreased (increased). Which was one of the main premises for the European central bank to execute these programs, as previously mentioned: the lower cost of financing for banks would, consequently, encourage credit institutions to expand their lending to clients at a lower yield, which would lead to a reduced cost of borrowing for firms (Beirne et al. 2011). The following table 7 shows the results of my regression, Eq. (1).

To answer my Question 2**,** it is important to execute the same regression but separating between two groups of countries from the eurozone, GIIPS and non-GIIPS, similarly done by Szczerbowicz (2015), Gibson et al. (2015) and Branco et al. (2020).

This will allow me to do a robustness check of my previous results and also compare the effects of all three corporate bond purchase programs.

The results demonstrated that, as expected, risk premia for corporate bonds raises as the rating grade is riskier on both country groups, although, again, growth in spread as the rating was riskier was not linear, supporting the idea that credit rating is highly correlated with spreads (Marques et al. 2020).

Table 7 – Regression analyses of the determinants of corporate bond credit spreads

Credit Spread	Corporate Bonds
Aaa	-618.67***
	(48.69)
Aa1	-615.92***
	(47.15)
Aa2	-582.20***
	(66.54)
Aa3	-597.09***
	(43.85)
A1	-577.42***
	(44.52)
A2	-566.10***
	(47.43)
A3	-563.63***
	(38.43)
Baa1	-535.85***
	(45.29)
Baa2	-508.62***
	(52.40)
Baa3	-489.26***
	(46.21)
Ba1	-407.86***
	(45.34)
Ba2	-340.20***
	(42.26)
Ba3	-291.11***
	(44.92)
B1	-162.39***
	(27.80)
B2	-45.17
	(45.79)
B3	-144.51***
	(39.86)
Caa1	-77.37
	(71.32)
Caa2	-41.15
	(65.73)
Maturity	3.15***
	(0.37)
Financial Crisis	228.31***
	(18.34)
Sovereign Debt Crisis	37.95*
	(17.64)
Shape of the Swap Curve	4.14
	(3.03)
Country risk	2.63
	(1.57)
CBPP1	-131.81***
	(27.06)
CBPP2	83.95***
	(20.74)
CBPP3	-34.07*
	(15.77)
Constant	659.21***
	(45.71)
Industry fixed effects	Yes
Country fixed effects	Yes
Adjusted R^2	0,50
Number of observations	2644

This table presents the results of an OLS regression analysis of the determinants of corporate bond credit spreads for: (i) a sample of 2644 corporate bonds of which 2030 are investment grade and 614 are non-investment grade according to Moody's (Figure 1). For a definition of the variables, see Table 6. ***, ** and * indicate that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The standard errors are reported in parenthesis. Due to cross-country differences, I estimate standard errors clustered by country.

This test indicates that the credit spread increases as the time to maturity increases, on average if a bond maturity raises one year the spread would rise 4.29 basis points for GIIPS and 3.09 basis points for non-GIIPS countries, similarly to Branco et al. (2020) and Marques et al. (2020).

The results indicate that the financial crisis had a bigger impact on firms in GIIPS, increasing, on average, 261.50 basis points, compared to firms in non-GIIPS, 219.84 basis points, in parallel with the findings of Szczerbowicz (2015) and Markmann (2018).

This test suggests that the Sovereign debt crisis had a greater difference of impact between GIIPS and non-GIIPS, it raised the risk premium for the average corporate bond in 146.89 basis points for GIIPS and in 20.70 basis points for non-GIIPS, in line with Szczerbowicz (2015) and Markmann (2018).

The shape of the swap curve only had the expected impact, of reducing credit spread for corporate bonds, on GIIPS (3.82 bps), in non-GIIPS it raised by 4.14 basis points

The country risk had the unexpected impact on both GIIPS and non-GIIPS, having lowered the spread by 4.13 basis points and 12.15 basis points, respectively.

The following table suggests that the CBPP1 lowered the risk premiums for corporate bonds in both groups, by 158.79 basis points on GIIPS and 122.60 basis points for non-GIIPS countries, being more effective on GIIPS, in countries with lower credit rating.

My results indicate that the CBPP2 did raise the spread to benchmark on both groups, about 172.57 basis points for GIIPS and 62.39 basis points for non-GIIPS. Again, the CBPP has more impact in GIIPS than in non-GIIPS, in this second program a positive impact.

This test also indicates that the CBPP3 did lower the spread to the benchmark for both groups, reducing the average corporate bond in 93.36 basis points for GIIPS and 8.67 for non-GIIPS.

The impact in all three programs was greater in the GIIPS comparing to non-GIIPS, in line with the results of Szczerbowicz (2015), Gibson et al. (2016), Markmann et al. (2017) and Markmann (2018). Suggesting that the effect of the covered bond purchase programs has more significance in low credit rating countries.

The spread of straight and covered bonds issued, both in GIIPS and non-GIIPS, has lowered both with CBPP1 and CBPP3 and increased with CBPP2. Similarly to the findings of Branco et al. (2020), whose results indicate that the covered bonds of GIIPS decreased with both CBPP1 and CBPP3 but decreased with the CBPP2. Once again suggesting a correlation between the covered bond credit spread of banks and the credit spread of corporate bonds. The results of my regression are demonstrated in table 8.

To further examine my Question 2, I use the Chow test, a methodology similarly utilized by Marques et al. (2020) and Correia et al. (2020), to examine whether the corporate bond credit spreads of countries in GIIPS and of countries in non-GIIPS are influenced similarly by the covered bond purchase programs.

It is concluded, at the 1% significance level, that GIIPS and non-GIIPS are affected differently by the second and third covered bond purchases programs, 24.26 for the CBPP2 and 12.66 for the CBPP3. Further verifying that the impact of both these programs is bigger on the corporate bond credit spread of firms in GIIPS. My findings are in parallel with Szczerbowicz (2015), Gibson et al. (2016), Markmann et al. (2017) and Markmann (2018).

Table 8 – Regression analyses of the determinants of corporate bond credit spreads for GIIPS and non-GIIPS

Credit Spread	GIIPS	Non-GIIPS
Aaa	-538.16***	-613.00***
	(58.75)	(32.32)
Aa1	-593.63***	-612.34***
	(43.25)	(30.83)
Aa2	-726.62	-578.04***
	(53.49)	(52.19)
Aa3	-649.33***	-585.24***
	(40.44)	(25.36)
A1	-587.05***	-576.68***
	(41.61)	(28.60)
A2	-605.45***	-557.11***
	(36.38)	(24.55)
A3	-589.72***	-558.75***
	(50.71)	(25.81)
Baa1	-569.06***	-537.02***
	(43.32)	(26.17)
Baa2	-553.21***	-508.04***
	(56.70)	(28.79)
Baa3	-534.78***	-488.50***
	(54.04)	(37.08)
Ba1	-441.58***	-405.75***
	(38.20)	(16.81)
Ba2	-400.22***	-338.72***
	(48.34)	(29.94)
Ba3	-255.61***	-302.61***
	(55.97)	(19.34)
B1	-203.78***	-162.57***
	(37.09)	(31.82)
B2	-103.98	-47.85***
	(59.96)	(11.09)
B3	-243.71***	-121.63***
	(42.35)	(31.50)
Caa1	-210.51*	-38.30
	(93.48)	(37.99)
Caa2	-21.35	-118.65
	(51.84)	(99.17)
Maturity	4.29***	3.09***
	(0.33)	(0.53)
Financial Crisis	261.50***	219.84***
	(33.95)	(17.43)
Sovereign Debt Crisis	146.89***	20.70
	(11.68)	(20.71)
Shape of the Swap Curve	-3.82	4.14
	(6.91)	(3.37)
Country Risk	-4.13	-12.15*
	(2.48)	(5.81)
CBPP1	-158.79***	-122.60***
	(23.44)	(31.06)
CBPP2	172.57***	62.39***
	(17.76)	(15.87)
CBPP3	-93.36**	-8.67
	(23.73)	(10.49)
Constant	657.30***	683.87***
	(59.93)	(79.50)
Industry fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
Adjusted R^2	0.64	0.54
Number of observations	551	2093

This table presents the results of an OLS regression analysis of the determinants of corporate bond credit spreads for: (i) a sub-sample of 551 corporate bonds issued by a firm from "GIIPS" and (2) a sub-sample of 2093 corporate bonds from "non-GIIPS" firms. For a definition of the variables, see Table 6. ***, ** and * indicate that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The standard errors are reported in parenthesis. Due to cross-country differences, I estimate standard errors clustered by country.

2.4 Robustness checks

In order to test the robustness of my results, an endogenous switching regression model will be used similar to Marques et al. (2020) and Correia et al. (2020). This will allow me to answer Question 1 and Question 2 more accurately.

Firstly, I utilized the two-stage least squares method with the same variables as in the previous Eq. (1), and due to cross-country differences, the standard errors were clustered by country. My instrumental variables were $Log(Transaction\ Size)_i$, logarithm of the bond transaction size, and $Tranche\ Size_i$, the amount of the tranche in euros, and my endogenous variable was $Maturity_i$, maturity of a bond represented in years. The instrumental variables explained maturity at a 1% significance level. The results are presented in table 9.

The impact of all variables on the credit spread of corporate bonds were similar to my Eq. (1), besides maturity.

The results further confirm that, in regard to Question 1, the CBPP1 and CBPP3 achieved their objective of reducing the cost of financing in the eurozone, by reducing the spread of corporate bonds, however CBPP2 did not obtain the same result having increased this spread, in line with the findings of Branco et al. (2020).

For my Question 2, I also used the two-stage least squares method with the same variables as in the previous equation, and due to cross-country differences, the standard errors were clustered by country. Again, my endogenous variable was $Maturity_i$ and my instrumental variables were $Log(Transaction\ Size)_i$ and $Tranche\ Size_i$. The results of my regression are presented in table 10.

Table 9 – Endogenous switching regression model

Credit Spread	Corporate Bonds
Aaa	-584.96***
	(40.86)
Aa1	-577.06***
	(45.81)
Aa2	-555.17***
	(58.12)
Aa3	-558.26***
	(42.47)
A1	-555.49***
	(40.95)
A2	-542.81***
	(44.79)
A3	-526.30***
	(44.75)
Baa1	-509.92***
	(42.30)
Baa2	-581.48***
	(51.22)
Baa3	-465.76***
	(39.47)
Ba1	-390.03***
	(40.00)
Ba2	-328.16***
	(37.75)
Ba3	-274.98***
	(43.25)
B1	-148.04***
	(23.30)
B2	-34.79
	(43.45)
B3	-133.97***
	(34.56)
Caa1	-64.81
	(69.52)
Caa2	-30.39
	(62.07)
Maturity = Log (Transaction Size)	-2.28
Tranche Size	(2.56)
Financial Crisis	211.06***
	(16.61)
Sovereign Debt Crisis	35.76**
	(17.50)
Shape of the Swap Curve	5.40*
	(3.10)
Country risk	2.99*
	(1.79)
CBPP1	-125.78***
	(26.98)
CBPP2	79.66***
	(18.55)
CBPP3	-31.01**
	(15.78)
Constant	691.82***
	(43.42)
Industry fixed effects	Yes
Country fixed effects	Yes
Wald chi2	8324.33***
Number of observations	2644

This table presents the results of estimating endogenous switching regression models on a sample of 2644 corporate bonds of which 2030 are investment grade and 614 are non-investment grade according to Moody's (Figure 1). I implement a two-stage least square (2sls) method for a more robust regression. For a definition of the variables, see Table 6. ***, ** and * indicate that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The standard errors are reported in parenthesis. Due to cross-country differences, I estimate standard errors clustered by country.

The results of this equation are consistent with my previous results, except for the impact of the maturity in corporate bonds from GIIPS.

Table 10 confirms that the effect of these programs was consistent across countries, as the bond spread had the same direction both in the GIIPS as in the rest of the eurozone countries and that, in the three programs, there was a more pronounced impact on the GIIPS, suggesting that these covered bond purchase programs have more relevance on the financing cost of companies in countries with higher credit risk, consistent with the findings of Szczerbowicz (2015), Gibson et al. (2016), Markmann et al. (2017) and Markmann (2018).

Table 10 – Endogenous switching regression models for GIIPS and non-GIIPS

Credit Spread	GIIPS	Non-GIIPS
Aaa	-586.65***	-601.91***
	(66.11)	(18.71)
Aa1	-537.57***	-599.68***
	(54.49)	(15.42)
Aa2	-656.21***	-568.80***
	(31.87)	(40.22)
Aa3	-605.79***	-572.57***
	(33.11)	(12.42)
A1	-538.31***	-569.82***
	(40.71)	(19.12)
A2	-568.06***	-549.69***
	(40.83)	(16.19)
A3	-525.47***	-547.20***
	(52.75)	(10.45)
Baa1	-557.21***	-527.50***
	(30.67)	(16.12)
Baa2	-478.25***	-501.64***
	(64.36)	(21.13)
Baa3	-495.29***	-480.44***
	(25.90)	(27.87)
Ba1	-408.20***	-400.31***
	(11.44)	(11.19)
Ba2	-380.93***	-334.53***
	(34.18)	(24.14)
Ba3	-226.76***	-296.99***
	(43.24)	(15.18)
B1	-165.49***	-158.29***
	(36.72)	(24.02)
B2	-68.66	-44.40***
	(48.60)	(6.32)
B3	-218.28***	-116.76***
	(35.41)	(24.50)
Caa1	-184.70***	-33.85
	(68.55)	(39.90)
Caa2	-24.81	-116.53
	(35.81)	(88.97)
Maturity = Log (Transaction Size)	-6.10	1.44
Tranche Size	(4.86)	(1.84)
Financial Crisis	213.09***	215.34***
	(42.91)	(16.06)
Sovereign Debt Crisis	119.87***	21.04
	(14.79)	(19.45)
Shape of the Swap Curve	-5.71	4.64
	(10.08)	(2.99)
Country Risk	-1.53	-12.24**
	(2.49)	(5.29)
CBPP1	-133.86***	-121.08***
	(31.75)	(28.87)
CBPP2	138.87***	61.92***
	(31.30)	(14.98)
CBPP3	-73.79*	-8.28*
	(43.14)	(10.45)
Constant	757.62***	673.46***
	(61.86)	(88.12)
Industry fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
Adjusted R^2	107.52***	1009.61***
Number of observations	551	2093

This table presents the results of estimating endogenous switching regression models on two sub-samples: (1) 551 corporate bonds issued in "GIIPS" and (2) 2093 corporate bonds issued in "non-GIIPS". I implement a two-stage least square (2sls) method for a more robust regression. For a definition of the variables, see Table 6. ***, ** and * indicate that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The standard errors are reported in parenthesis. Due to cross-country differences, I estimate standard errors clustered by country.

Conclusion

The 2008 global financial crisis and the consequent European Sovereign debt crisis led to a lack of confidence between banks, which, in turn, led to a concern about banks' liquidity risk. To minimize the effects of the crisis, the European Central Bank began a quantitative easing program. The three covered bond purchase programs were crucial parts of the eurozone rebuilding strategy, as the main objectives were to promote liquidity, encourage credit institutions to maintain and expand their lending to clients and lowering the cost of borrowing of states, banks and corporates.

The goal of this paper is to test the effect of all three covered bond purchase programs on the cost of borrowing of firms from the eurozone. I assess this goal by employing an OLS regression, measuring the spread to the benchmark of corporate bonds in the eurozone closed in the 2000-2019. I also investigate, how the impact of these programs differs from firms from low credit rating countries and firms from high credit rating countries. I analyzed this by testing, with an OLS regression, the effects that all three programs had on the firms from Greece, Italy, Ireland, Portugal and Spain (GIIPS) and compared them to the firms from the rest of the eurozone, similar tests were done by Szczerbowicz (2015), Gibson et al. (2015) and Branco et al. (2020).

For the CBPP1, my results are consistent with those of Beirne et al. (2011), Szczerbowicz (2015), Markmann (2018) and Correia et al. (2020), who find a narrowing of covered bond spreads due to this program, my results suggest that there is also a narrowing of corporate bond spreads.

For the CBPP2, in line with Markmann (2018) and Correia et al. (2020) but contrary to Szczerbowicz (2015) and Gibson et al. (2015), as the former found that the spread for covered bonds widened while the latter two found that the spread

of covered bonds lowered with this second program, my test indicates that the CBPP2 did not accomplish its goals and did increase the spread of firms from the eurozone. This can potentially be explained by the fact that the CBPP2 was announced at the same time as other monetary policy measures which may have reduced interest for banks to pursue this option (Branco et al. 2020).

For the CBPP3, my results are in parallel with the findings of Branco et al. (2020) that find a negative impact of the CBPP3/ABSPP on covered bond spreads, but contrary to Markmann (2018) whose results suggest an increase in covered bond spreads. My test also suggests a narrowing of corporate bond spreads. The mixed results may be because, from a bank funding perspective, the spreads before the CBPP3 were mostly trading as tightly as in pre-crisis levels (Markmann 2018).

My research also contributes to former studies, as it investigates the impact of these programs on low credit rating countries. My findings indicate that the direction on the spread of corporate bonds is consistent, throughout all three covered bond purchase programs, between GIIPS and the rest of the eurozone. Also, I find that the impact of these programs was bigger in the GIIPS, in line with Szczerbowicz (2015), Gibson et al. (2016), Markmann et al. (2017) and Markmann (2018).

My thesis complements the study of quantitative easing, there is a growing body of literature focused on the impact of these measures on financial firms, however, little research has been done on this same topic regarding nonfinancial firms. My research is now more relevant than ever as we now live in a global pandemic. Nonfinancial firms have been forced to follow strict rules that limit both supply and demand. Several firms have been closed for months and will need financial support to stimulate the economy and even to avoid high unemployment rates, one of the main objectives of the European Central Bank. The topic of unconventional monetary policies after hitting the lower bound of

interest rates is fundamental at this moment, interest rates are already low in the eurozone, and therefore, as several experts expect a recession, due to the COVID-19 pandemic, policymakers must be informed on how to promote economic growth after interest rates reaching their lower bound of 0.

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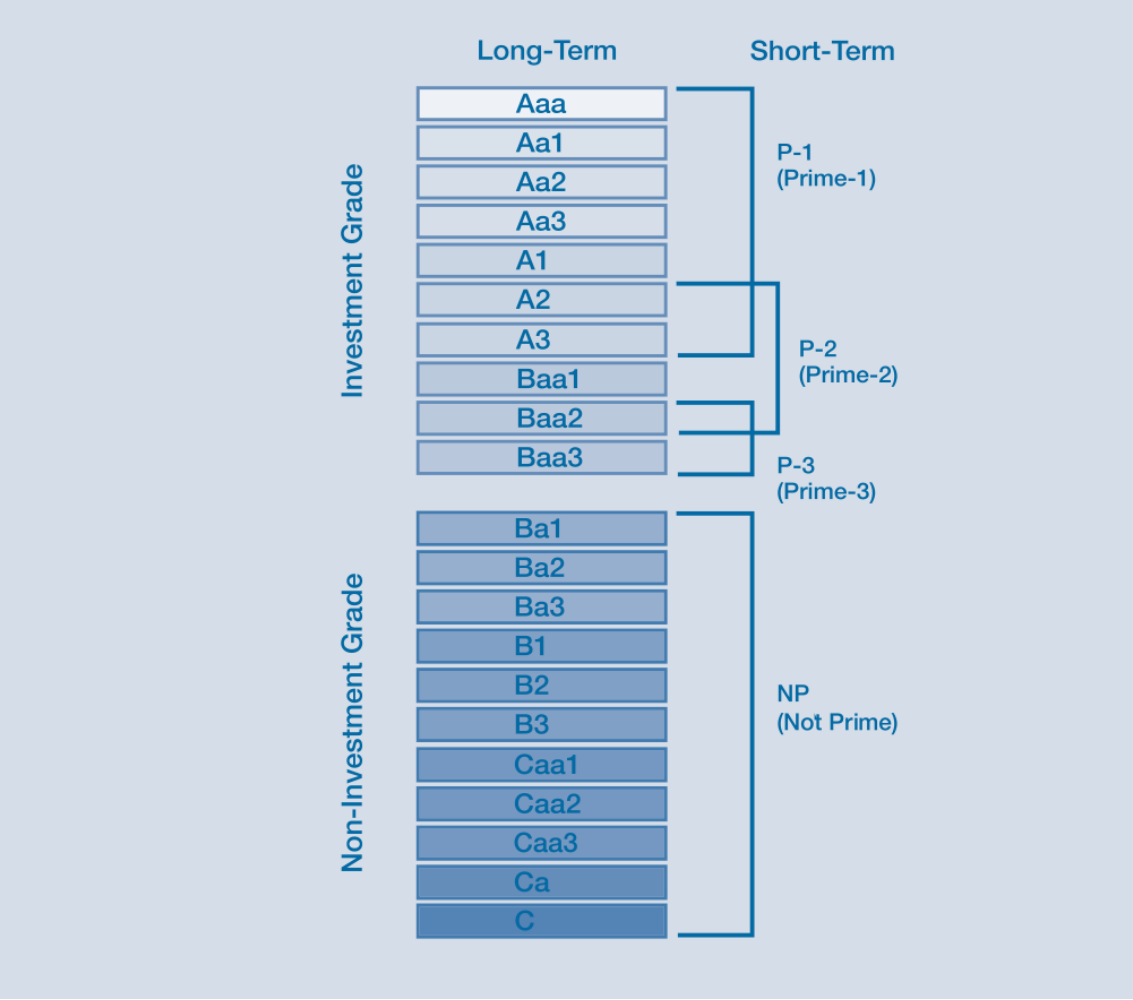
Attachments

Appendix I – Moody's Credit Rating Scales

Figure 1 – Moody's Credit Rating Scales



Source: www.moodys.com