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Leveraging the Pandemic:

A Study investigating the influence of the Riksbank's Corporate Bond Purchase Program on the debt financing of Swedish commercial real estate firms

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Abstract: This thesis investigates the impact of the Riksbank's Corporate Bond Purchase Program (CBPP), announced during the COVID-19 pandemic, on the financing dynamics of Swedish commercial real estate (CRE) firms. The CBPP expanded the Riksbank's bond purchases to include corporate bonds, leading to significant purchases of CRE bonds due to their heavy representation on the corporate bond market. Using a difference-in-difference approach, this study examines the CBPP's effects at the capital market, firm, and bank levels. The findings indicate that the CBPP announcement reduced the yield spreads of eligible bonds compared to non-eligible ones, aligning with the signaling channel theory of how monetary policy impacts the economy. This effect was present across both CRE and non-real estate bonds, though it was smaller in size for CRE bonds. At the firm level, no significant changes in the capital structure of eligible CRE firms were observed, while non-real estate firms showed a significant increase in their bond debt-to-asset ratio, suggesting a rise in bond financing post-CBPP. The results indicate that the CBPP did not spillover on the capital structure of eligible CRE firms, but it did achieve the desired effect on the broader capital market.

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1 Introduction

On March 11, 2020, the World Health Organization declared that the COVID-19 outbreak had officially reached the level of a pandemic (WHO, 2020). That same day, the very first fatality from the novel virus was recorded in Sweden. The following two weeks, the Swedish Public Health Agency issued several new declarations, encouraging individuals over 70 to limit contact with others, and for employees to work from home if possible (The Publich Health Agency of Sweden, n.d.). Following the annoucments, the Swedish GPD fell dramatically and the expectation that the Riksbank would be able to meet its inflation target eroded. As a response, the Swedish central bank implemented a range of policy measures to prop up and assist the economy in the short term. One of the Riksbank's measures was an expansion of their program for purchasing bonds - previously limited to only government bonds, the program was now expanded to include mortgage, municipal, and commercially issued bonds (Andersson, Österholm, & Gustafsson, 2022).

The asset purchasing program that the Riksbank announced on March 19, 2020 was massive and included a commitment to acquire large quantities of corporate bonds issued by non-financial firms at or above a certain credit rating. One consequence of this program was that the Riksbank would come to purchase a large amount of bonds issued by commercial real estate (CRE) companies. Because CRE firms represent a large share of the non-financial Swedish firms active on the bond market, this outcome was inevitable. Other efforts by central banks (primarily the Bank of Japan, Federal Reserve and the European Central Bank) to boost the economy through large-scale asset purchases have been investigated in previous research (Andersson et al., 2022). However, there is limited research done focusing solely on the Swedish context, and surprisingly few studies investigating the impact of asset purchasing programs on the commercial real estate sector.

In this study, I address this gap in the research by analysing the impact of the Riksbank's Corporate Bond Purchase Program (CBPP) on the Swedish capital and credit markets, focusing on the impact on the commercial real estate sector. My study primarily addresses the notable shortage of studies exploring the impact of unconventional monetary policy on real estate firms, particularly during crises like the pandemic. This absence is significant given the industry's size and systemic implications highlighted in financial stability reports by the Riksbank and the Swedish Financial Supervisory Authority (Finansinspektionen, 2019; Riksbanken, 2022a). Louis Landeman, head of Credit Analysis at Danske Bank, has repeatedly emphasized this issue in recent years. According to Landeman, the Riksbank's substantial bond purchases from commercial real estate companies undeniably influence the sector's growth and risk exposure. The increasing reliance of Swedish real estate firms on bond markets, and the shift from traditional bank financing, raises concerns over market dependency and moral hazard due to expected continuous support from the Riksbank, even after the pandemic. Landeman has warned in media of the challenges of reducing support once initiated, possibly requiring future interventions during crises (SvD, 2024).

To investigate the impact of the CBPP on the debt financing of Swedish CRE firms, I utilize a difference-in-difference approach, inspired by the methodology applied by Grosse-Rueschkamp,

Steffen, and Streitz (2019) in their analysis of the European Central Bank's corporate sector purchase program (CSPP) in 2016. Their findings suggest that eligible firms of the CSPP tended to replace bank loans with bond debt, leading to relaxed lending constraints for some banks, particularly those with lower tier-1 ratios and a higher share of non-performing loans. This shift appears to have increased these banks' risk-taking in corporate credit. These observations align with De Santis and Zaghini (2021); Roberto A. De Santis and Cruz (2018), who also found that incentives within corporate bond purchase programs encouraged eligible firms to increase their bond financing, resulting in spillover effects that influenced the financing behavior of non-eligible firms. Additionally, studies by Arce, Mayordomo, and Gimeno (2021); Galema, Lugo, et al. (2017) noted an increase in bond issuance also by non-eligible firms following corporate quantitative easing (QE) announcements, implying substitution effects from loans to bonds even for non-eligible firms.

The European-focused research is extensive in the area of corporate bond programs and QE, providing valuable insights. My study aims to contribute to this literature by examining similar dynamics in the Swedish context - a smaller economy with its own central bank, that was one of the last central banks in the EU to implement unconventional monetary policy and in particular a corporate bond purchase program. I further attempt to contribute by distinguishing between real estate and non-real estate firms, looking at how highly leveraged firms, active in the bond market, might react differently to corporate bond purchase programs.

My results show a decline in the yield spreads of eligible bonds compared to non-eligible bonds following the CBPP announcement, in line with the theory of signaling as a channel for how monetary policy impacts markets. This effect is observed across both real estate and non-real estate bonds, though the reduction in yield spreads is smaller for eligible real estate bonds. The bid-ask spreads of non-real estate bonds also declined significantly, indicating that the CBPP impacted the market through the liquidity channel as well, while no such effect was found for real estate bonds. At the firm level, I do not find evidence of significant changes in eligible real estate firms' capital structures post announcement. For non-real estate firms, however, there was a slight increase in the bond debt-to-asset ratio, suggesting a rise in bond financing post-CBPP for eligible non-real estate firms. The results of the firm level analysis suggests that there are no spillover effects from the CBPP on the capital structure of eligible real estate firms, when compared to non-eligible real estate firms, while eligible non-real estate show a slight increase in bond financing compared to non-eligible firms.

To complement my analysis, I also analyze bank lending before and after the announcement. However, the results for this analysis should be viewed with caution, as there are many limitations to the dataset and analysis. However, the results indicate that there has been an effect on constrained bank's lending towards commercial real estate after the announcement, where banks constrained by their NPL ratios showed a slight decrease in their share of commercial real estate loans to total loans, compared to unconstrained banks.

1.1 Purpose and research questions

The purpose of my study is to investigate the effect of the Riksbank's CBPP on Swedish CRE firms' financing opportunities and debt structure. Given the Swedish CRE industry's substantial size and systemic implications for financial stability, this research seeks to address a research gap in understanding whether unconventional monetary policy like the CBPP impacts real estate firms differently, compared to other sectors. My study aims to fill this gap by providing at least partial insights into this question.

I analyze these effects at three different levels: the capital market, the firm level, and the bank level. In the first two analyses I use two datasets: one focused exclusively on real estate bonds and firms, and the other encompassing bonds and firms from other non-financial sectors. In the bank lending analysis, I look at loans to CRE firms, household loans, and corporate loans excluding real estate firms. This structure allows for a direct comparison between the financing dynamics of real estate and non-real estate firms.

First, at the capital market level, I examine the signalling channel and liquidity channel by looking at the impact of the announcement on bond yields and the bid-ask spread. Lower yields for eligible firms is expected to make bond financing a more attractive option for these companies.

In my second analysis I look at the firm level, investigating whether the composition in the capital structure of the firms has changed in response to the CBPP program. Specifically, whether the eligible firms have opted for increasing their bond financing over bank loans.

Lastly, I look at the effect on the banks themselves, evaluating if the CBPP has had an impact on the risk profile of bank lending to non-financial firms, and in particular, CRE firms. In the analysis on banks lending, I aim to explore how the CBPP might have influenced the liquidity channel of banks.

This summarizes into the following three research questions:

1. What is the effect on yield spreads and bid-ask spreads of eligible bonds, compared to non-eligible bonds, following the announcement of the CBPP, and does this differ between bonds issued by real estate and non-real estate firms?
2. What is the effect on the composition of the capital structure of eligible firms, compared to non-eligible firms, following the CBPP announcement, and does this differ between real estate and non-real estate firms?
3. Have banks changed their lending composition to non-financial firms following the CBPP announcement, and does this depend on the banks' lending constraints?

1.2 Delimitations

My study has several limitations that should be acknowledged for a comprehensive understanding of its scope and implications. In this section, I summarize the limitations shortly, however I

discuss them thoroughly in Chapter 7 and in Section 4.4 of Chapter 4.

One significant concern is the fact that the COVID-19 pandemic coincides with the implementation of the CBPP, which complicates the isolation of the policy's specific impact from that of the pandemic. This external shock likely amplified the observed effects on yield spreads, potentially leading to an overestimation of the CBPP's influence. Moreover, market volatility from the pandemic might have disproportionately impacted non-eligible bonds, complicating comparisons between eligible and non-eligible groups. Another concern is the non-random assignment of my treatment variable: credit ratings, raising endogeneity concerns in my treatment variable. I discuss this further in section 4.4.

Furthermore, the firm level analysis focus solely on data of public firms, due to limited data availability for private companies on a quarterly basis. This limits the generalizability of the results, as results on public firms cannot account for the broader Swedish corporate landscape. Addionally, my research design focuses on the effects on eligible bonds and firms compared to non-eligible. The absence of an in-depth analysis of the effects on non-eligible firms further limits the understanding of how the broader market reacted to the policy.

The small size of the Swedish market, compared to those in previous research, combined with dividing firms into real estate and non-real estate categories, reduced the sample size. The bank lending analysis was similarly constrained by the dominance of a few Swedish banks, and by the arbitrary classification of "constrained" versus "non-constrained" banks due to the small sample size, which may not fully capture lending constraints.

Overall, these limitations provide critical context for interpreting the study's findings and suggest potential avenues for further research. A more comprehensive understanding of the CBPP's effects would benefit from a larger sample size, inclusion of private firms, and a more nuanced examination of sectoral variations over time.

1.3 Structure of the paper

This paper is structured as follows: Chapter 2 introduces the relationship between CRE and financial stability, provides an overview of the Swedish CRE market, and analyzes financing trends over the past decade. It then reviews the literature on unconventional monetary policy, particularly quantitative easing and corporate bond purchase programs, and outlines the framework of the Riksbank's CBPP. Chapter 3 establishes the theoretical framework, exploring the transmission channels of unconventional monetary policy through relevant empirical research. Chapter 4 details the econometric model used, while Chapter 5 describes the study's data. Chapter 6 presents the empirical results, and Chapter 7 interprets these findings, discussing their limitations and future research directions. Finally, Chapter 8 concludes with a summary of the study's findings.

2 Literature review

The focus of this study is on the impacts of quantitative easing (QE) programs on the decision making within firms in the commercial real estate market. Specifically, the purpose is to analyze whether the Swedish Riksbank's CBPP program, initiated during the COVID-19 pandemic, had a different effect on the Swedish real estate sector compared to other industries. The purpose of this litterature review is threefold: first, to present an overview of the Swedish commercial real estate sector over the last 15 years. Second, to present the basic functioning of a QE program, and specifically the Riksbank's programs initiated before and during the pandemic. Lastly, to connect the two by explaining the potential role QE programs may have on furthering risk-taking of non-financial corporations, and in particular the CRE sector, laying out the main questions for to be addressed in this study.

2.1 Commercial real estate and financial stability

The CRE market forms a crucial part of the economic system of most economies, and plays an important role as it relates to financial stability. Because CRE is often a large sector of the economy, it represents a substantial share of the banks' lending to firms. Furthermore, the CRE sector is also inherently sensitive to broader economic fluctuations, making it cyclical. This dynamic has historically been a precursor to or an amplifier of financial crises, highlighted for instance by the Swedish financial crisis of the early 1990s. During the late 1980s, deregulation of credit markets, favourable tax and interest rate conditions, speculation and overvaluation contributed to a boom and a demand surge in the CRE market. However, a collapse in property values in conjunction with interest rate hikes and changes in tax policy in the early 1990s popped the bubble, resulting bankruptcies, in substantial bank credit losses and an overall deterioration of financial stability. Only through substantial government intervention and support for ailing companies was the financial sector able to keep functioning (Finansinspektionen, 2019).

On a global scale, the 2007-2008 financial crisis was triggered by a speculative real estate bubble characterized by widespread overvaluation and risky lending practices, especially in the United States. The bubble burst, triggering a chain reaction of mortgage defaults that precipitated a worldwide financial crisis and culminated in a severe global economic downturn (Finansinspektionen, 2019).

To ensure financial stability, it is essential to recognize the capacity of CRE market risks to impact the financial system and the real economy. The primary link between the CRE market and financial stability is the debt held by CRE firms. To finance themselves, CRE firms can lend from banks, issue bonds, or make us of other debt instruments. By lending money to CRE firms, lenders expose themselves to risks associated with the CRE market (Finansinspektionen, 2019).

2.1.1 The role of property values in CRE loans

One way to illustrate how the CRE market operates in cycle with the more general economic developments is by looking at property values. Loans issued to CRE firms by banks often have the actual property as well as shares in the company as collateral. Hence, lenders with exposure to CRE firms are not only exposed to the development of the property companies themselves,

but also to the development of the assets. The lender often sets the loan amount relative to the value of the property, measured as loan-to-value ratio (LTV)[1]. As property values and lending surge during upswings, a downturn in the market may quickly lead to elevated LTV ratios and a risk of increased losses given defeaults (LGD) (Finansinspektionen, 2019; Riksbanken, 2022b).

As the loan amount is often set relative to the value of the property, the factors in which the value is calculated will affect the risk exposure of the lender. One prevalent method to estimating the value of a property is the "income approach". This approach calculates the value by dividing the net operating income (NOI) by the capitalization rate (cap rate). The NOI is calculated by subtracting the gross income (such as rent, supplements, and fees) from the operating expenses (for example, maintenance, taxes, and insurance). Therefore, the CRE value is not only determined by the property's inherent quality but also on its tenants and in turn by downturns in sectors other than real estate. For instance, the health of the retail sector can influence the retail tenants within a commercial property, such as a shopping center. A downturn could lead to tenant's not being able to pay rent, vacancies or bankruptcies, thereby diminishing income and, by extension, the property's value. Thus, the cap rate is subject to various external factors that, while not immediately apparent, affect the property's value and, in turn, the lender's exposure to risk. In other words, if these decreases in value spread throughout the CRE sector and, subsequently, to the financial system via lenders like banks, the overall financial stability could be negatively impacted (Aranki & Cronbäck, 2023; Riksbanken, 2022b).

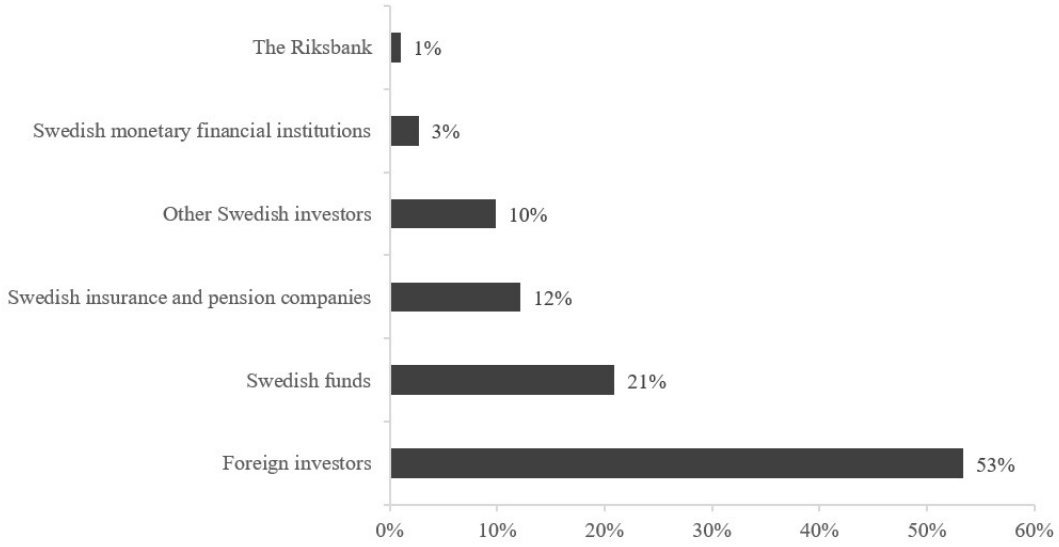
Another aspect related to LTVs and property value declines is the refinancing risk. Suppose a property's value declines such that the LTV ratio increases from an initial 50% to 80%. This increase does not imply that the loan amount has risen, but rather that the value of the property securing the loan has dropped. This shift imposes a refinancing risk when it is time for the borrower to repay the loan. Typically, when a real estate loan nears the end of its term, the property owner either pays off the loan by replacing it with a new one or by selling the property and repaying the loan. However, the probability of a new lender offering a loan under more favorable conditions than before is unlikely, especially if this involves a high LTV ratio of 80% for a property that has had a sharp reduction in value. This situation can create significant financial pressure on the borrower, particularly if the market conditions implies selling the property at a price that would not exceed the LTV ratio or leave the property owner with a loss. In such scenarios, borrowers may find themselves unable to secure refinancing or forced to accept terms that are less advantageous, such as higher interest rates or additional loan fees. These conditions not only increase the cost of borrowing but may also lead to financial distress if the borrower is not equipped to manage the higher payments (Aranki & Cronbäck, 2023; Riksbanken, 2022b).

[1]A lender calculates the LTV by dividing the amount of the loan by the lesser of the property's appraised value or its purchase price. A lower LTV is considered less risky for the lender, as the borrower have more equity in the property compared to a loan with higher LTV

2.1.2 Increased capital market funding increases interconnections to the financial system

Moreover, institutional investors' investments in CRE provide another pathway through which CRE can impact financial stability. In 2022, domestic investors owned 47% of bonds issued by real estate companies. Of these, Swedish funds held 21%, while the corresponding share for Swedish pension and insurance companies was 12%. Increased capital requirements on monetary financial institutions have increased the cost of holding corporate bonds, probably leading to their reduced exposure to real estate bonds over the years, with monetary financial institutions owning 3% of real estate bonds in 2022. In comparison, the Riksbank owned only 1% of real estate bonds in 2022 (Riksbanken, 2022a). However, to put this 1% in context of the CBPP, and as stated by the Riksbank's published transactions, at the program's volume peak on June 30, 2022, 53% of the corporate bonds on the Riksbank's balance sheet were real estate bonds. Hence, a significant portion of the central bank's bond purchase program targeted bonds issued by real estate firms.

Figure 1: Owners of Swedish commercial real estate corporate bonds, Q1 2022



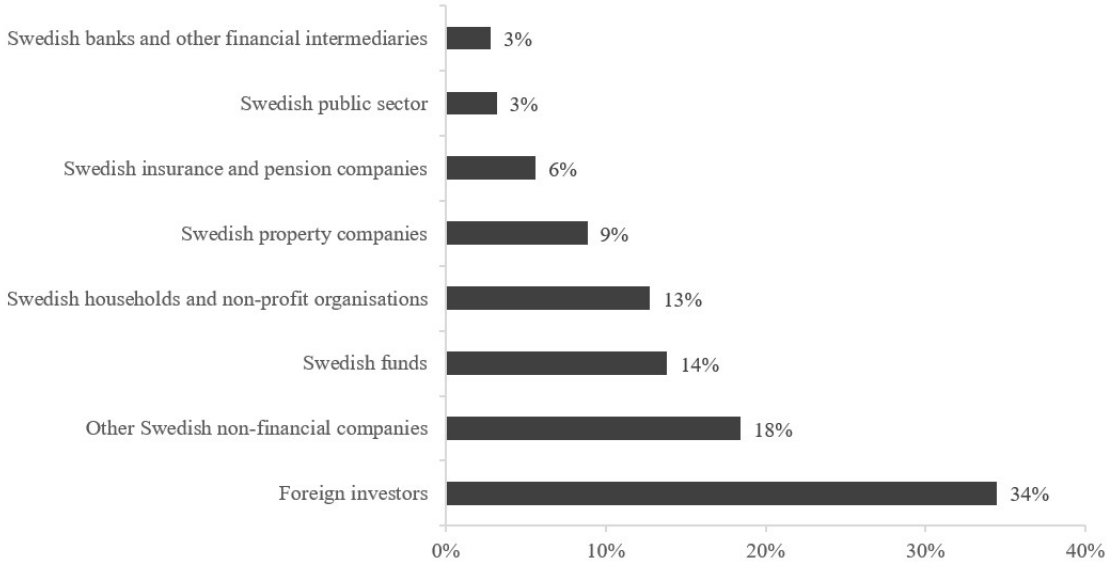
Source: Riksbanken (2022a)

The exposure of funds, insurance, and pension companies to real estate businesses means that they are exposed to issues arising within the property sector. For instance, widespread fire sales due to plummeting property values could significantly reduce bond prices, resulting in substantial losses for bondholders. If bond prices drop in sync with market prices, these investors may be compelled to downgrade their holdings or liquidate bonds to minimize further losses (Riksbanken, 2022a).

Interestingly, funds, pension funds, and insurance companies are also exposed to the real estate sector through their ownership of physical properties and shares in listed property firms. In 2021,

Swedish and foreign funds' total exposure to physical property was estimated to exceed SEK 200 billion, with insurance and pension companies holding almost SEK 650 billion in physical property value. Additionally, as highlighted in Figure 2, these investors collectively owned about 20% of the shares in listed property companies during the first half of 2022, valued at around SEK 450 billion. According to the Riksbank, they also hold shares in non-listed companies (Riksbanken, 2022a).

Figure 2: Shareholders in listed Swedish commercial real estate companies, Q1 2022



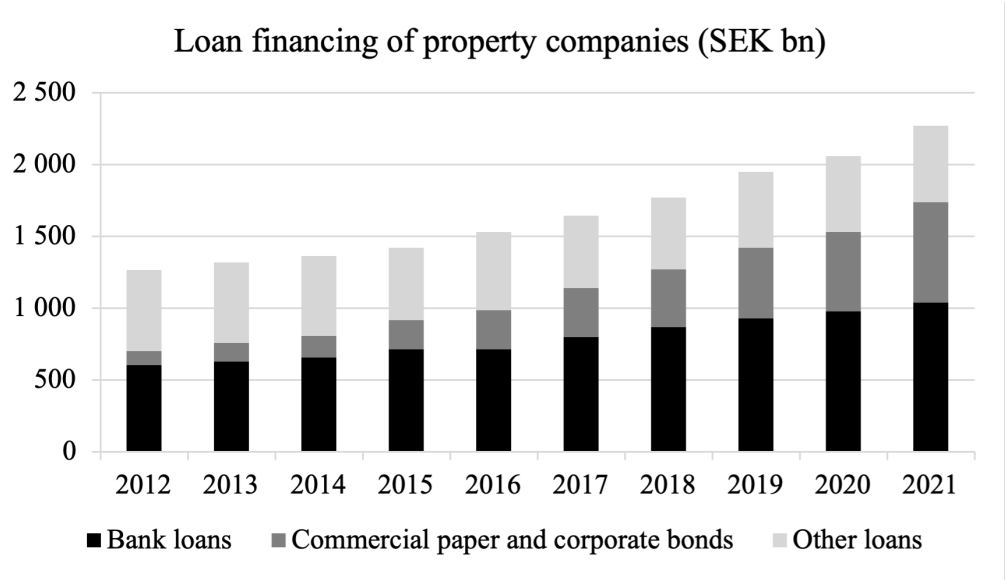
Source: Riksbanken (2022a)

Furthermore, indirect connections are not to be underestimated, with CRE and the construction sector comprising substantial portions of GDP in many EU countries, making negative developments in these sectors a notable threat to economic growth and overall financial resilience (Riksbanken, 2022a).

2.1.3 Commercial real estate and financial stability in Sweden 2012-2021

The Swedish CRE sector is large. Prior to the pandemic, Sweden experienced robust economic growth alongside persistently low and decreasing interest rates. This fostered favorable financing conditions for Swedish CRE firms. Between 2012 and 2021, the borrowing activities of these firms surged, increasing from SEK 1.3 billion to SEK 2.3 billion by the end of 2021, equivalent to 42 percent of Sweden's GDP in 2022. Despite this substantial increase in debt, the average loan-to-value (LTV) ratio remained relatively stable at around 50 percent over the same period. This stability of LTV can be attributed to the simultaneous increase of property values (Riksbanken, 2022a).

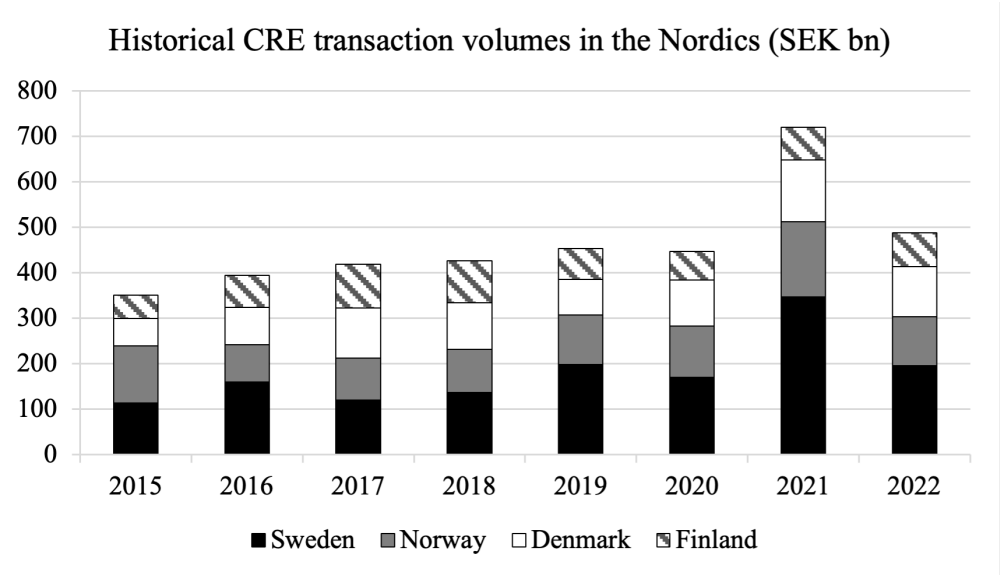
Figure 3: Loan financing of property companies



Source: Riksbanken (2022a)

The Swedish property market concluded 2021 with investors pouring an all-time high of approximately SEK 340 billion into CRE, marking a historic peak in transaction volume. Key drivers behind this surge included domestic players engaging in substantial portfolio deals and heightened consolidation within listed property companies. For example, the year saw significant entity-level transactions, with Corem Property Group taking control of Klövern, Castellum acquiring Kungsleden, and SBB's purchase of Offentliga Hus (MSCI, 2023).

Figure 4: Historical CRE transaction volumes in the Nordics



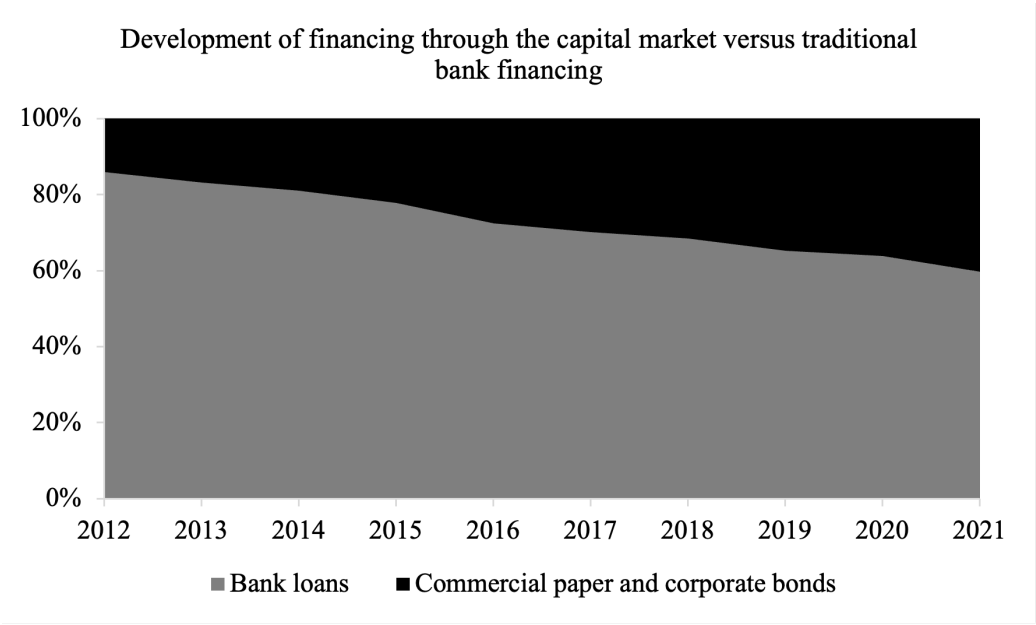
Source: Colliers Sweden

To finance the surge of the past decade, CRE firms have had to explore alternative options to

support the large volume of transactions. In the past, the large Swedish banks were the primary source of funding. But the 2008-2009 financial crisis caused both foreign and domestic investors to implement a more cautious lending polices, especially to the property sector. Meanwhile, the low-interest rate environment spurred greater demand for higher-yielding assets, including corporate bonds, among investors seeking to retain their fixed-income returns. In addition, the financial crisis prompted a gradual rise in capital requirements for banks, causing their lending rates to decline less than other interest rates. This made capital market financing more favorable. As a result leading Swedish CRE companies increasingly opted for capital market financing to support their business activities (Riksbanken, 2022a).

Prior to the financial crisis, listed property companies relied on capital market financing for less than one percent of their total loans. However, between 2012 and 2021, there was a substantial increase in this form of financing, accounting for 10 to 30 percent of property companies' loans, indicating a noteworthy shift in their financing strategies (Riksbanken, 2022a).

Figure 5: Development of financing through the capital market

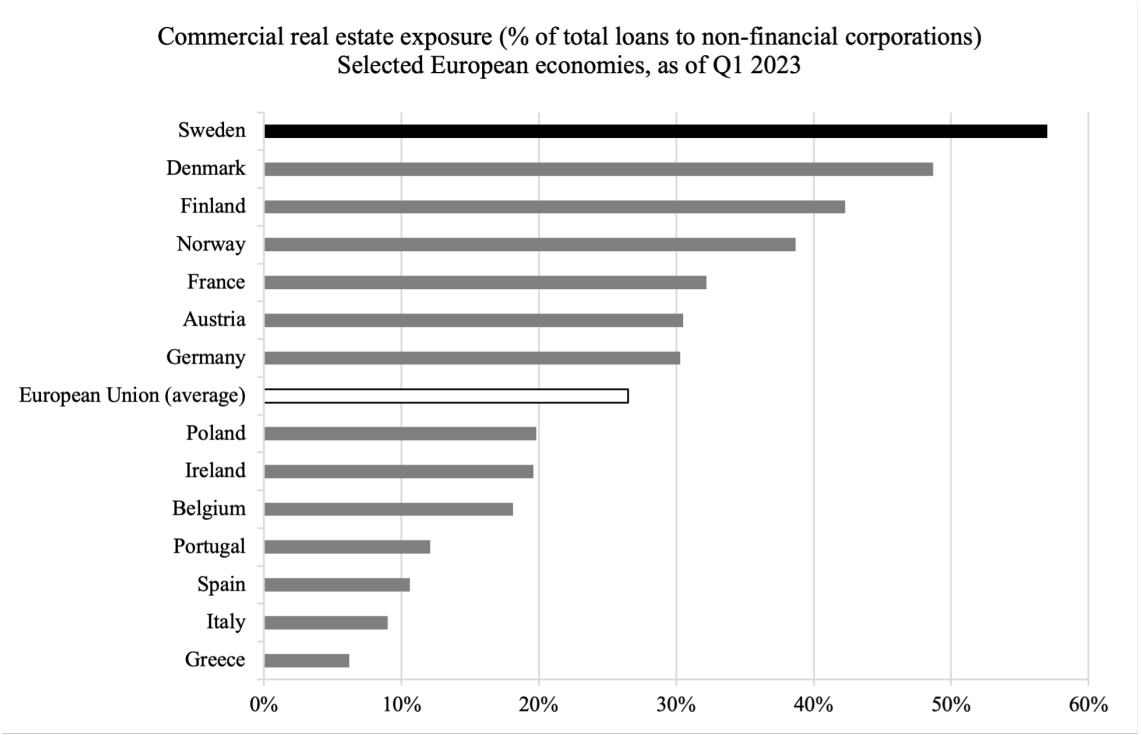


Source: Riksbanken (2022a)

2.1.4 The Swedish commercial real estate sector 2022-

By 2022, 42 percent of lending on the capital market went to property companies. Despite a great increase in the usage of capital markets by CRE firms, Swedish banks' exposure to the property market grown as well: from 30 percent in 2012 to 44 percent in 2022. The average bank exposure to commercial property companies in the EU in 2022 was 25 percent. Depending on the scope of what is considered lending to CRE firms (for example, whether one includes bank's off-balance sheet exposures to major property companies), the exposure is even higher (Riksbanken, 2022a). As of Q1 2023, Eurostat reported that Swedish bank's CRE exposure, measured as percentage of total loans to non-financial corporations, was close to 60% (Figure 6).

Figure 6: Commercial Real Estate Exposure

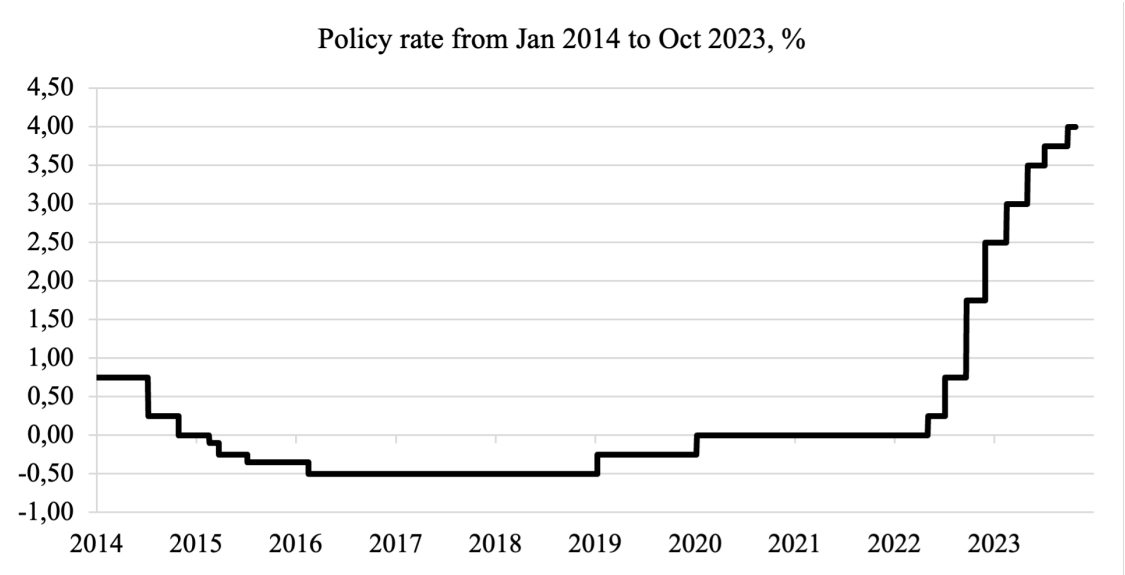


Source: Eurostat, European Banking Authority data

Many actors, including the European Systematic Risk Board, have drawn attention to the fact that the large loans to CRE firms are increasing the risk for financial turmoil in Sweden as economic conditions worsen (Finansinspektionen, 2019). In a downturn, market participants may reduce the holdings of bonds issued by CRE firms. As the demand for CRE firm issued bonds decline, these companies may turn to the banks for additional financing. In fact, this happened at the start of the pandemic and again in early 2022 (Riksbanken, 2022a).

In 2022, the global financial outlook darkened drastically, spelling trouble for Swedish CRE firms. As Russia invaded Ukraine in February 2022, prices of energy and food soared worldwide and inflation rose throughout the world. As a response, central banks around the world started increasing interest rates. The Riksbank raised the policy rate from 0.0 in May of 2022 to 4.0 in September 2023. Increased interest rates also caused a decline in bond prices. CRE firms, facing increased interest rates and constrained financing opportunities on the capital market, started taking measures to reduce the debt burden. SBB initiated a strategic review that could lead to an eventual sale. Corem sold a 25 percent stake in Klövern and divested multiple property portfolios.

Figure 7: The Riksbank Policy Rate



Source: Riksbanken

2.2 A brief history of quantitative easing

The primary pursuit of monetary policy within a modern economic framework is to attain and preserve low, stable inflation. This objective forms a cornerstone of macroeconomic stability, and its achievement necessitates the adept utilization of various monetary instruments by central banks. In line with several other central banks, the Swedish central bank, the Riksbank, aims for inflation to be around 2 per cent. Before the great financial crisis in 2007-2008 (henceforth referred to as the GFC), the preeminent monetary policy tool used by the central banks had been the regulation of short-term interest rates.

The main monetary policies before the GFC were limited to inflation targeting, without any focus on financial stability. Consequently, when the asset market bubble burst, central banks found themselves in a situation where interest rates could not be lowered anymore and the conventional monetary policies proved insufficient; they found themselves in the liquidity trap as introduced and theorized by Hicks (1937), and popularized by Krugman, Dominquez, and Rogoff (1998).

There are many forms of unconventional monetary policies, such as negative interest rates or adjusted inflation targets. The most common one however is known as quantitative easing (QE), which is defined by Blinder et al. (2010) as "*changes in the composition and/or size of a central bank's balance sheet that are designed to ease liquidity and/or credit conditions*". In more practical terms, when the literature refers to QE it means the central banks' purchases of securities on the open market. While the acquisition of assets on a minor scale has historically constituted a standard operational technique for central banks, the innovation of large-scale asset purchases marks a departure from conventional monetary policy. The purchases tend to reduce the yields on the bonds and thus are intended to pass through to lower interest rates for households and businesses, stimulating economic activity in a similar way as lowering the policy rate.

This non-traditional approach was initially implemented by the Bank of Japan (BoJ) in 2001 as a measure to combat persistent deflation. At that time in Japan, the policy rate had been lowered to near-zero levels, yet the deflationary pressures remained unmitigated. Although some central banks have been using QE since the early 2000s, they policies became household names after the GFC. For example, the central banks in the United States and the United Kingdom instituted asset-purchasing schemes in 2008-2009, during the GFC. The ECB later adopted this approach in 2014, with subsequent expansion in 2015. Notably, the Riksbank also embarked on asset purchases in the same year, integrating this strategy into its broader monetary policy framework (Andersson et al., 2022).

2.2.1 Related literature on QE corporate bond purchase programs

Several models have been employed in the literature on corporate bond purchase programs. Abidi and Miquel-Flores (2018) utilized a regression discontinuity design to identify shifts in yield spreads across various credit ratings, finding that bond yield spreads decline by around 15 bps at the announcement, and that the impact is mostly noticeable in the sample of eligible bonds of the ECB's corporate sector purchase program (CSPP) that are perceived high yield from the viewpoint of market participants. Nozawa and Qiu (2021) conducted event studies to track changes in credit spreads at the security level on specific event dates in the first half of 2020, finding that the bond markets are segmented across credit ratings which led to different initial reactions across the rating scale, but spread across various sectors of corporate bonds over the longer event window. However, to my knowledge most studies examining the effects of these programs have utilized a difference-in-differences (DiD) approach to account for market shocks, differentiate reactions among groups like eligible versus non-eligible bonds, and investigate distinct treatment periods, such as the announcement or actual purchase date. For example, Boneva et al. (2022) utilizes a DiD method to investigate the 2016 UK corporate bond purchase scheme's effect on liquidity of bonds, finding that the purchases improved the liquidity of purchased bonds. Ertan, Kleymenova, and Tuijn (2020) study the spillover effects from the ECB CSPP on the supply of credit to small and medium enterprises by employing a DiD design. Other studies utilizing a DiD approach to study the effects of the ECB's CSPP on corporate bond markets are Todorov (2020), De Santis and Zaghini (2021), and Grosse-Rueschkamp et al. (2019).

The impact of QE and corporate bond purchase programs on the capital market has been studied from multiple angles. The large share of the research focuses on the Federal Reserve's QE programs. Krishnamurthy and Vissing-Jorgensen (2011) study QE impact on interest rates and find evidence of several key channels through which QE affects bond yields. Christensen and Gillan (2022) reported that the Fed's second QE round improved market liquidity of targeted assets through the liquidity channel, with an average liquidity premium of 10 bps for the duration of the program. Song and Zhu (2018) explored which bonds the Fed preferred for purchase, finding that the Fed harvested gains from undervalued bonds in the market.

Grosse-Rueschkamp et al. (2019), investigate the ECB CSPP in 2016. They find that while yield spread between eligible and non-eligible bonds showed no significant differences after the announcement of the CBPP. However, when dividing eligible bonds into two groups, AAA-rated

and BBB-rated, they found that BBB-rated bonds experienced a significant yield spread decline. In the UK context, M. Joyce, Tong, and Woods (2011), investigate the impact of the Bank of England's first QE program. They discover that investment-grade corporate yields declined by 70 bps, with credit spreads remaining stable. Furthermore, they saw a larger effect size on BBB-rated bonds, where a decline in 100 bps in yields was noted and a 75 bps decrease in yield spreads.

Studies on when the effect of the policy takes place, i.e. on the announcement or the implementation show different conclusions. Some studies like Grosse-Rueschkamp et al. (2019), focus on the announcement date, while Zaghini (2019) find that the larger effect is on the implementation date rather than the announcement. In contrast Arce et al. (2021) show that the excess yield spread to a bank loan of eligible firms drops significantly after the announcement, while the effect is insignificant at the start of implementation, i.e. at the actual purchase. Goodhart and Ashworth (2012) finds evidence of QE having a diminishing effect, showing that the second round of QE increased credit spread by 10-20 bps instead of decreasing spreads, and that if policy-makers fail to restore the bank lending channel, further rounds of QE could potentially have negative returns. Dell'Ariccia, Rabanal, and Sandri (2018) conduct a meta-analysis of three QE programs across the globe: Japan, the EU, and the UK, finding evidence of significant reductions in bond yields across all regions.

In searching for studies focused on the Swedish real estate sector, I found two master's theses investigating QE's impact. Hallsten and Valdenström (2020) analyzed whether QE influenced the stock prices of the Swedish real estate market, concluding that it had a significant effect on these prices. In their study on the Riksbank's CBPP during the pandemic, Hajimirza and Thamrongsak (2022) examined bond yield spreads and firm-level debt structures, noting that property companies represent a significant portion of their sample. They ran a couple of specifications on the real estate sector but found no significant results. However, their study did not isolate property companies in the bond market analysis nor explore potential spillover effects on banks, as their focus was on Swedish firms overall and not in real estate firms in particular.

In the broader literature on monetary policy and bank lending channels, research has shown that banks with varying leverage ratios and credit risks may respond differently to monetary policy shocks (Gambacorta & Mistrulli, 2004; Gomez, Landier, Sraer, & Thesmar, 2021; Kashyap & Stein, 1995, 2000). Jiménez, Ongena, Peydró, and Saurina (2014) and Ioannidou, Ongena, and Peydró (2015) found that interest rate reductions prompted poorly capitalized banks to engage in excessive risk-taking, while Dell'Ariccia, Laeven, and Suarez (2017) identified risk-shifting behavior among better-capitalized banks when interest rates decrease. My research aims to contribute to this field by analyzing whether these patterns hold in the Swedish context, which is unique due to its highly concentrated bank market.

2.3 The Riksbank's QE programmes

The Riksbank's quantitative easing measures between the early 2010s and 2021 can be divided into three periods: the early phase before 2015, the upscaling after the policy rate was reduced below zero in 2015, and the large-scale purchases of securities during the pandemic. In this

section, I will provide an overview of all three.

2.3.1 The Riksbank's first implementation of QE

Prior to 2015, Sveriges Riksbank's interaction with QE primarily revolved around the accumulation of a portfolio of government bonds in 2012. This strategic move was executed predominantly as a precautionary measure. At the time, the Swedish financial markets were well-functioning and the policy rate stood at 1.50 per cent. As such, unconventional monetary policy approaches were not deemed necessary by the Riksbank. However, a strategic foresight of potential future difficulties, necessitating the implementation of more unconventional measures, prompted the 2012 purchase of government bonds. The Riksbank states it was perceived not just as a valuable learning exercise in the operationalization of QE, but also as a proactive step towards future monetary policy contingencies (Andersson et al., 2022).

2.3.2 The Riksbank's purchases of government bonds 2015-2019

Since 2015, the Riksbank has implemented QE as one of its monetary policy tools. In early 2015, the Riksbank took a bold step by reducing the policy rate below zero per cent and initiating purchases of Swedish government bonds to implement a more expansionary monetary policy. This move was a response to the persistently low inflation, which had remained well below the target of 2 per cent for a long time. Consequently, long-term inflation expectations had also decreased, staying below the 2 per cent mark (Andersson et al., 2022).

The Riksbank identified specific factors that could prolong the period of below-target inflation and inflation expectations. One of these factors was the ECB's announcement of a significant government bond purchasing program, which was expected to strengthen the Swedish krona against the euro. This in turn could have further reduced import prices and hence increased the inflationary pressure in Sweden (Andersson et al., 2022).

During 2015-2017, the Riksbank adopted a cautious approach, demonstrating a low tolerance for risks that could prolong the period of below-target inflation. The Riksbank was concerned that an extended period of not reaching the target might further diminish inflation expectations. To address the situation, the Riksbank reduced the policy rate below zero and gradually adjusted the forecast for the policy rate further downward. It also expanded its holdings of government bonds. The overall objective of this expansionary monetary policy was to strengthen the economy in an uncertain economic environment and to ensure that inflation increased towards the targeted 2 per cent level. Over the period from 2015 to 2017, the Riksbank decided to purchase both nominal and real government bonds, investing a total of SEK 290 billion (Andersson et al., 2022).

2.3.3 The Riksbank's purchases of securities in 2020-2021 to support the economy during the pandemic

Historically the Riksbank had limited its QE program to purchasing government bonds, a decision aimed at mitigating possible financial risks. This framework profoundly transformed in reaction to the difficulties engendered by the COVID-19 pandemic. The Riksbank, recognizing the situation's urgency, implemented an asset-purchasing program amounting to SEK 300 billion to

last until the end of 2020, extending the range to potentially include municipal bonds, corporate bonds and mortgage bonds [2] (Andersson et al., 2022).

The catalyst for this substantial change in the securities procured by the Riksbank was the unrest that swept through the Swedish and global financial markets. A swift decline in investors' willingness to purchase riskier assets precipitated a shift towards safer investments. This resulted in a surge in risk premiums across various securities and credit instruments, with banks simultaneously confronting heightened obstacles in obtaining funding (Andersson et al., 2022).

The following liquidity shortage in the financial system imposed a substantial threat, with far-reaching implications for the banks' ability to maintain lending to households and businesses, thus jeopardizing the broader economic stability. In response to this threat, the Riksbank implemented its QE program to inject liquidity into the financial system in parallel to keep interest rates low (Andersson et al., 2022).

The QE program was expanded by SEK 200 billion on two separate instances, and the timeframe was extended to encompass acquisitions until the end of 2021. The amplified program allowed purchases of various instruments, including Swedish government and municipal bonds, mortgage bonds, treasury bills, and, significantly, corporate bonds and commercial paper. By the close of 2021, the aggregate nominal value of the Riksbank's securities holdings, due to purchases made between 2015 and 2021, exceeded SEK 900 billion (Andersson et al., 2022).

2.4 The Riksbank's Corporate Bond Purchase Program

2.4.1 The Program: scope, terms and constraints

On 19 March 2020, following its general quarterly monetary policy meeting on 16 March, the Riksbank announced its intention to purchase corporate bonds and commercial papers. This decision was aimed at supporting the credit supply for Swedish companies. Further details regarding the timing and budget for these purchases were subsequently disclosed by the Riksbank on 30 June 2020. According to the June 2020 decision, the Riksbank committed to exclusively acquiring corporate bonds issued by non-financial corporations with a credit rating equivalent to Baa3/BBB- or higher, denoting investment-grade status. In addition, these bonds were required to have a remaining time to maturity of up to five years and must be issued in Swedish Kronor (SEK) (Riksbanken, 2020a).

The credit rating requirements define the eligibility criteria primarily based on the security's credit rating. However, in cases where a security lacked an individual credit rating, the credit rating of the issuing company would be used as the basis for eligibility. Furthermore, these credit ratings had to be issued by Standard & Poor's, Moody's, Fitch Ratings, Nordic Credit Rating, or Scope Ratings. Importantly, if multiple rating agencies had evaluated the security or the company, none of their ratings could be below the lowest acceptable credit rating, meaning no less than Baa3/BBB-. Moreover, at the time of purchase, there should be no indications that any

[2] Mortgage bonds are also referred to as covered bonds by the Riksbank

of these ratings may deteriorate and fall below the minimum credit rating threshold (Riksbanken, 2020a).

Furthermore, the risk classification of the corporate bonds should be non-subordinated, ensuring a certain level of security, as non-subordinated debt ensures the highest ranking, i.e., above other loans or securities concerning claims on assets or earnings. Furthermore, the purchases were exclusively restricted to the secondary market and were to be conducted through the Riksbank's monetary policy counterparties (Riksbanken, 2020a).

To ensure a balanced and market-neutral approach, the decision imposed a limit, stating that the Riksbank should not, at the time of the purchase, possess more than 50 per cent of an individual issue's total outstanding volume of corporate bonds. This rule extended to individual bond issues as well, ensuring diversification and preventing any undue concentration of holdings. These limits were strategically implemented to help the Riksbank build a diversified portfolio of corporate bonds, thereby ensuring a broad and neutral influence on the market to achieve the desired monetary policy impact. These restrictions were aimed at managing the risks associated with bond purchases and safeguarding the integrity of Riksbank's balance sheet (Riksbanken, 2020a).

2.4.2 Credit Ratings: an overview

The Riksbank's main determination of eligibilty for the CBPP was based on credit ratings. A credit rating is a forward looking third-party assessment of an obligor's creditworthiness. Credit ratings are provided by Credit Rating Agencies (CRAs), which consider both confidential and publicly available information to evaluate an entity's capability to fulfill its financial obligations over both the short term and long term. This evaluation process can include the analysis of recovery rates and default probabilities (*S&P Global Ratings*, 2024).

In the context of evaluating a potential or current borrower, credit ratings can deliver valuable insights that aid in the decision-making process regarding the prerequisite measures, such as the security package. This could include the implementation of stricter covenants or the requirement of collateral (White, 2010). The significance of evaluating a borrower extends beyond determining a company's ability to secure funding, it also influences the cost of borrowing (Byström, 2007).

The credit rating industry is dominated by three major CRAs: Standard & Poor's (S&P), Moody's, and Fitch. Credit ratings often vary between these agencies due to methodological differences. Moody's distinguishes itself by employing a rating system focused on the analysis of recovery rates. In contrast, S&P and Fitch primarly focus on assessing the probability of default when issuing credit ratings. As highlighted by Hirk, Hornik, and Vana (2019), an issue with the different methodologies is the lack of transparency, adding complexity to understanding how different factors are weighted in CRA's different assessments.

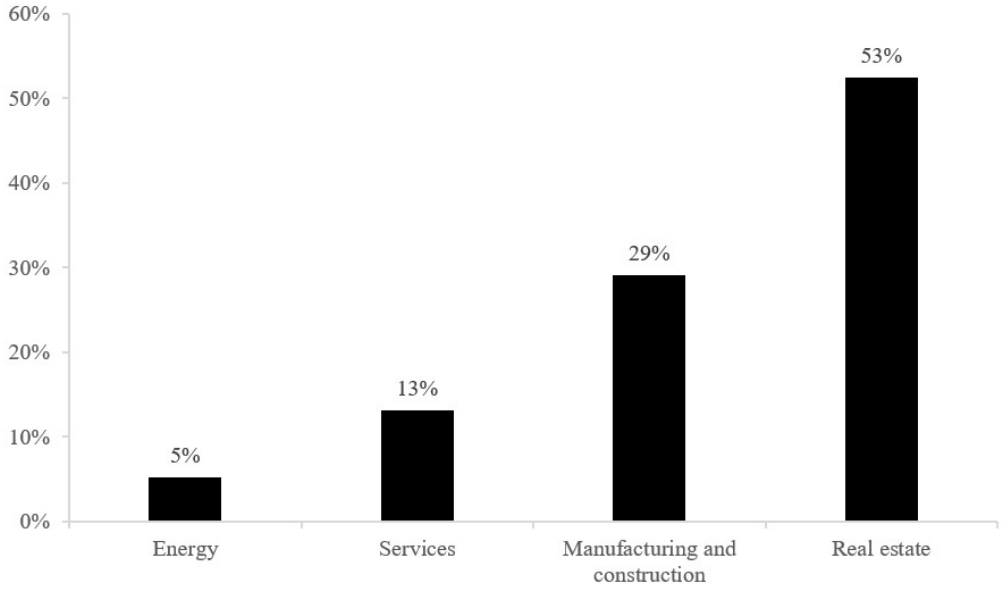
Credit ratings are typically strcuctured using an alphabetical scale. S&P's system, one of the most recognized, ranges from AAA (the highest) down to D (the lowest), with intermediate ratings such as AA, A, BBB, and BB. The ratings are further refined with pluses or minuses to indicate subtle variations (White, 2010; Zanin, 2022). For a side-by-side comparison of Moody's

and S&P's rating scales, see Table 21 in the Appendix.

2.5 The CBPP and commercial real estate

There are plenty of disagreements regarding the role of the Riksbank's QE program as it relates to risk-taking in the CRE sector. As presented above, in the wake of the pandemic, the Riksbank decided to increase the scope to include purchases of corporate bonds. And as discussed in section 2.2, around 40% of the corporate bond market is represented by CRE firms. The natural outcome then was that as the QE program expanded, the Riksbank in large part purchased bonds issued by Swedish CRE companies. At the peak of the CBPP, CRE bonds represented 53% of the holdings of corporate bonds on the Riksbank's balance sheet (see Figure 8). However, unlike many other sectors during the pandemic, the Swedish CRE sector experienced a boom in 2021. And by its purchases of corporate bonds, the Riksbank was one actor that particiated and contributed to further lending to CRE firms, enabling further expansion. Paradoxically, the Riksbank and the Financial Supervisory Authority had warned about the risks that excess exposure to the real estate market represented to the Swedish financial system (Finansinspektionen, 2019; Riksbanken, 2022a; SvD, 2024).

Figure 8: Sector division of the Riksbank's holdings of corporate bonds, at peak volume Q2 2022



Source: (Riksbanken, 2022a)

Given the non-functioning state of the corporate bond market at the time the CBPP was announced, and the unclear alternatives, action was imperative. Nevertheless, the Riksbank's decision to purchase corporate bonds remains notably unconventional. In this thesis, I will explore whether these actions might have contributed to increased risk-taking among CRE firms, while acknowledging that this question can only be partially addressed within the scope of a Master's thesis.

3 Theoretical framework

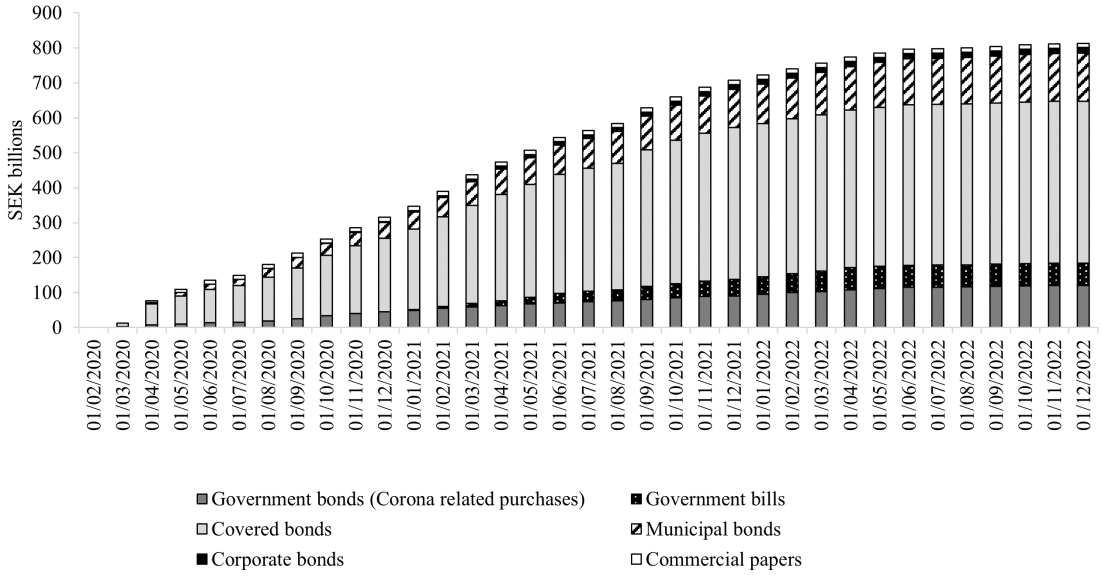
3.1 Transmission channels: how QE can affect the economy

As outlined in section 2.2, central banks employ various monetary policy instruments to regulate inflation, with the policy rate being the predominant tool. The process by which alterations made through these instruments will affect markets and the economy is typically denoted as the monetary policy transmission or the transmission mechanism. This mechanism encompasses multiple components and is frequently characterized through various channels. There is extensive literature discussing the transmission channels of the central bank's assets purchase program to the real economy through its effect on the interest rates (Bauer & Rudebusch, 2014; Christensen & Krogstrup, 2019; Daines, Joyce, & Tong, 2012; Dunne, Everett, Stuart, et al., 2015; Krishnamurthy, Nagel, & Vissing-Jorgensen, 2018; Krishnamurthy & Vissing-Jorgensen, 2011; Sack, 2011). However, there has yet to be a consensus on the categorization and definitions of transmission channels. The significance attributed to specific channels might differ based on geographic contexts, the prevailing economic conditions, and, most notably, disruptions within financial markets (Andersson et al., 2022). Given the objective of this thesis to analyze the QE programs instituted by the Riksbank, the channels defined in this section are those used by the Riksbank itself.

Furthermore, as the scope of central banks' QE programs, including the Riksbank, has broadened beyond government bond purchases, the channels in which QE operates may become more diverse, rendering their identification and analysis more challenging. In the following section, the research reviewed mainly explores the effect of traditional asset purchases by central banks, such as government bonds. As described in section 2.3.3, the Riksbank extended its asset purchasing program during the pandemic to include purchases of covered bonds, municipal bonds, commercial papers, and corporate bonds. However, when looking at the purchases overall, the new asset types work through many similar channels as government bonds. As defined by the Riksbank, the purchase of municipal bonds and covered bonds affects rates on the market through approximately the same mechanisms as government bonds (Jan, Erikson, Sandström, & Vestin, 2015). Hence, the literature on the transmission channels of government bonds will likely reflect the channels of municipal and covered bonds.

Regarding the Riksbank's purchases of commercial papers and corporate bonds, the purchases are focused on supporting the credit supply in the market. However, the purchase of commercial papers and corporate bonds only represents a small share of the total asset holdings of the Riksbank (see Figure 9) and a small share of the outstanding stock on their respective markets (see Figure 10). The intended effect of such asset purchases will be described separately and not through the same transmission channels as government bonds and their equivalents.

Figure 9: The Riksbank's purchases of securities during the Corona pandemic



Source: Riksbank data

3.1.1 Composition of Long-term Bond Rates

In discussing the mechanisms of Quantitative Easing (QE) and its effects on the market, it is important to grasp the formula used to calculate long-term bond rates.

$$\text{Long-term bond rates} = \text{Average short term bond rates} + \text{premium} \tag{1}$$

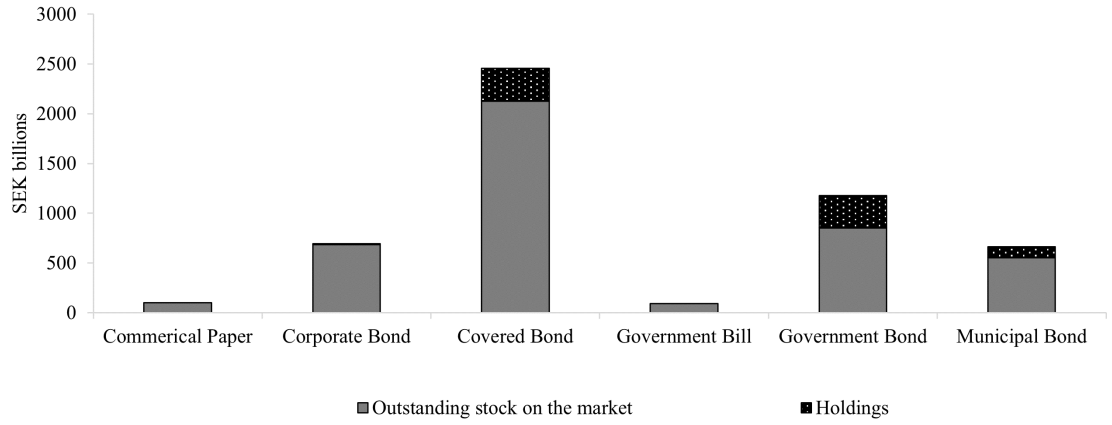
As depicted in Equation 1, the long-term bond rate comprises two components: the average of short-term bond rates and a premium. The rationale behind this formula is that an alternative investment strategy might involve continuously buying short-term bonds over a period equivalent to the maturity of a long-term bond. Short-term rates are closely tied to central bank policy decisions, so expectations about future monetary policy significantly influence long-term bond rates. (Jan et al., 2015).

However, if short and long-term bonds offered equal rates, investors would have little incentive to take on the additional risk associated with the longer maturity of long-term bonds. Such risks include the potential for unexpected future changes in bond prices due to shifts in central bank policy or the premium itself. Hence, the market demands a premium for holding longer-term investments to compensate for this risk. However, it is also possible for this premium to be negative. This might occur when a bond offers its holder benefits beyond simply the future payout of the bond—such as serving as collateral in financial transactions (Jan et al., 2015).

3.1.2 Signaling Channel

The signaling channel functions by influencing market expectations regarding future interest rates through the announcement of QE policies (Andersson et al., 2022). When a QE policy is publicly announced, markets interpret it as a firm commitment by the central bank to ease

Figure 10: The Riksbank´s holdings of securities compared to the outstanding stock on the market



Source: Riksbank data

monetary policy for an extended period. Consequently, yields begin to decline immediately upon the announcement rather than at the onset of the central bank's active bond purchasing (Bailey, Bridges, Harrison, Jones, & Mankodi, 2020; Bauer & Rudebusch, 2014; Christensen & Rudebusch, 2012).

The effect of the signaling channel extends to various types of bonds, leading to a reduction in yields across the board (Cawley & Finnegan, 2019; Dunne et al., 2015). However, the scale of this reduction varies, depending on the maturity of the bonds (Krishnamurthy & Vissing-Jorgensen, 2011). Complementing this view, Bauer and Rudebusch (2014) provide evidence that the public announcement of an asset purchase program contributes to yield reduction. They demonstrate that this effect is mediated by a decrease in the average expected risk-neutral rate component of long-term rates, further emphasizing the dynamics of the signaling channel in the context of QE implementation.

3.1.3 Premium Channel

One possible way to expand monetary policy through QE is by decreasing premiums. The underlying theory is that some participants in the market tend to stick to bonds with specific maturities. In contrast, other participants, known as "arbitragers," can invest freely across all maturities on the yield curve. When the central bank buys government bonds from market participants, the total volume of outstanding bonds decreases, increasing competition for the remaining bonds in the market. If a sufficient number of investors are hesitant to switch to other assets, the premium on government bonds will decline, causing the bond prices to increase and the bond rates to decline. Of course, the more significant the proportion of market participants that fit this description, the greater the impact on the premium and the more effective the purchases through the premium channel become (Andres, López-Salido, & Nelson, 2004; H. Chen,

Cúrdia, & Ferrero, 2012; De Graeve & Iversen, 2017; Harrison, 2012).

As delineated in section 3.1.1, long-term interest rates can be decomposed into two distinct components: a premium, which tends to decrease in response to government bond purchases, and the expected future repo rates. When government bond purchases are successful, they can lead to an increase in inflation expectations. This, in turn, creates an expectation of higher future repo rates. As a result, the long-term rates may decrease at a slower pace than the premium itself (Jan et al., 2015).

3.1.4 Portfolio Balance Channel

Assume the central bank can impact the premiums in the securities market, as explained in 3.1.3 regarding the premium channel. In that case, as described by the Jan et al. (2015), their bond purchases might have a contagion effect on other assets and even impact credit volumes through what is referred to as the portfolio balance channel.

The strength of this channel is determined by what the market participants who sell their government bonds to the Riksbank choose to do after the sale. The portfolio balance channel, as explained by Sack (2011), involves the central bank reducing the supply of assets it purchases. When the return on government bonds decreases, investors tend to rebalance their portfolios toward similar asset classes, such as government bonds with other maturities, covered bonds issued by banks, or corporate bonds (Jan et al., 2015). This can influence the relative price of assets when the market is segmented, and investors have a preferred habitat for assets with similar risk and return but are not perfect substitutes for each other, as shown by Vayanos and Vila (2009). Koijen, Koulischer, Nguyen, and Yogo (2021) argue that a reduction in the risk premium would lead investors to rebalance their portfolio toward other risky instruments, causing a drop in their risk premia. In other words, when investors purchase other assets, prices rise and interest rates fall, provided that the assets are not perfect substitutes. The impact of this channel on risk premia depends on the extent to which investors substitute assets across different segments and characteristics, such as maturity, as explained by Krishnamurthy and Vissing-Jorgensen (2011). The more investors actively reinvest their money, the greater the effect on other market rates. Ultimately, the rebalancing process increases asset prices and reduces market yields, leading to lower borrowing costs for firms and households, stimulating inflation and real activity (M. A. Joyce, Liu, & Tonks, 2017).

Studies conducted internationally have shown that bond purchases can have a significant effect on portfolio rebalancing. Two studies that the Jan et al. (2015) highlights are, firstly, a study carried out in the United States by Carpenter, Demiralp, Ihrig, and Klee (2015), which investigates how the central bank's acquisition of assets, specifically government bonds, affects investor behavior. The study found that the central bank's strategic purchase of government bonds has led to the private sector reducing their holdings of such bonds and shifting their investments towards corporate and municipal bonds.

3.1.5 Liquidity Channel

In addition to the effect of QE on interest rates, the process by which the central bank purchases bonds involves creating new electronic money. This directly results in expanding the volume of capital available in the market. Specifically, when a central bank implements QE, it increases its volume of central bank reserves. These reserves, through the mechanism of QE, increase the liquidity within the banking system. The increased liquidity, in turn, influences the pricing of liquid assets, such as money market accounts, cash equivalents, marketable securities, short-term bonds, and accounts receivable. As defined by J. Chen (2022), liquid assets are those that can be quickly and easily converted into cash. Notably, these liquid assets typically command a price premium due to the convenience of their rapid conversion into cash. As the overall system liquidity increases due to QE, investors' willingness to pay this premium for liquid assets diminishes. As demand for these assets decreases, their prices and yields rise. This is commonly referred to as the liquidity channel of QE (Krishnamurthy & Vissing-Jorgensen, 2011).

A further effect, encompassed within the liquidity channel, is the increased propensity of banks to extend loans to corporations and households due to the increased liquidity in the banking system. The nature of this effect is closely tied to the structure of a country's payment system. To illustrate this, in Sweden, the payment system is designed so that each bank maintains an account with the Riksbank, which is utilized to facilitate interbank payments. At the close of each day, banks with account deficits borrow from those with surpluses. Any residual surplus or deficit in the banking system can be deposited with the Riksbank overnight. The banks face constraints on how much money they can lend to another bank overnight, as these loans are unsecured. The Executive Board of the Riksbank determines the interest rate applied to this remaining surplus or deficit through its monetary policy decisions. Consequently, each bank operates a liquidity management system to avoid ending the day with a significant deficit. In this framework, increased access to capital through QE reduces the likelihood of banks incurring interest on a deficit, encouraging them to expand their lending activities (Jan et al., 2015).

3.1.6 Commercial Paper

Purchases of commercial paper can be in the form of bonds or certificates. Commercial paper with maturities longer than one year at the date of issue are known as bonds, and those with maturities shorter than one year are known as certificates. Historically, Swedish companies have relied heavily on bank loans to finance their operations. However, in recent years, an increasing number of businesses have been exploring commercial paper as an alternative means of funding (Riksbanken, 2020b).

During times of market turbulence, the central bank can step in and purchase commercial paper in the form of bonds and certificates, which can be an effective tool. In the Swedish market, which is comparatively small and underdeveloped, selling these types of instruments can be challenging, even when the market is stable. However, the knowledge that the Riksbank is active in the market can reduce the liquidity premium demanded by purchasers of the instruments, making them more attractive. As a result, the Riksbank's purchases of commercial paper on the secondary market can be seen as a way of keeping the cost of companies' market-based funding

low (Riksbanken, 2020b).

Overall, the Riksbank's involvement in the secondary market for commercial paper is intended to support the financial system's proper functioning, especially during economic uncertainty.

4 Methodology

The aim of this study is to investigate the impact of the Riksbank's CBPP on firms' capital debt structure, specifically looking at potential differences between real estate and non-real estate firms. The hypothesis is that, in line with the signaling channel of transmission, the announcement of the CBPP reduces bond yields for firms eligible for the purchasing program. I investigate the impact on firms' capital debt structure at three different levels of corporate financing. First, at the capital market level, by examining the signalling channel and liquidity channel by looking at the impact of the announcement on bond yields and the bid-ask spread. Lower yields for eligible firms is expected to make bond financing a more attractive option for these companies. Thus, in my second analysis I look at the firm level, investigating whether the composition in the capital structure of the firms has changed in response to the CBPP program. Specifically, whether the eligible firms have opted for increasing their bond financing over bank loans. Lastly, given that eligible firms may choose bonds over term loans, I look at the effect on the banks themselves, evaluating if the CBPP has had an impact on the risk profile of bank lending to non-financial firms. By examining the banks, I aim to explore how the CBPP might have influenced the liquidity channel of banks, increasing their capacity to lend by reducing the likelihood of incurring interest on a deficit, hence encouraging them to expand their lending activities.

Following Grosse-Rueschkamp et al. (2019), a difference-in-difference (DiD) model is employed to examine the effects of the CBPP on the corporate bond market, firms' capital structures, and bank lending. This model is widely used in social science research for causal inference in quasi-experimental settings (Angrist & Pischke, 2009; Cunningham, 2021; Roth & Sant'Anna, 2023). The DiD estimator leverages variation in treatment across time and space to create counterfactual outcomes for treated units post-treatment. In this section, I outline how I apply the DiD methodology for each of my three analyses, starting with the capital market analysis, then the firm level analysis, and finally the bank level analysis. Lastly, I discuss the underlying assumptions and potential concerns facing the DiD method in the context of my study.

4.1 Methodology of the capital market analysis

The purpose of the capital market analysis is to investigate the impact of the CBPP announcement on bond yield spreads, specifically looking at how the impact differs between bonds issued by Swedish CRE firms and those by other non-financial corporations. The aim is to ascertain whether the CBPP achieved its intended effects in the capital market and whether there are variations in these effects for CRE firms compared to other corporations.

Building upon theories that emphasize the influence of Large-Scale Asset Purchase programs (LSAPs) on asset prices (Greenwood, Hanson, & Stein, 2010; Grosse-Rueschkamp et al., 2019; Krishnamurthy, Vissing-Jorgensen, et al., 2013; Vayanos & Vila, 2009), the hypothesis is that the CBPP announcement leads to a decrease in yields for eligible corporate bonds when contrasted with non-eligible bonds. I extend this theory to analyze whether this effect is different between CRE bonds and bonds issued by other non-financial firms in the Swedish context. This analysis allows us to look closer on whether Swedish real estate companies may have been affected in a

distinct way by the CBPP.

As outlined in the introduction to this section, I use a DiD methodology to investigate my research question. Given the potential endogeneity of the Riksbank's bond purchase decisions, I utilize the eligibility for purchase before the program's announcement as an instrument. Specifically, I conduct an Intent-to-Treat (ITT) analysis where the bond purchases are instrumented using eligibility status prior to the program's announcement. This approach mirrors the one employed by Grosse-Rueschkamp et al. (2019) with respects to the ECB's CSPP.

The ITT effect measures the average impact of corporate bond purchases on the entire group of eligible bonds. Since the Riksbank does not necessarily purchase all eligible bonds under the CBPP, this effect is distinct from the Treatment-on-the-Treated (TOT) effect, which quantifies the average impact on eligible bonds that the Riksbank actually purchases.

It is essential to consider potential spillover effects on eligible bonds that are not purchased. These spillovers may occur due to shifts in investor demand leading to portfolio re-balancing and corresponding changes in the term premium. Consequently, the ITT effect emerges as the preferred measure for capturing the causal effect of the CBPP on yield spreads of bonds (Grosse-Rueschkamp et al., 2019; Koijen, Koulischer, Nguyen, Yogo, et al., 2016; Stein, 2012). However, it is to important to acknowledge that this identification strategy has limitations, as the actual treatment (eligibility) is not randomly assigned, raising concerns about the endogeneity of the eligibility variable. In section 4.4 I discuss potential endogeneity problems further.

As will be described in detail later, I have developed four distinct datasets for analysis: two datasets include the full range of bonds, one from bonds issued by CRE firms and another from other non-financial corporations. The other two datasets have been refined by excluding outliers defined by the 1st and 99th percentiles - one dataset for bonds issued by commercial real estate firms and another for those issued by other non-financial corporations.

I run the following DiD specifcation:

$$Y_{it} = \omega_t + \alpha_i + \alpha_{qs} + \beta(Post * T)_{it} + \lambda(Spread_{it-1}) + \epsilon_{it} \tag{2}$$

My outcome variable Y_{it}, represents the Mid-Yield-to-Maturity relative to a government bond yield with the same maturity for bond i on day t. I use a dummy variable called $Post$ which equals one during the post-treatment period, corresponding to the period after the CBPP announcement. Additionally, I employ a dummy variable T to identify the treatment group, taking the value one if the bond is eligible for the Riksbank's CBPP. The parameter β captures the impact of the treatment on the eligible bonds.

I also include ω as a control for time-fixed effects and α for bond-fixed effects, as well as one specification including industry $\times$ quarter fixed effects α_{qs}. To account for liquidity effects, I introduce $Spread_{it-1}$ as a control variable, representing the Bid-Ask spread averaged on a quarterly basis. To calculate the Bid-Ask spread, I subtract the Bid price from the Ask price

and divide the result by the Ask price. I incorporate a one-period lag in the Bid-Ask spread variable to address possible simultaneous effects between the yield spread and liquidity, following the approach of Boneva, De Roure, and Morley (2018). I then average the individual calculations of Bid-Ask spreads at issuance on a quarterly basis. Lastly, I cluster standard errors at the treatment level, i.e., bond level (Bertrand, Duflo, & Mullainathan, 2004).

In addition, I employ a supplementary analysis to investigate whether the policy announcement has an impact on the liquidity within the bond market. This analysis explores whether the impact varies between the corporate bond markets of commercial real estate companies and other non-financial corporations.

I run the following DiD specifcation:

$$Spread_{it-1} = \omega_t + \alpha_i + \alpha_{qs} + \beta(Post * T)_{it} + \epsilon_{it} \tag{3}$$

I utilize a basic DiD model, employing the Bid-Ask spread as a proxy for bond liquidity on the announcement date. As in previous analyses, I run separate regressions for the CRE subsample and the other non-financial company subsample. I include ω as a control for time-fixed effects and α for bond-fixed effects, as well as one specification with industry $\times$ quarter fixed effects α_{qs}. I use the dummy variable $Post$ and T in the same manner as in (2), where the parameter β captures the impact of the treatment on the eligible bonds. Lastly, I cluster standard errors at the treatment level, i.e., bond level.

4.2 Methodology of the firm level analysis

In this analysis, my objective is to evaluate the second part of the hypothesis, which suggests that the effect on the yield spread of corporate bonds will influence the debt structure of eligible firms, potentially leading to an increase in their bond financing. To gain a comprehensive understanding of the impact on eligible firms' capital structure, I will not only assess changes in bond financing but will also consider the entire capital structure of firms. To achieve this, my dependent variables will include various proxies for leverage, following the approach of Grosse-Rueschkamp et al. (2019).

The treatment group consists of firms stated on the Riksbank's list of eligible non-financial corporations, while the control group encompasses all other non-financial corporations not eligible for the CBPP. This identification strategy mirrors the one used in the previous analysis, but instead of looking at the companies' bond issues, this analysis focus on their debt structure. As will be detailed in Chapter 5, I obtain public firm-level data from S&P Capital IQ, excluding firms without publicly outstanding debt in Q4 2019 to ensure the inclusion of active bond market participants. Additionally, to account for systematic differences between control and treatment firms, I will integrate an extensive set of controls and fixed effects, aligning with the methodology employed by Grosse-Rueschkamp et al. (2019).

The DiD specification is as follows:

$$Leverage_{it} = \alpha_i + \alpha_{qs} + \beta(Post * T)_{it} + \lambda Z_{it} + \epsilon_{it} \quad (4)$$

Leverage serves as the dependent variable, and it is represented using different proxies, including Bond Debt to Assets, Term Loans to Assets, Revolving Credit to Assets, and Bank Debt to Bond Debt. For a comprehensive list of these variables and their definitions, see Appendix Table 22.

The *Post* variable is a dummy that equals one during the period following the CBPP announcement, from Q2 2020 to Q1 2021, and zero otherwise. T is a dummy variable that equals one if the firm is part of the treatment sample and zero otherwise. Z_{it-1} represents a set of firm characteristics that influence a firm's demand for debt. These characteristics, following Grosse-Rueschkamp et al. (2019), include firm size (measured as the natural logarithm of total assets), firm profitability (measured as EBITDA over total assets), tangible assets of the firm, and the market-to-book ratio (Faulkender & Petersen, 2005; Grosse-Rueschkamp et al., 2019; Sufi, 2007). All control variables are included in the regression with a one-quarter lag.

Additionally, I incorporate firm fixed effects α_i, and industry $\times$ quarter fixed effects α_{qs}. These fixed effects account for shocks within industry groups that may influence a firm's choice of bond debt. The variable β represents the effect of the CBPP on a firm's debt capital structure. Standard errors are clustered at the firm level, following Bertrand et al. (2004).

Similar to the previous analysis, I run two distinct specifications for each proxy of leverage: one for the dataset comprising CRE firms and another for other non-financial corporations. It is important to note that the general differences-in-differences (DiD) specification in equation (4) remains consistent across both specifications, with the only difference being the sample of firms.

4.3 Methodology of bank lending analysis

The final part of my analysis consist of investigating if and how bank lending is impacted by the Riksbank's purchases of corporate bonds. As discussed in section 3.1, one possible way in which QE programs impact the real economy is through the liquidity channel, by increasing the amount of lending a bank provides. This relates to the literature on monetary policy and bank lending, in which banks with varying leverages and risk exposures act differently in response to changes in monetary policy (see for instance Kashyap and Stein (1995)). Grosse-Rueschkamp et al. (2019) show that in the European context, the ECB's CSPP resulted in banks with the highest credit constraints (such as a high rate of non-performing loans) increasing their lending to private firms and thereby increasing the banking sectors risk-exposure to corporate credit. The question I seek to answer in this section is if there is a similar pattern for Swedish banks in response to the Riksbank's CBPP program, specifically whether the rate of lending to commercial real estate is impacted, and if that impact differs depending on the banks' credit constraints.

To answer this question I will combine the methodologies used by Grosse-Rueschkamp et al. (2019) and Dhital, Dixon, and Evanczyk (2023) who both investigate the relation between QE programs and banks' risk-taking, but using two different approaches. Following the approach in

Dhital et al. (2023), I will use the banks loan portfolio as dependent variables in my analysis. For instance, investigating how the share of CRE loans to total loans have changed over the studied period.

I will divide the banks in my sample in line with the approach in Grosse-Rueschkamp et al. (2019) by the banks' tier 1 ratio, and by the share of non-performing loans of total loans. The purpose of these divisions is to investigate whether the banks credit constraints is influencing how they are impacted in terms of their lending to different sectors. I will also control for a range of bank fixed effects, in line with Grosse-Rueschkamp et al. (2019).

Similar to previous parts, I employ a DiD approach. The basic specification of the model is as follows:

$$LoanStructure_{it} = \alpha_i + \beta(Post * Constrained)_{it} + \epsilon_{it} \tag{5}$$

LoanStructure serves as the dependent variable and is measured in several different ways. In line with Dhital et al. (2023) I use the logarithm, the share of total loans and the natural logarithm as dependent variables for total loans[3], household loans, corporate (non-financial) loans and CRE loans. The *Post* variable is a dummy that equals one during the period following the CBPP announcement, from Q2 2020 to Q1 2023, and zero otherwise. α_i capture a range of different bank fixed effects that I control for.

I run all specifications twice with two different measures on *Constrained* following Grosse-Rueschkamp et al. (2019). First using the banks' regulatory capital (their tier 1 ratio) as well as the ratio of non-performing loans (NPL) to total loans. Banks are categorized as constrained based on their tier 1 ratio and their NPL ratio at the end of the third quarter of 2019 to reduce potential endogeneity.[4] Two banks are coded as constrained based on their tier 1 ratio: Nordea and SBAB (16.3% and 17.4% respectively, slightly lower than the others). Three banks are coded as constrained based on the NPL ratio: Nordea, SEB and Swedbank, all with a NPL ratio around 0.6-0.7 %.

4.4 Assumptions and endogeneity concerns

My methodology and the DiD approach in general rely on a number of assumptions in order to estimate a causal relation. In the following section, I will discuss the underlying assumptions of the DiD method and my application of it. I begin by outlining the parallel trends assumption, a crucial part of any DiD approach. This is followed by a discussion on the potential concerns facing my particular ITT approach in which eligibility status prior to the CBPP announcement is used as an instrument to measure the effect, and how I deal with them in the analysis.

[3]For obvious reason, there is no point in doing the estimation of share of total loans for total loans.

[4]Ideally, I would have chosen Q4 of 2019, the final quarter before the announcement, in line with Grosse-Rueschkamp et al. (2019). But for one of the banks, there was a missing value for that quarter.

4.4.1 The parallel trends assumption

In the DiD method, the parallel trends assumption is crucial, implying that trends in outcomes for treated and control groups would be identical without treatment. For the corporate bond market and firm-level analyses, I first validate this assumption by plotting mean outcome variables for treatment and control groups in each of my datasets. However, in the bank lending analysis, inconsistent reporting and the small dataset (given that the Swedish market is dominated by a few large banks) makes it challenging to validate the DiD assumptions in a similar way. As such, I only present the results for the analysis without further elaboration on the validity of the DiD estimate, given the significant limitations of such a discussion. Instead, the bank analysis should be viewed as supplementary, offering observations that could highlight areas for future research

Following graphical visualization, I conduct statistical tests based on Equations (2), (3), and (4) respectively, to examine the parallel trends assumption further. First, I test whether the trends are parallel prior to treatment by augmenting the DiD model with terms that capture differences in slopes between treated and control groups before the CBPP announcement. This test, often referred to as a parallel trends test, checks if pre-treatment trends in the outcome variable are statistically different between treated and control groups, which would indicate a violation of the parallel trends assumption. Secondly, I perform a Granger Causality test to determine if treatment effects can be observed in anticipation of treatment. This test identifies whether changes in the treated group's outcomes before the treatment announcement can predict future outcomes, suggesting that expectations of treatment might have already influenced behavior. Together with the graphical identification, these tests provide a thorough examination of whether the DiD assumptions of parallel trends are met.

4.4.2 Challenges for the ITT approach

As previously described in this chapter, I utilise an intent-to-treat (ITT) approach in the capital market and firm level analysis, defining treatment based on the eligibility of purchase prior to the announcement of the CBPP. An unbiased ITT estimate requires random assignment of treatment between treatment and control groups (Angrist & Pischke, 2009). In my study, this means that the eligibility for purchase would ideally be randomly assigned among firms and bonds. However, this is not the case, as the identification in my setting is based on a potentially endogenous variable: a firm's credit rating prior to the announcement of the CBPP. This could lead to other variables influencing treatment and control groups differently while also correlating with the outcomes. One such obvious variable is the COVID-19 shock on the financial market, which coincided with the CBPP announcement. In the discussion of the results, I will elaborate on this further.

The direction of the potential bias in the ITT estimate will depend on the correlation between the treatment variable (eligibility for purchase) and the unobservable factor. According to Khwaja and Mian (2008), comparing an unbiased coefficient of the endogenous variable to a biased coefficient could provide insight of the direction of the bias. However, because I lack an unbiased estimation of the endogenous variable, it is difficult to run a test to determine the direction of bias in my setting. Therefore, my assessment of the direction of bias will rely on intuition and

observing coefficient changes across different specifications, as well as shifts in the coefficient of determination (R-squared), following the reasoning of Oster (2019) and Grosse-Rueschkamp et al. (2019). To allow for such a discussion I employ four different specifications in my DiD analyses in the capital market and firm-level analysis. I compare the coefficient of the endogenous variable, i.e. the coefficient of the interaction term *Treated*Post*, across different specifications: one without any controls or fixed effects, one with firm and time fixed effects, one with controls and fixed effects, and one with controls and an interaction between industry and time fixed effects. In the results section, I elaborate further on this topic, discussing the validity of my results based on the outcome of the coefficients across different specifications, as well as the R-squared value.

In addition to endogeneity concerns, the exclusion restriction poses another significant challenge. This is a necessary (but not sufficient) condition for a valid instrument, and requires that the instrument (eligibility for purchase prior to the CBPP announcement) affects the outcome variable only through the treatment assignment. However, since the eligibility criterion is based on a firm's credit rating, which is closely linked to other financial characteristics, it is plausible that eligibility directly affects outcomes such as yield spreads, bid-ask spreads, or leverage proxies, even in the absence of the CBPP. For instance, investment-grade ratings generally improve market access and reduce perceived credit risk. As a result, eligible bonds may attract higher demand due to the rating itself rather than any specific CBPP influence, potentially leading to an overestimation of the CBPP's effect.

To address these intertwined challenges of endogeneity and exclusion, I carefully analyze the results across various specifications and provide theoretical justification for the expected direction of bias. By evaluating the coefficient of determination (R-squared) and the coefficients of the interaction term *Treated*Post* across different models, there seem to be support that the directon of the bias is in general leaning toward overestimating the actual impact of the CBPP.

Another assumption required for the validity of the estimated treatment effect on the treated group is the homogeneity assumption. This assumption requires that the instrument should have a consistent impact across the treatment group. In my analysis, I argue that the homogeneity assumption is satisfied because eligibility for the CBPP is expected to only increases the probability of purchase for all eligible entities, as reasoned by Grosse-Rueschkamp et al. (2019). Given that the ITT effect measures the average effect on the group of eligible firms and bonds, and not on the treated-on-the-treated (in this case the bonds actually purchased by the Riksbank). The ITT effect provides support for the homogeneity assumption by accounting for potential spillover effects on bonds that are eligible but not directly purchased by the Riksbank. These spillover effects may arise due to a shift in investor demand from portfolio rebalancing, possibly leading to a reduction in the term premium (Grosse-Rueschkamp et al., 2019; Koijen et al., 2016; Stein, 2012).

5 Data and descriptive statistics

In this section I outline the data selection for each of my three analyses, starting with the capital market analysis, then the firm analysis, and lastly the bank level analysis. In the following sections I will provide an overview of the construction of my three datasets and summary statistics will be presented and commented.

5.1 Data selection for the capital market analysis

The study period for the analysis of the capital market spans from Q1 2019 to Q1 2021, allowing the analysis to include four periods before and after the CBPP announcement, aligning with the methodology outlined by Grosse-Rueschkamp et al. (2019). I distinguish between two primary time periods: the "pre" period, which covers quarterly data from Q1 2019 to Q1 2020 prior to the CBPP announcement, and the "post" period, spanning from Q2 2020 to Q1 2021.

Quarterly bond data was extracted from Refinitiv Eikon, a comprehensive database extensively used in both academia and industry for its financial, economic, and corporate data, thus ensuring accuracy in data collection (SSE Library, 2024).

The selection process for relevant bonds involved constructing a dataset in Refinitiv Eikon using specific criteria: bonds issued in Swedish krona by Swedish non-financial corporations, non-subordinated, with a remaining maturity of between 6 months to 5 years as of the date of the CBPP announcement. The maturity range was chosen to align with the CBPP guidelines, and permits the inclusion of bonds issued before Q1 2019, provided they had a remaining maturity of between 6 months and 5 years at the CBPP announcement date. Additional data collected included details on the bond issuers, agency ratings, industry classification codes, company types, and the ISINs of all the bonds.

After extracting the bond dataset, I refined and restructured the data by excluding bonds with missing data across all time periods (for instance, bonds that were issued and redeemed quickly, resulting in no market trades), dividing the data into two different datasets based on their main industry division according to the Standard Industry Classification (SIC) code, with one dataset for bonds issued by CRE firms and one dataset for issuers within other industries. For bonds lacking an individual credit rating, I used classifications based on Refinitiv Eikon's historical data of issuer's credit rating, and otherwise categorized it as non-rated, in line with the CBPP framwork communicated by the Riksbank.

The treatment group of the capital market analysis consists of all bonds eligible for the CBPP program. In other words, bonds issued in Swedish krona by Swedish non-financial corporations, carrying a credit rating equivalent to Baa3/BBB- or higher. The control group consists of all bonds that do not fulfill the CBPP standards in rating; these include high-yield or non-rated bonds. Furthermore, to examine whether the effects of the CBPP differed for CRE bonds, I also divide both treatment and control group into bonds issued by CRE firms, and bonds issued by other non-financial corporations.

I collected historical data from Refinitiv Eikon on the Bid-Price and Ask-Price at close, as well as the Mid-Yield-to-Maturity, on a daily frequency. Subsequently, I aggregated the daily figures into quarterly averages for each bond. The yield spread was calculated following the method outlined by Grosse-Rueschkamp et al. (2019), utilizing the Mid-Yield-to-Maturity relative to a Swedish treasury bill of the same maturity obtained from Refinitiv Eikon. The final dataset comprises of 534 publicly-traded non-subordinated bonds denominated in Swedish krona, of which 349 were issued by Swedish commercial real estate firms and the remaining 185 by other non-financial corporations. An overview of the sample distributed by industry and credit rating is presented in Table 1 and Table 2 respectively.

Table 1: Bond sample breakdown based on industry over the period Q1 2019 - Q1 2021

Industry	Freq.	Percent
Real Estate	3,141	65.23
Manufacturing	405	8.41
Services	378	7.85
Holding & Other Investment Offices	369	7.66
Transportation, Communication, Electric, Gas, Sanitary Services	261	5.42
Retail Trade	117	2.43
Mining	54	1.12
Agriculture, Forestry, Fishing	54	1.12
Construction	18	0.37
Wholesale Trade	18	0.37
Total	**4,815**	**100.00**

Table 2: Bond sample breakdown based on credit rating over the period Q1 2019 - Q1 2021

Credit rating categories	Freq.	Percent
AAA-A	1,314	27.29
BBB-B	1,791	37.20
Non-Investment Grade & Non-Rated	1,710	35.51
Total	**4,815**	**100.00**

5.1.1 Treatment of outliers

For the quarterly Yield-to-Maturity (YTM) data, there are outliers that are likely to impact the results and conclusions of my analysis. In this section I will briefly discuss the reasons for why these outliers may be observed, and how I will treat them in my analysis.

A bond's YTM is one measurement of the return an investor receives for purchasing a bond at the market price and holding it until maturity. It is defined mathematically as the discount rate at which the sum of all future cash flows, i.e. coupons and principal repayment, equals the

price of the bond. Higher yields imply larger interest payments to bond holders and often signal greater risk. Higher yields are often common for bonds with longer maturity and for issuers with lower creditworthiness. The riskier the borrower, the higher the yield demanded by investors. The price and yield of a bond are inversely related, meaning that as the price of a bond increases, its yield decreases and vice versa (Hayes, 2024).

High yields can be driven by several different factors. One is the creditworthiness of the issuer and the associated risk of default. Unusually high YTM data for some bonds could also be due to other reasons such as the proximity of the bond's maturity, particularly if it is shortly after the end of one quarter, which might skew the YTM calculations in Refinitiv Eikon's model. Other factors include call risk and event risk. For example, callable bonds give the issuing company the right to redeem the bond after a minimum period, potentially affecting its yield. Event risks might involve corporate transactions, regulatory changes, or other crises that could cause a sudden downgrade in a corporate bond. Additionally, changes in interest rates affect bond holders; the bondholder benefit from declining interest rates and from a narrowing of credit spreads, contributing to increased bond prices compared to newly issued bonds. Conversely, rising interest rates and widening credit spreads decrease the price of bonds (Harper, 2022). Lastly, the abnormally high yields can also be due to errors in the data. However, as I have not had access to a similar database to Refinitiv Eikon (such as Bloomberg), I have not been able to identify whether this could be the case.

There is no single explanation for all the outliers in my dataset. However, many of them are associated with high-risk entities with heightened likelihood of default shortly after issuance or during the bond's term. An example of a abnormally high-yielding bond in my dataset is one issued by Oscar Properties, a real estate company which, during and after my study's time period, has faced numerous financial challenges and a high risk of default. However, for some bonds I find no explanation to why the YTM is extremely high for a period, neither when looking at macroeconomic factors or firm-specific factors.

There is no consensus in the literature on how to handle outliers in corporate bond data. As such, I have chosen to adopt a conservative model, conducting two separate analyses for the capital market analysis: one using the entire dataset without outlier treatment, and another where the outliers (as defined by the 1st and 99th percentile) are removed. The second analysis follows the methodology of Grosse-Rueschkamp et al. (2019), who treats outliers by winsorising the dataset by the 1st and 99th percentile. I choose to conduct two separate analysis as I have found that in addition to winsorising, other studies such as Bai, Bali, and Wen (2019) and Huynh and Xia (2021) remove entire bonds yielding price outliers, Goldberg and Nozawa (2021) opts to exclude only specific observations identified as price outliers, and in Jostova, Nikolova, Philipov, and Stahel (2013), the authors choose to exclude return outliers rather of price extremes.

Because of the lack of consensus on how to treat outliers, and because my data allows it, I choose to conduct two analysis with and without outliers. By doing so, my goal is to allow for a transparent analysis, and to be able to discuss how including and excluding outliers might influence the conclusions of my research.

5.1.2 Summary statistics for the capital market analysis

In this section, I will describe the summary statistics for the dataset used in my capital market analysis. I start by discussing the data for bonds issued by commercial real estate firms, followed by bonds issued by other non-financial firms.

Real estate bonds

Table 3 presents summary statistics for the data used in the capital market analysis. The table is divided into two main parts, Panel A1 and A2, focusing on real estate bonds and non-real estate bonds respectively. Each panel is then further divided to show data before and after the CBPP announcement and for both non-eligble and eligble bonds. For each type of firm, before and after the announcement, the data includes the Yield-to-maturity (YTM) data, the Yield spread, Bid price, Ask price, and the Bid-ask price. As will be described in the methodology later, the data on YTM and the Bid-Ask spread is the most central for my analysis, and thus I will focus on these throughout the discussion of the data.

On average, eligible real estate bonds exhibit lower yield spreads and bid-ask spreads compared to non-eligible real estate bonds, both before and after the introduction of the CBPP. I test for difference in means for every variable between eligible and non-eligible bonds, and find statistically significant differences at the 1% level for each one. This is unsurprising as, for instance, we would expect eligible bonds in general to be lower risk and be in higher demand compared to non-eligible bonds, and thus have lower YTM and Bid-Ask spreads respectively. However, as discussed in section 5.1.1, large standard errors and outliers complicate the interpretation. After the CBPP announcement, the yield spread for non-eligible real estate bonds on average decreased by 331 bps, while for eligible real estate bonds, it increased by 28 bps. Following the announcement, the bid-ask spread for non-eligible real estate bonds increased on average by 65 bps, and for eligible real estate bonds, by 3 bps.

Panel A3 in Table 4 shows corresponding summary statistics for real estate bonds with outliers removed. The standard deviations are notably smaller for both non-eligible and eligible bonds. When removing the outliers, the total number of observations in the dataset decreases by 48 observations, 24 of which are observations of eligible bonds and 24 of non-eligible bonds. Similar to Panel A1, the yield spreads are on average lower for eligible bonds compared to non-eligible ones both before and after the CBPP announcement. The differences in means for all variables are significant at the 1% level. The yield spread for non-eligible bonds increases on average with 67 bps following the announcement instead of decreases. For eligible bonds, there is instead a modest decrease in the yield spread with 6 bps on average. The bid-ask spread increases on average by 32 bps for non-eligible bonds and by 3 bps for eligible bonds.

Non-real estate bonds

Panel A2 of Table 4 presents the identical data as discussed above, but for non-real estate firms. On average, eligible bonds exhibit lower yield spreads and bid-ask spreads compared to non-eligible non-real estate bonds, both before and after the introduction of the CBPP. However, for the yield-to-maturity and the yield spread variable, the standard errors for the non-eligible bonds are very large. This is driven by a few very large data points for the yield data, which

makes it difficult to interpret these summary statistics. Furthermore, the difference in means for the yield-to-maturity variable and yield spread before the announcement of the CBPP are not significant. The difference in means for the remaining three variables before the announcement of the CBPP is significant at either the 1% or 5% level.

Addressing these issues by removing the outliers in the 1st and 99th percentile of the YTM variable, in Panel A4 of Table 4, the standard errors are notably smaller. When removing outliers, the number of total observations in the dataset decreases by 27 observations, which mainly includes non-eligible bonds (23 out of 27 observations removed). Furthermore, the difference in means for the yield-to-maturity and the yield spread are now significant at the 1% level both prior to and after the announcement. The difference in means for the bid price, ask price, and the bid-ask spread are significant at the 1% level after the announcement, while the corresponding variables priort to the announcement are significant at the 5% level. After the CBPP announcement, the yield spread for non-eligible non-real estate bonds on average increases by 167 bps, while for eligible non-real estate bonds, it increases by 2 bps on average. The bid-ask spread for non-eligible non-real estate bonds increases on average by 29 bps, and for eligible non-real estate bonds, by 3 bps.

Table 3: Descriptive statistics for key variables of the capital market analysis, divided by eligible and non-eligible bonds, and real-estate and non-real-estate issuing firm

Panel A1: Real estate bonds

Before announcement	**Non-eligble bonds**				**Eligble bonds**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	186	1,479	6,239	326	1013	111	350	79	1,368.5**
Yield Spread (bps)	186	1,514	6,239	356	1013	146	350	112	1,368.4**
Bid price	186	97.8	11.4	100.2	1013	100.8	1.3	100.7	-2.9356**
Ask price	186	98.7	10.9	100.6	1013	101.1	1.3	101.0	-2.4286**
Bid-Ask Spread (bps)	186	102.8	219.8	51.7	1013	34.3	20.2	29.6	68.5069**
After announcement	**Non-eligble bonds**				**Eligble bonds**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	202	1,170	3,884	304	1,044	161	846	81	1,008.8**
Yield Spread (bps)	202	1,183	3,884	318	1,044	174	846	94	1,008.8**
Bid price	202	97.1	11.3	99.9	1,044	100.2	1.5	100.3	-3.0939**
Ask price	202	98.3	9.5	100.2	1,044	100.6	1.3	100.5	-2.2081**
Bid-Ask Spread (bps)	202	168	485	53	1,044	37	51	26	130.9694**

Panel A2: Non-real estate bonds

Before announcement	**Non-eligble bonds**				**Eligble bonds**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	452	14,812	305,165	121	205	66	289	76	14,745.8
Yield Spread (bps)	452	14,847	305,166	156	205	101	289	107	14,746.2
Bid price	452	99.4	6.8	100.3	205	100.7	1.4	100.5	-1.2649**
Ask price	452	100.1	5.8	100.6	205	101.1	1.3	100.7	-1.0076*
Bid-Ask Spread (bps)	452	71.7	173.3	36.2	205	37.5	25.8	31.3	34.1793**
After announcement	**Non-eligble**				**Eligble**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	443	717	2,972	158	212	120	148	75	597.1185**
Yield Spread (bps)	443	730	2,972	171	212	133	148	87	597.0756**
Bid price	443	97.2	8.8	99.8	212	99.9	1.8	100.2	-2.7169**
Ask price	443	98.1	8.0	100.1	212	100.3	1.5	100.3	-2.2222**
Bid-Ask Spread (bps)	443	103.5	224.5	44.8	212	40.1	43.0	29.5	63.4191**

Notes: This table reports summary statistics of key variables for the capital market analysis of Swedish real estate and non-real estate bonds, before and after the CBPP announcement in Q1 2020. The non-eligible control group consists of non-IG-rated Swedish real estate bonds, while the eligible treatment group includes the real estate bonds that the Riksbank identified as eligible for the CBPP. *, ** denote significance at the 5% and 1% level respectively. All variables are defined in Table 22 in the Appendix.

Table 4: Descriptive statistics for key variables in the capital market analysis, excluding outliers beyond the 1st and 99th percentiles of the variable yield-to-maturity.

Panel A3: Real estate firms (excluding outliers)

Before announcement	**Non-eligble bonds**				**Eligble bonds**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	175	375	370	199	1006	100	79	79	274.2819**
Yield Spread (bps)	175	410	370	214	1006	136	79	113	274.0849**
Bid price	175	99.9	2.6	100.2	1006	100.8	1.3	100.7	-0.8811**
Ask price	175	100.6	2.4	100.6	1006	101.1	1.3	101.0	-0.4940**
Bid-Ask Spread (bps)	175	73	62	50	1006	34.4	20.2	29.7	39.0296**
After announcement	**Non-eligble bonds**				**Eligble bonds**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	189	464	528	291	1,027	117	182	82	347.0144**
Yield Spread (bps)	189	477	528	304	1,027	130	181	96	347.0163**
Bid price	189	98.6	4.4	99.9	1,027	100.2	1.5	100.3	-1.5813**
Ask price	189	99.6	3.2	100.2	1,027	100.6	1.4	100.5	-0.9409**
Bid-Ask Spread (bps)	189	105	161	48	1,027	37	51	26	68.3296**

Panel A4: Non-real estate firms (excluding outliers)

Before announcement	**Non-eligble bonds**				**Eligble bonds**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	436	271	486	122	202	97	77	77	173.3685**
Yield Spread (bps)	436	306	485	157	202	132	76	109	173.7750**
Bid price	436	99.8	5.3	100.3	202	100.7	1.4	100.5	-0.8945*
Ask price	436	100.4	4.6	100.6	202	101.1	1.3	100.7	-0.6961*
Bid-Ask Spread (bps)	436	61	136	36	202	37	25	31	24.6362*
After announcement	**Non-eligble**				**Eligble**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Yield-to-Maturity (bps)	436	459	860	157	211	121	148	75	338.8685**
Yield Spread (bps)	436	473	860	169	211	134	148	87	338.8365**
Bid price	436	97.5	7.5	99.8	211	99.9	1.8	100.2	-2.3592**
Ask price	436	98.4	7.0	100.1	211	100.3	1.5	100.3	-1.9259**
Bid-Ask Spread (bps)	436	90.2	146.3	42.2	211	40.3	43.0	29.7	49.9438**

Notes: This table reports summary statistics of Swedish real estate bonds and non-real estate bonds, excluding outliers (1st and 99th percentiles), before and after the CBPP announcement in Q1 2020. The non-eligible control group consists of non-IG-rated Swedish real estate bonds, while the eligible treatment group includes the real estate bonds that the Riksbank identified as eligible for the CBPP. *, ** denote significance at the 5% and 1% level respectively. All variables are defined in Table 22 in the Appendix.

5.2 Data selection for the firm level analysis

For the firm-level analysis, I obtain quarterly data from S&P Capital IQ database. This database provides access to financial data, analysis, and reports covering international businesses, markets, and individuals (*S&P Global*, 2024).

The dataset spans from Q1 2019 to Q1 2021, encompassing four quarters before and after the

CBPP announcement, aligning with the methodology outlined by Grosse-Rueschkamp et al. (2019). I distinguish between two primary time periods: the "pre" period, covering quarterly data from Q1 2019 to Q1 2020, which predates the CBPP program announcement, and the "post" period, spanning from Q2 2020 to Q1 2021. The dataset exclusively focuses on Swedish non-financial corporations, with selection criteria based on headquarters and place of incorporation. Because only a few private companies in the Capital IQ database reported quarterly statistics, the dataset is limited to public companies.

As the purpose of my analysis is to investigate the level of bond financing relative to other sources of credit, the main variables I collect for each firm from the Capital IQ database include Bond Debt to Assets, Term Loans to Assets, Revolving Credit to Assets, and Bank Debt to Bond Debt. Additionally, I also include quarterly data for the size, profitability, tangibility, and market-to-book value - variables that will be used as controls in the specifications for the firm analysis. For a detailed overview of the variable used in the firm-level analysis, see Appendix Table 22.

To ensure a balanced panel, firms lacking data for several key variables in any time period were excluded which follows the method of Grosse-Rueschkamp et al. (2019). Additionally, to guarantee active participation in the bond market, the dataset excludes firms without outstanding bond debt in the fourth quarter of 2019.

The treatment group in my study includes all public firms that are eligible for the Riksbank's purchase of corporate bonds within the program, i.e., that meet the requirements set out in the terms and constraints described in section 2.4.1. The information regarding the eligible companies that meet the Riksbank criteria is gathered from a list that the Riksbank published in connection with the announcement of the program[5]. The control group contains all remaining Swedish non-financial public firms that are not eligible for the CBPP program.

Lastly, I categorize the dataset into two groups: CRE companies and other non-financial corporations. CRE companies include the main industry specifications of "Real Estate Operating Companies, Diversified Real Estate Activities, and Real Estate Development". The final sample consists of 95 public non-financial firms, of which 27 are classified as CRE companies. Furthermore, the treatment group consists of a total of 22 firms eligible for the CBPP program, of which 10 are real estate firms. An overview of the sample distributed by industry and credit rating is presented in Table 6 and Table 5 respectively.

[5]Note that while the original list is no longer accessible on the Riksbank's website, it was obtained from students who conducted a similar study in 2022 (Hajimirza & Thamrongsak, 2022)

Table 5: Firm sample breakdown based on credit rating over the period Q1 2019 - Q1 2021

Credit rating categories	Freq.	Percent
Non-Investment Grade	657	76.84
Investment Grade	198	23.16
Total	**855**	**100.00**

Table 6: Firm sample breakdown based on industry over the period Q1 2019 - Q1 2021

Industry	Freq.	Percent
Real Estate	243	28.42
Industrial and Manufacturing	117	13.68
Technology and Electronics	117	13.68
Healthcare and Pharmaceuticals	81	9.47
Media, Entertainment, and Leisure	72	8.42
Consumer Goods and Services	63	7.37
Retail and Distribution	36	4.21
Energy and Utilities	36	4.21
Materials and Natural Resources	36	4.21
Aerospace, Defense, and Transportation	27	3.16
Construction	27	3.16
Total	**855**	**100.00**

5.2.1 Summary statistics for the firm-level analysis

In this section, I will describe the summary statistics for the dataset used in my firm-level analysis. I start by discussing the data for CRE firms, followed by the statistics for other non-financial firms

Real estate firms

Panel B1 of Table 7 presents the summary statistics for the firm analysis for CRE companies, categorized into eligible and non-eligible groups, before and after the CBPP announcement. On average, eligible firms are larger, although their profitability is nearly identical to that of non-eligible firms. Tangibility is higher on average for eligible firms, though it remains substantial for both groups, reflecting the large share of physical assets on their balance sheets. The difference in means for the variable size is statistically significant at the 1% level both before and after the announcement. Market-to-book value is, on average, higher for eligible firms both before and after the CBPP. For tangibility and market-to-book value, the differences are significant at the 1% level before the announcement and at the 5% level afterwards. Profitability differences are not significant either before or after the announcement.

The long-term debt to asset ratio is 48% for eligible firms and 50% for non-eligible firms pre-announcement; post-announcement, it is slightly lower, 46%, for eligible firms, while it remains at 50% for non-eligible firms. Eligible firms have a higher bond-to-assets ratio, with 21% pre-announcement and 22% post-announcement, compared to 16% and 15% for non-eligible firms,

respectively. This larger bond share for eligible firms is expected, as investment-grade ratings are likely to provide more competitive pricing and access to capital on the bond market. In contrast, non-eligible firms show a higher term loan to asset ratio both pre and post-announcement (31% and 28%, respectively) compared to eligible firms (18% and 16%). This difference may be attributed to non-eligible firms relying more on bank loans as a financing method. The statistical significance of these differences is maintained at the 5% level for total bond debt to assets both pre and post-announcement, and at the 1% level for term loans to assets for both periods. The difference in long-term debt to assets is not significant pre-announcement but is significant at the 5% level post-announcement.

Table 7: Descriptive statistics (part 1) for key variables, real-estate firms, by if the firms were eligible for the program

Panel B1: Real estate firms

Before announcement	**Non-eligble**				**Eligble**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Size	85	9.45	1.25	9.17	50	10.62	0.87	10.58	-1.1702**
Profitability	85	0.01	0.01	0.01	50	0.01	0.00	0.01	0.0008
Tangibility	85	0.77	0.36	0.96	50	0.91	0.08	0.93	-0.1417**
Market-to-book	80	0.82	0.35	0.94	47	1.09	0.35	1.04	-0.2699**
Long-term debt/Assets	85	0.50	0.11	0.53	50	0.48	0.07	0.48	-0.0226
Total bond debt/Assets	85	0.16	0.13	0.14	50	0.21	0.11	0.20	-0.0431*
Term loans/Assets	58	0.31	0.17	0.38	38	0.18	0.08	0.17	0.123**
After announcement	**Non-eligble**				**Eligble**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Size	68	9.45	1.21	9.45	40	10.78	0.87	10.78	-1.1389**
Profitability	68	0.01	0.01	0.01	38	0.01	0.00	0.01	-0.0013
Tangibility	68	0.77	0.34	0.94	40	0.90	0.08	0.93	-0.1269*
Market-to-book	68	0.89	0.38	0.90	40	1.05	0.43	0.89	-0.1622*
Long-term debt/Assets	68	0.50	0.09	0.52	40	0.46	0.06	0.47	0.0350*
Total bond debt/Assets	68	0.15	0.14	0.11	40	0.22	0.13	0.17	-0.0664*
Term loans/Assets	49	0.28	0.17	0.36	35	0.16	0.10	0.16	0.1210**

Notes: This table reports summary statistics of key variables for the firm-level analysis of public Swedish real estate firms, before and after the CBPP announcement in Q1 2020. The non-eligible control group consists of non-IG-rated Swedish real estate firms, while the eligible treatment group includes the real estate firms that the Riksbank identified as eligible for the CBPP. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

Non-real estate firms

Panel B2 of Table 8 presents the summary statistics for the firm analysis for non-real estate firms, categorized into eligible and non-eligible groups before and after the CBPP announcement. Similar to the real-estate firm sample, eligible non-real estate firms are on average larger than non-eligible firms both prior to and after the announcement. However, the difference in means is more pronounced compared to real-estate firms. The difference in means for size is statistically significant at the 1% level both before and after the CBPP announcement. Profitability is higher on average for eligible firms, with the difference in means significant at the 5% level prior to the announcement and at the 1% level after the announcement.

Tangibility and market-to-book value are also larger for the eligible firms in both periods. However, it is crucial to note that there are large standard errors for the market-to-book value, a result of a few companies in the dataset having a negative book value, indicating that these companies have more debt than assets. The difference in means for market-to-book value is not statistically significant in any of the time periods, while the difference in tangibility is significant at the 5% level in both time periods.

The long-term debt to asset ratio prior to the announcement averages 36% for non-eligible firms and 26% for eligible firms. After the announcement, the respective figures are 34% for non-eligible firms and 26% for eligible firms, with the difference in means being statistically significant at the 1% level prior to the announcement and at the 5% level after the announcement. The total bond debt to assets ratio is higher for non-eligible firms prior to the announcement, at 17%, compared to 13% among eligible firms. Post-announcement, the levels are 17% for non-eligible firms and 16% for eligible firms. This is a reverse of the differences observed for the CRE firms. The total term loans to assets ratio is also higher on average for non-eligible firms compared to eligible firms, both before (9% versus 5%, respectively) and after the announcement (8% versus 5%, respectively). The difference in means for the total bond debt to assets and the total term loans to assets are significant at the 5% level prior to the announcement, while not significant after the announcement.

Table 8: Descriptive statistics (part 2) for key variables, non-real-estate firms by if the firms were eligible for the program

Panel B2: Non-real estate firms

Before announcement	**Non-eligble**				**Eligble**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Size	224	8.34	2.08	7.94	48	11.33	0.95	11.47	-2.9823**
Profitability	224	0.01	0.05	0.02	47	0.03	0.02	0.03	-0.0166*
Tangibility	224	0.21	0.23	0.09	48	0.30	0.24	0.22	-0.0936*
Market-to-book	220	0.17	20.53	1.27	48	1.78	1.09	1.41	-1.6062
Long-term debt/Assets	224	0.36	0.21	0.32	48	0.26	0.11	0.24	0.1060**
Total bond debt/Assets	224	0.17	0.15	0.14	48	0.13	0.07	0.11	0.0436*
Term loans/Assets	224	0.09	0.14	0.03	48	0.05	0.05	0.04	0.0450*
After announcement	**Non-eligble**				**Eligble**				**Difference in means**
	N	Mean	SD	Median	N	Mean	SD	Median	
Size	224	8.39	2.09	8.30	48	11.40	0.88	11.47	-3.0042**
Profitability	223	0.01	0.04	0.02	47	0.03	0.02	0.03	-0.0144**
Tangibility	224	0.22	0.25	0.10	48	0.31	0.27	0.20	-0.0885*
Market-to-book	222	1.09	9.95	1.42	48	1.95	1.48	1.46	-0.8606
Long-term debt/Assets	224	0.34	0.23	0.30	48	0.26	0.11	0.26	0.0806*
Total bond debt/Assets	175	0.17	0.15	0.14	44	0.16	0.09	0.13	0.0194
Term loans/Assets	224	0.08	0.14	0.02	48	0.05	0.05	0.05	0.0246

Notes: This table reports summary statistics of key variables for the firm-level analysis of public Swedish non-real estate firms, before and after the CBPP announcement in Q1 2020. The control group comprises of non-IG-rated Swedish firms that are not a part of the real estate sector, while the treatment group includes non-real estate firms that the Riksbank identified as eligible for the CBPP. *, ** denote significance at the 5% and 1% level respectively. The high standard errors for the Market-to-book variables is result of a few companies in the dataset with a negative book value, meaning that the companies have more debt than assets, indicating financial distress or insolvency. All variables are defined in Appendix Table 22.

5.3 Data selection for the bank lending analysis

The last part of my analysis focus on bank lending. The hypothesis is that the CBPP led to bonds being an increasingly attractive source of financing for eligible firms. Thus, these firms may have been more inclined to swap bank loans for bonds. As a result the banks may have had to increase the risk profile of their lending, as many of their previous borrowers turned to the capital market for financing. To examine the CBPP's impact on the risk profile of bank lending, I have collected loan and bank level data from some of the largest banks operating in Sweden. The data is colleted on a quarterly basis from Q1 2018 to Q1 2023, encompassing eight quarters before the CBPP announcement, and twelve quarters after the announcement. The time period both before and after the announcement is prolonged compared to the other analyses to allow more time to elapse and to investigate any long-term effects.

The dataset contains financial statement data obtained from five banks: Nordea, SBAB, SEB, Svenska Handelsbanken and Swedbank. These represent five of the eight largest bank groups in Sweden (Swedish Bankers, 2023). Because of insufficient data or irregularities in how loan data was reported across the studied period, Danske Bank, Länsförsäkringar, and Skandiabanken were excluded from the analysis. Still, because of the large concentration in the Swedish bank market,

my sample of five banks still represents roughly 70 percent of total lending to the Swedish public[6].

The primary data collected from the financial statements contains loan data. The banks often report their lending to the public in differing ways, but it is possible to aggregate the data into five broader categories relevant to this analysis: corporate (non-financial) lending excluding commercial real estate, commercial real estate lending, household loans, other loans and total loans. Of these, the only category in which there may be some variation in composition between the banks is corporate loans. Some banks provided information on lending to, for instance, public administration or housing co-operatives, while others did not. To create comparable categories for all banks, these have all been aggregated in to corporate (non-financial) lending.

In the analysis I also control for a variety of bank fixed effects. The control variables are chosen in line with Grosse-Rueschkamp et al. (2019) and have been collected using the S &P Captial IQ database. A description of all bank fixed effects controlled for can be found in table 22 in the appendix.

5.3.1 Summary statistics for the Bank analysis

Table 9 shows summary statistics for constrained and non-constrained banks based on their tier 1 capital ratio before and after the announcement. The difference in means between the two groups is insignificant before the announcement but becomes significant post-announcement. This is most probably due to the small sample size of five large banks, all which share many characteristics. As a result, the distinction between constrained and non-constrained in this setting is highly arbitrary.

Before the announcement of the CBPP, the difference of the capitalisation variables between constrained banks and non-constrained banks does not show a clear pattern for either of the groups. After announcement, the constrained banks have lower tier 1 ratios, capital ratio and equity to assets compared to the non-constrained banks, and these differences are significant on the 1% level. However it is important to note that for the equity to assets ratio, this difference is very small, 0.6%. Notably, for the non-constrained banks, the levels of the capitalization variables are roughly the same as prior to the announcement, while there is a notable decrease in the tier 1 ratios and capital ratio for the constrained banks.

In both periods, Return on Assets (ROA) and Return on Equity (ROE) were lower for non-constrained banks compared to constrained banks. A similar pattern as for the capitalization variables can be seen - there is a larger difference for the constrained banks prior to and after the announcement for the profitability variables, compared to non-constrained banks. The differences in means are significant on the 1% level both prior to and after the announcement. However, one should keep in mind that the actual difference for the ROA is very small, 0.3% pre-announcement and 0.2% post-announcement.

[6]Because the Swedish bank market is heavily concentrated to a few large actors, in 2022, the three main commercial banks (Swedbank, SEB and Svenska Handelsbanken) alongside the two largest non-Swedish banks (Nordea and Danske Bank) provided almost 75 percent of all lending to the public (Finansinspektionen, 2023).

Post-CBPP announcement, liquidity has increased for both groups. In both periods, the constrained banks show a higher average liquidity than the non-constrained. However, the difference in means is insignificant pre-announcement. Looking at the loan to asset structure of the two groups, the non-constrained banks have on average a higher share of commercial real estate loans and corporate loans (excluding real estate firms), while the constrained banks show a higher share of household loans to assets across both periods. For both groups, the share of commercial real estate loans increased in the period after the announcement. The non-constrained banks have also increased their exposure to corporate loans, while the constrained banks have an identical mean across the two periods. The non-constrained banks show a lower proportion of household loans to assets in the period after the announcement, while the constrained banks maintains their exposure. However, these differences in means are mainly insignificant.

Table 9: Summary statistics for the bank analysis part 1, constrained based on tier 1 capital ratio

Before announcement

Variables	Non-Constrained			Constrained			Difference in means
	Mean	St. dev.	Median	Mean	St. dev.	Median	
Capitalization							
Tier 1 ratio (%)	0.207	0.030	0.196	0.380	0.680	0.178	-0.172
Tier 1 common ratio (%)	0.185	0.027	0.173	0.181	0.067	0.155	0.004
Total capital ratio (%)	0.237	0.036	0.220	0.249	0.101	0.200	-0.013
Equity/Assets (%)	0.050	0.004	0.050	0.047	0.008	0.049	0.003
Asset quality							
NPL/Total loans (%)	0.006	0.002	0.006	0.005	0.004	0.007	0.001
Loan loss reserves/Loans (%)	0.000	0.000	0.000	0.001	0.001	0.000	-0.000
Profitability							
ROA(%)	0.007	0.002	0.007	0.004	0.001	0.004	0.003**
ROE(%)	0.135	0.045	0.131	0.088	0.024	0.091	0.047**
Liquidity							
Loans/Deposits (%)	1.385	0.282	1.375	1.714	1.276	1.747	-0.329
Investments							
Total Assets	2,841	323	2,886	3,258	2,873	3,065	-417
Household Loans/Assets (%)	0.291	0.096	0.271	0.344	0.256	0.337	-0.053
Corporate Loans/Assets (%)	0.167	0.047	0.166	0.080	0.030	0.077	0.086**
CRE Loans/Assets (%)	0.085	0.011	0.081	0.053	0.024	0.053	0.032**

After announcement

Variables	Non-Constrained			Constrained			Difference in means
	Mean	St. dev.	Median	Mean	St. dev.	Median	
Capitalization							
Tier 1 ratio (%)	0.206	0.012	0.207	0.174	0.013	0.171	0.032**
Tier 1 common ratio (%)	0.189	0.011	0.187	0.148	0.019	0.146	0.041**
Total capital ratio (%)	0.228	0.011	0.231	0.192	0.015	0.195	0.036**
Equity/Assets (%)	0.053	0.004	0.054	0.048	0.009	0.048	0.006**
Asset quality							
NPL/Total loans (%)	0.005	0.002	0.004	0.003	0.003	0.002	0.002*
Loan loss reserves/Loans (%)	0.000	0.000	0.000	0.000	0.001	0.000	-0.000
Profitability							
ROA(%)	0.007	0.001	0.007	0.005	0.002	0.004	0.002**
ROE(%)	0.127	0.022	0.128	0.099	0.032	0.093	0.027**
Liquidity							
Loans/Deposits (%)	1.158	0.215	1.078	1.742	1.369	1.602	-0.584*
Investments							
Total Assets	3,299	399	3,342	3,413	2,919	3,104	-114
Household Loans/Assets (%)	0.278	0.091	0.261	0.345	0.246	0.325	-0.067
Corporate Loans/Assets (%)	0.145	0.062	0.145	0.080	0.026	0.084	0.064**
CRE Loans/Assets (%)	0.107	0.083	0.082	0.076	0.046	0.062	0.008

Notes: This table reports summary statistics of key variables for the bank lending analysis, before and after the announcement of the CBPP in Q1 2020. The division of constrained and non-constrained is based on the banks' tier 1 capital ratio. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

In Table 10 I present the summary statistics before and after the announcement for non-constrained and constrained banks, but now based on their share of non-performing loans of total loans. To start, I observe a statistically significant difference in means between the groups based on their share of non-performing loans to total loans both before and after the CBPP announcement, which is the expected result given the constructions of the groups.

Before the announcement of the CBPP, constrained banks, categorized based on a higher share of non-performing loans, exhibit slightly lower mean values in Tier 1 and total capital ratios compared to non-constrained banks. This aligns with expectations since Tier 1 and total capital ratios are critical measures of financial strength, and banks with higher NPLs often have a greater portion of their capital absorbed by risk-weighted assets. However, these differences in means are not statistically significant, likely due to considerable variability within the group, and the small sample size. Constrained banks maintain a higher equity-to-assets ratio, which initially seems contradictory to the lower capital ratios. This discrepancy highlights the fact that these metrics assess different aspects of financial health: while equity-to-assets ratio provides a broader measure of a bank's capital structure, Tier 1 and total capital ratios specifically look at the core equity that is available to cover risk-weighted assets.

After the announcement of the CBPP, all variables measuring capitalization decreased for both non-constrained and constrained banks. However, there are some slight differences compared to the pre-treatment period. Also, the fact that these ratios differs is likely due to the pandemic which affected many firms financial health, spilling over on the banks. After the announcement, the Tier 1 ratios and the total capital ratio are smaller for non-constrained banks compared to constrained banks, while the equity to assets ratio follows the same pattern as prior to the announcement - the constrained banks hold a higher ratio than the non-constrained banks. The differences in means after the announcement for the two groups are statistically significant on the one-percent level for the Tier 1 common ratio and the equity to asset ratio.

Before the CBPP announcement, Return on Assets (ROA) and Return on Equity (ROE) were both lower in non-constrained banks compared to constrained banks, suggesting slightly higher profitability in the latter. Although the difference in ROA is statistically significant at the 1% level, the actual differences are small (about 0.2 percent), indicating very similar profitability across both groups. After the CBPP announcement, the differences in profitability measures between constrained and non-constrained banks remain relatively stable compared to the period before the announcement. However, the gap in ROE slightly widened, potentially contributing to the statistical significance observed in the differences between these groups post-announcement.

Post-CBPP announcement, liquidity has generally declined for both groups, with non-constrained banks consistently showing higher liquidity than constrained banks. These differences are statistically significant at the 1% level in both periods. Regarding loans to asset ratios, non-constrained banks increased their loans to CRE post-announcement, whereas constrained banks maintained their pre-announcement levels. In contrast, loans to corporates (excluding real estate) decreased for non-constrained banks, while remaining stable for constrained banks. The differences in means of CRE to asset ratios are significant at the 1% level after the announcement,

while insignificant between the groups prior to the announcement of the CBPP. Additionally, the differences in household loans to assets are significant across both groups and time periods, with non-constrained banks almost having a twice as large share of household loans compared to constrained banks.

To summarize, the statistics shown in Tables 9 and 10 indicate that using the share of non-performing loans as a measure of constraint does a better job dividing the group of banks into two groups exhibiting distinctive features, and thus better suited for analysis. The most prominent indicator that using the Tier 1 ratio is flawed for these purposes is of course that even though the banks have been divided based on this measure, the difference between the mean ratio pre-announcement is not statistically significant. Thus, it is difficult to determine whether the statistically significant differences in means we observe following the announcement (and subsequent results from the analysis) in this group has anything to do with the banks Tier 1 ratio in the pre-period. When the banks are divided based on their share of non-performing loans, the difference in means for that variable is statistically significant both before and after the announcement. This provides some indication that this division does a better job dividing the group, and may thus provide results that actually vary based on the level of constraint. However, as always, the limited dataset for this analysis means that any results should still be interpreted with caution.

Table 10: Summary statistics for the bank analysis part 2, constrained based on share of non-performing loans

Before announcement

Variables	Non-Constrained			Constrained			Difference in means
	Mean	St. dev.	Median	Mean	St. dev.	Median	
Capitalization							
Tier 1 ratio (%)	0.389	0.677	0.199	0.201	0.031	0.188	0.188
Tier 1 common ratio (%)	0.190	0.066	0.174	0.179	0.028	0.167	0.011
Total capital ratio (%)	0.260	0.099	0.221	0.230	0.036	0.215	0.030
Equity/Assets (%)	0.043	0.005	0.044	0.053	0.004	0.052	-0.010**
Asset quality							
NPL/Total loans (%)	0.002	0.001	0.003	0.007	0.002	0.007	-0.005**
Loan loss reserves/Loans (%)	0.000	0.000	0.000	0.001	0.001	0.000	-0.004*
Profitability							
ROA(%)	0.005	0.001	0.004	0.006	0.003	0.007	-0.002**
ROE(%)	0.106	0.020	0.109	0.123	0.054	0.130	-0.016
Liquidity							
Loans/Deposits (%)	2.158	0.828	2.289	1.089	0.516	1.082	1.069**
Investments							
Total Assets (bn)	1,808	1,380	1,742	3,808	1,633	2,886	-2,000**
Household Loans/Assets (%)	0.430	0.168	0.426	0.233	0.137	0.188	0.0197**
Corporate Loans/Assets (%)	0.131	0.031	0.114	0.133	0.073	0.122	-0.002
CRE Loans/Assets (%)	0.078	0.004	0.078	0.068	0.029	0.075	0.011

After announcement

Variables	Non-Constrained			Constrained			Difference in means
	Mean	St. dev.	Median	Mean	St. dev.	Median	
Capitalization							
Tier 1 ratio (%)	0.188	0.027	0.185	0.197	0.013	0.195	-0.009
Tier 1 common ratio (%)	0.162	0.033	0.016	0.180	0.014	0.181	-0.018**
Total capital ratio (%)	0.207	0.031	0.208	0.218	0.012	0.217	-0.011
Equity/Assets (%)	0.046	0.007	0.048	0.055	0.004	0.054	-0.008**
Asset quality							
NPL/Total loans (%)	0.002	0.001	0.002	0.005	0.002	0.005	-0.004**
Loan loss reserves/Loans (%)	0.000	0.000	0.000	0.000	0.001	0.000	-0.001
Profitability							
ROA(%)	0.005	0.001	0.004	0.007	0.002	0.007	-0.002**
ROE(%)	0.100	0.019	0.096	0.125	0.031	0.130	-0.025**
Liquidity							
Loans/Deposits (%)	2.096	1.013	2.059	0.922	0.421	0.946	1.174**
Investments							
Total Assets	2,025	1,492	1,898	4,225	1,519	3,489	-2,200**
Household Loans/Assets (%)	0.423	0.167	0.405	0.226	0.125	0.181	0.197**
Corporate Loans/Assets (%)	0.103	0.006	0.104	0.130	0.075	0.106	-0.027
CRE Loans/Assets (%)	0.101	0.023	0.093	0.067	0.026	0.076	0.034**

Notes: This table reports summary statistics of key variables for the bank lending analysis, before and after the announcement of the CBPP in Q1 2020. The division of constrained and non-constrained is based on the banks' share of non-performing loans of total loans. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

6 Results

In this section I present the results of my three analyses. First, the capital markets analysis, second for the firm-level analysis, and lastly the bank analysis. The capital market and the firm level analysis are divided into two main parts. First, I examine if the basic assumptions necessary for running a DiD specification hold, specifically focusing on the assumptions of parallel trends. Then I present the results. Given the small selection of firms in the bank analysis and the limitations of data, the third analysis should be viewed as supplementary and therefore I only focus on the results for that part.

6.1 Results of the capital market analysis

In this section I will present the results of the capital market analysis. I will begin by examining the basic requirements of the data for conducting a difference-in-difference analysis: the parallel trends assumption evaluated both graphically and through statistical testing. I will evaluate assumption for both datasets, the one with the full dataset and the one with outliers removed. After that I will move on to discuss the results of the difference in difference analysis of the effect of the CBPP on yield spreads and bid-ask spreads. I will discuss limitations with my analysis, affecting the validity of the results in Chapter 7.

6.1.1 Parallel trends identification for the capital market analysis

In this section I will begin by investigating the parallel trend assumption graphically for the bid-ask spread, followed by the yield spread, comparing the parallel trends for the full dataset and the dataset where outliers are removed.

Real estate bonds

Figure 11 and Figure 12 examine the parallel trends assumption for the bid-ask spread of bonds issued by real estate firms using the full dataset and the dataset excluding outliers respectively. Visual inspection suggests that the data seem to support the parallel trends assumption for both datasets. The trend for both eligible and non-eligible firms follow the same general trend prior to the CBPP announcement.

Figure 11: Bid-Ask Spread for Eligible and Non-eligible real estate firms

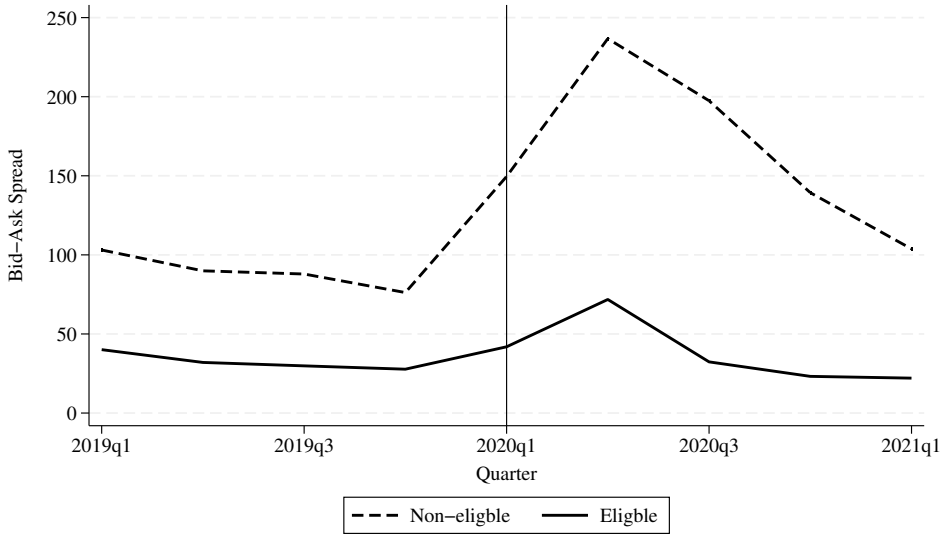


Figure 12: Bid-Ask Spread for Eligible and Non-eligible real estate firms (Excluding outliers)

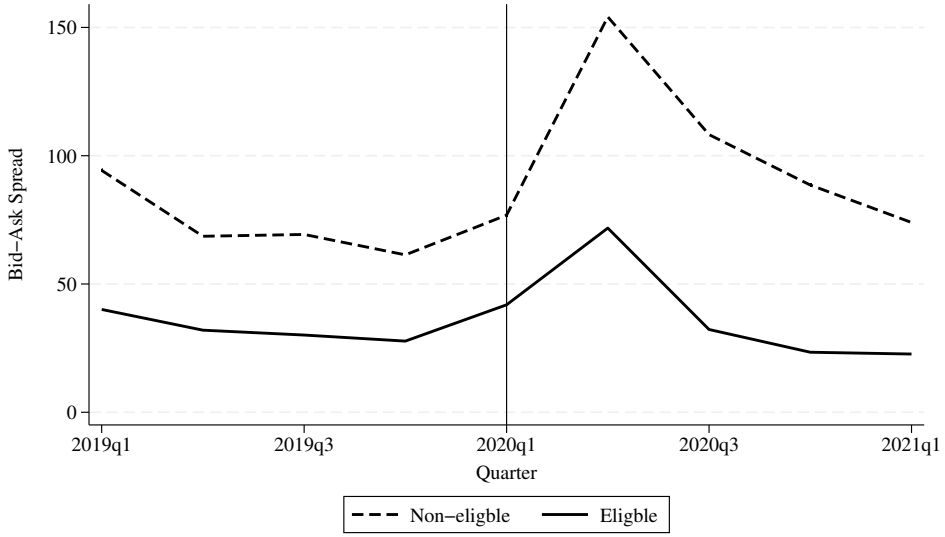


Figure 13 and Figure 14 assess the parallel trends assumption for the yield spread of bonds issued by real estate firms, comparing the full dataset and one excluding outliers, respectively. Unlike the bid-ask spread, visual inspection suggests that the full dataset does not meet the parallel trends assumption. We observe a large spike in the trend for the non-eligible firms in the period prior to the announcement, which is not observed for the eligible firms. However, after the outliers are removed, the spike for non-eligible firms disappears, and the general shape of both curves do appear to be in line with the parallel trends assumption.

Figure 13: Yield Spread for Eligible and Non-eligible real estate firms

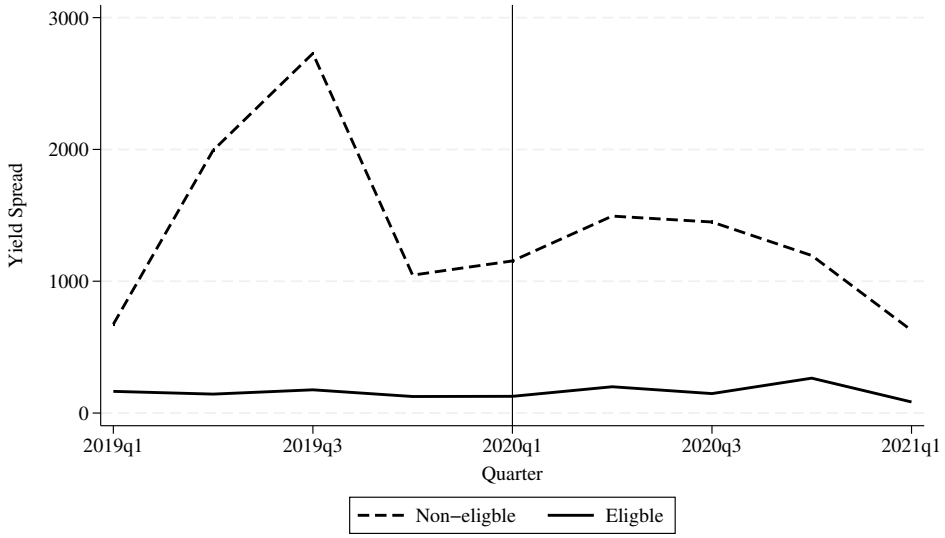
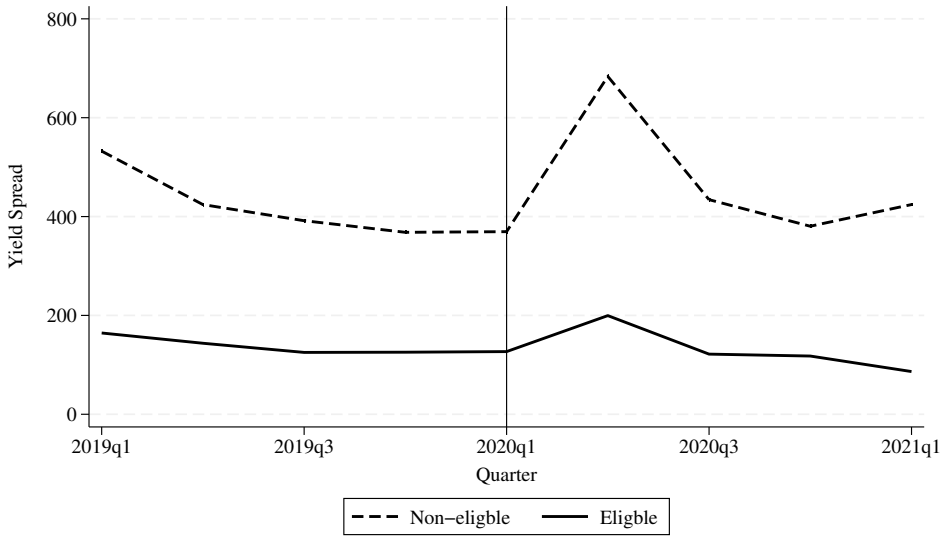


Figure 14: Yield Spread for Eligible and Non-eligible real estate firms (Excluding outliers)



Non-real estate bonds

Figure 15 and Figure 16 examine the parallel trends assumption for the bid-ask spread of bonds issued by non-real estate firms using the full dataset and the dataset excluding outliers, respectively. Visual inspection suggests that the data seem to support the parallel trends assumption for both datasets.

Figure 15: Bid-Ask spread for Eligible and Non-eligible non-real estate firms

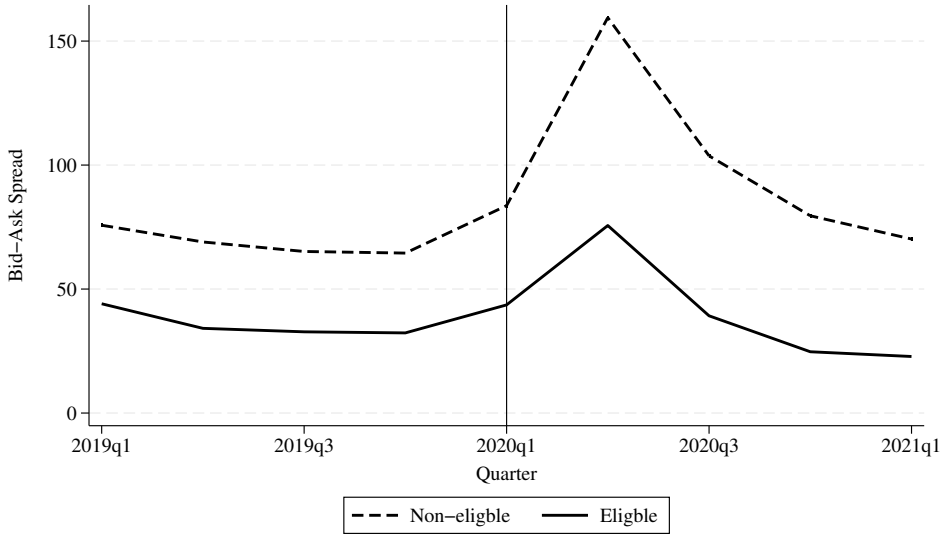


Figure 16: Bid-Ask Spread for Eligible and Non-eligible non-real estate firms (excluding outliers)

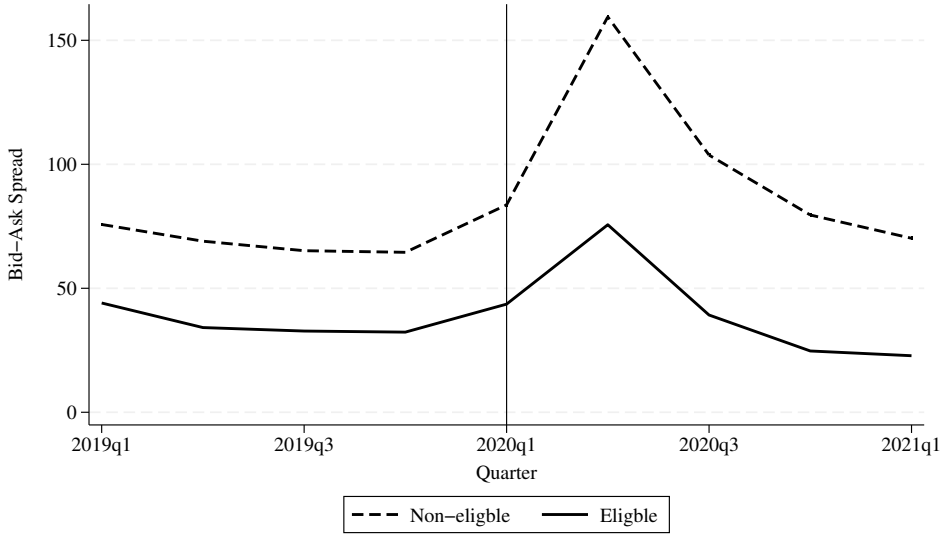


Figure 17 and Figure 18 assess the parallel trends assumption for the yield spread of bonds issued by non-real estate firms, using the full dataset and one excluding outliers, respectively. Similar to the results for real-estate firms, visual inspection indicates that the full dataset fails to support the parallel trends assumption as there is once again a large spike prior to the announcement. Removing the outliers does remove the spike and the trends appear more parallel now. However, the trends are not completely parallel for the treatment group and control group: there appears to more volatility in the variable for the non-eligible firms. This suggest that parallel trends assumption is violated and indicate that results for this analysis should be interpreted with some care.

Figure 17: Yield Spread for Eligible and Non-eligible non-real estate firms

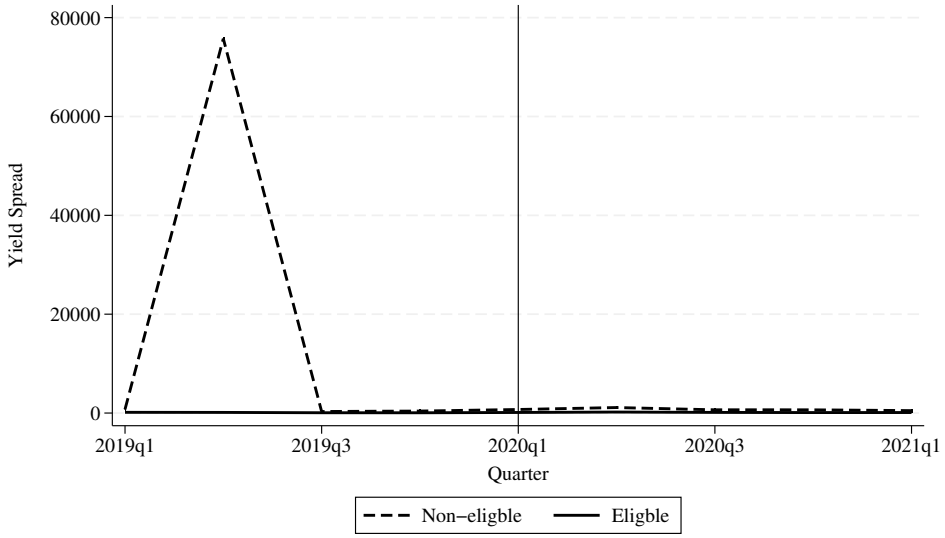
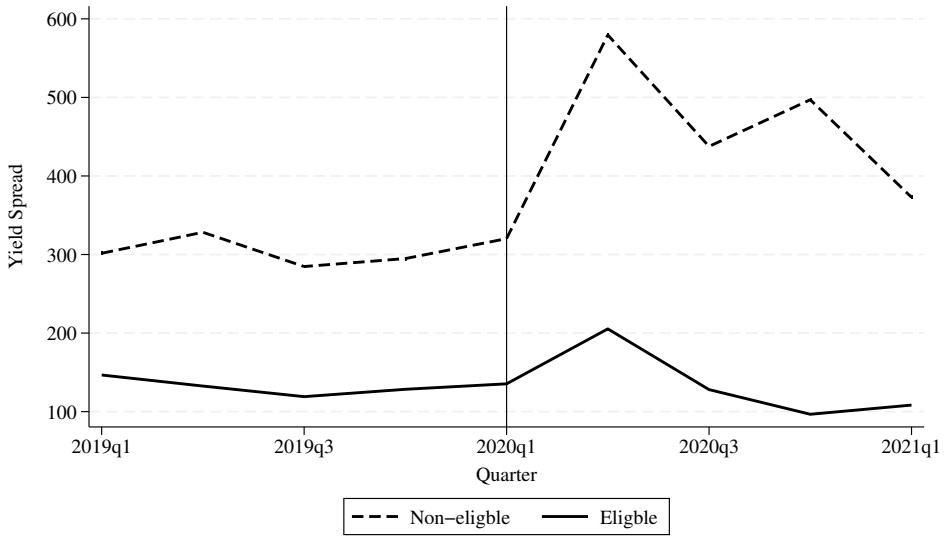


Figure 18: Yield Spread for Eligible and Non-eligible non-real estate firms (excluding outliers)



After visually analysing the parallel trend assumption for bonds issued by real estate and non-real estate firms, the outlier-excluded dataset, particularly at the 1st and 99th percentile for yield spread, consistently shows stronger support for the parallel trends assumption. Consequently, I will focus my analysis on the outlier-excluded dataset, adopting the winsorising method suggested by Grosse-Rueschkamp et al. (2019).

6.1.2 Statistical tests for parallel trends identification

To statistically validate the visual interpretation of the parallel trends assumption, I conduct a test of parallel trends and a Granger causality based on Equation (2) for the yield spread variable and (3) for the bid-ask spread variable.

The unbalanced nature of the bond panel data presents a challenge for running this type of

analysis in Stata. Some bonds issued late in 2019 lack early period data, while others matured before the final quarter of my study's time period. As of my knowledge, there is no simple way of running a parallel trends test and Granger causality test when the dataset is unbalanced. Therefore, for this specific test, I restrict my sample to only include the bonds that have data available for the whole period, reducing the dataset for real estate bonds from 349 to 158 bonds, and from 187 to 82 for bonds issued by non-real estate firms.

Although this approach may not be ideal for testing the parallel trends assumption and the effect in anticipation of treatment across the entire dataset, the additional tests on these restricted datasets can work as a complement to validate the visualizations of the non-restricted datasets presented in the previous section.

Tables 11 and 12 present the test statistics for the respective datasets and outcome variables, limited to bonds with complete data. The results of the parallel trends test in Stata shows that we do not have sufficient evidence to reject the null hypothesis of parallel trends for both variables and datasets, hence supporting the parallel trends assumption. Furthermore, I conduct a Granger causality test in Stata for both outcome variables and datasets, which shows that we do not have sufficient evidence to reject the null hypothesis of no behavior change prior to the treatment. Together with the graphical analysis of parallel trends, these results suggest that the assumption of parallel trends may be valid.

Table 11: Parallel trends test

H0: Linear trends are parallel		
Real estate bonds	F-test	Prob>F
Yield spread	F(1, 157) = 0.56	0.4539
Bid-Ask spread	F(1, 157) = 0.07	0.7982
Non-real estate bonds	F-test	Prob>F
Yield spread	F(1, 81) = 1.29	0.2585
Bid-Ask spread	F(1, 81) = 0.77	0.3840

Table 12: Granger causality test

H0: No effect in anticipation of treatment		
Real estate bonds	F-test	Prob>F
Yield spread	F(3, 157) = 0.97	0.4094
Bid-Ask spread	F(3, 157) = 1.18	0.3202
Non-real estate bonds	F-test	Prob>F
Yield spread	F(3, 81) = 0.59	0.6264
Bid-Ask spread	F(3, 81) = 1.09	0.3600

6.1.3 Results from difference-in-difference

As outlined in 6.1.1, following the graphical visualization of parallel trends and statistical verification via a parallel trends test and a Granger causality test, the subsequent analysis will focus on the dataset excluding outliers.

Effects on the yield spread

Table 13, panel C1, displays the results from my DiD specification for the effect on yield spreads of CRE bonds as defined in Equation (2). Column (1) provides the baseline results without fixed effects or controls. In the base line specification, the interaction term of *Treated* and *Post* shows a decrease in yield spread of 75.0 bps for eligible bonds compared to non-eligible bonds post the announcement of the CBPP. When including bond and time fixed effects as seen in column (2), the interaction terms is slightly lower, indicating a 78.7 bps decrease for eligible bonds in following the announcement compared to non-eligible bonds. Both coefficients are significant at the 5% level, but the addition of fixed effects results in a substantial drop in the R-squared, from 0.26 to 0.14. The low R-squared value indicates that the specification has low explanatory power for the outcome variable.

Table 13: Results Capital Market Analysis (Real estate firms)

C1: Bonds issued by real estate firms: Effects on Yield Spread

Variables	(1) Yield Spread (bps)	(2) Yield Spread (bps)	(3) Yield Spread (bps)	(4) Yield Spread (bps)
Treated	-319.4**	Omitted	Omitted	Omitted
Post	172.6**	Omitted	Omitted	Omitted
Treated × Post	-75.0*	-78.7*	-64.0	-64.0
Industry × Time FE	No	No	No	Yes
Bond FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.26	0.14	0.38	0.38
Observations	2,397	2,397	2,041	2,041

C2: Bonds issued by real estate firms: Effects on Bid-Ask Spread

Variables	(1) Bid-Ask Spread (bps)	(2) Bid-Ask Spread (bps)	(3) Bid-Ask Spread (bps)
Treated	-45.6**	Omitted	Omitted
Post	54.5**	Omitted	Omitted
Treated × Post	-17.9	-17.4	-17.4
Industry × Time FE	No	No	Yes
Bond FE	No	Yes	Yes
Time FE	No	Yes	No
Controls	No	No	No
R-squared	0.15	0.09	0.09
Observations	2,066	2,066	2,066

Notes: This table reports the effect at announcement of the Riksbank CBPP on the yield spread and bid-ask spread of bonds issued by real estate firms, over the sample period of Q1 2019 - Q1 2021. The dataset of bonds excludes outliers of the 1st and 99th percentile. The variable Post equals one after the CBPP announcement, and treated is a dummy variable equal to one for IG-rated bonds and zero for non-IG rated bonds. I include time fixed effects, bond fixed effects, and the interaction of time and bond fixed effects. In the analysis on the yield spread effect, the bid-ask spread with one lag is included as a control for liquidity. Standard errors are clustered at the bond level. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

In column (3), incorporating a one-lag bid-ask spread as a liquidity control slightly changes the effect on the yield spread for eligible bonds compared to non-eligible bonds and results in an increase of the R-squared to 0.38. However, the coefficient is not statistically significant.

Column (4) is redundant for the real estate analysis. Since all the firms that has issued the bonds are within the CRE sector, controlling for industry fixed effects through an interaction with time fixed effects does not alter the results from column (3).

In table 14, I present the results for bonds issues by non-real estate firms. Looking first at the effect on the yield spread suggest that the CBPP may have impacted these bonds differently compared to the real estate bonds.

Table 14: Results Capital Market Analysis (Non-real estate firms)

D1: Bonds issued by Non-real estate firms: Effects on Yield Spread

Variables	(1) Yield Spread (bps)	(2) Yield Spread (bps)	(3) Yield Spread (bps)	(4) Yield Spread (bps)
Treated	-193.8**	Omitted	Omitted	Omitted
Post	244.6**	Omitted	Omitted	Omitted
Treated × Post	-193.4**	-197.0**	-112.6*	-129.4*
Industry × Time FE	No	No	No	Yes
Bond FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.05	0.03	0.40	0.50
Observations	1,285	1,285	1,093	1,093

D2: Bonds issued by Non-real estate firms: Effects on Bid-Ask Spread

Variables	(1) Bid-Ask Spread (bps)	(2) Bid-Ask Spread (bps)	(3) Bid-Ask Spread (bps)
Treated	-32.1*	Omitted	Omitted
Post	60.1**	Omitted	Omitted
Treated × Post	-29.4**	-29.8**	-19.1**
Industry × Time FE	No	No	Yes
Bond FE	No	Yes	Yes
Time FE	No	Yes	No
Controls	No	No	No
R-squared	0.02	0.03	0.03
Observations	1,114	1,114	1,114

Notes: This table reports the effect at announcement of the Riksbank CBPP on the yield spread and bid-ask spread of bonds issued by non-real estate firms, over the sample period of Q1 2019 - Q1 2021. The dataset of bonds excludes outliers of the 1st and 99th percentile. The variable Post equals one after the CBPP announcement, and treated is a dummy variable equal to one for IG-rated bonds and zero for non-IG rated bonds. I include time fixed effects, bond fixed effects, and the interaction of time and bond fixed effects. In the analysis on the yield spread effect, the bid-ask spread with one lag is included as a control for liquidity. Standard errors are clustered at the bond level. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

In the base specification for the non-real estate bonds, the coefficient of the interaction term of *Post* and *Treated* show a decrease of 193.4 bps on the yield spread for eligible bonds compared to non-eligible bonds following the announcement. However, the R-squared for this specification

is very low, only 0.05.

When incorporating time and bond fixed effects, the magnitude of the CBPP's effect on eligible compared to non-eligible non-real estate yield spreads shifts downwards slightly, to -197 bps. Still, the R-squared is very low. Although both the coefficients for the specifications in column (1) and (2) are significant at the 1% level, the R-square is near zero, suggesting that the model predicts almost none of the outcome of the yield spread between the groups, leaving room for further investigation and refinements of the specification.

The introduction of a liquidity control in column (3) reduces the effect size of the CBPP on yield spreads for eligible compared to non-eligible, non-real estate, bonds to -112.6 bps, with a 5% significance level and an increase in R-squared from 0.03 to 0.40. The increase in R-squared suggest that the liquidity of the bonds plays a larger role in explaining the effect on the bond yield spread in the sample of non-real estate bonds, possibly more so than in the sample of real estate bonds.

The most refined specification in column (4) of panel D1 includes an additional control for industry time fixed effects. The result is another change in the effect size of the CBPP on yield spreads of eligible versus non-eligible bonds, now to -129.4 bps, and again significant at the 5% level. This adjustment of the effect size, in combination with slightly increased R-squared value to 0.50, can indicate that there are variability across industries regarding the effect on the yield-spread of bonds for eligible versus non-eligible bonds after announcement.

Overall, the comparison between real estate and non-real estate bonds suggests that the decrease in yield spreads for eligible bonds compared to non-eligible bonds might be smaller in size for real estate bonds than for non-real estate bonds. However, this observation is accompanied by considerable variability in the significance of coefficients and R-squared values across both datasets, which introduces uncertainty. Notably, eligible bonds in both sectors show a decrease in yield spreads compared to non-eligible bonds following the CBPP announcement, indicative of a consistent direction in the policy's effect and in line with this study's hypothesis. Hence, eligible bonds seem to "benefit" more of the CBPP than non-eligible bonds, as the yields seem to decrease more compared to non-eligible bonds. However, the extent of this decrease varies, and with generally low R-squared values and variable levels of significance, these results provide limited evidence of the effect on the CBPP on eligible bonds versus non-eligible bonds.

I will further discuss limitations with my specifications affecting the validity of the results, in section 7.1.

Effects on the bid-ask spread

In addition to looking at the yield spread of bonds, I also investigate how the liquidity of the bonds were impacted by the CBPP by looking at the bid-ask spread. As with the yield data, I run a basic differences-in-differences model for both real estate bonds and non-real estate bonds.

Table 13, panel C2, illustrates the effects on bid-ask spreads for real estate bonds, employing the methodology specified in Equation (3). When including bond and time fixed effects in column

(2), the interaction term shows a modest decrease of 17.4 bps in bid-ask spread for eligible real estate bonds following the CBPP announcement compared to their non-eligible counterparts. However, the coefficient is not statistically significant, and the explanatory power of the models, as indicated by R-squared values of 0.09 remains limited.

Contrasting these findings, Table 14, panel D2, which focuses on non-real estate bonds, reveals a slightly more pronounced effect. With time and bond fixed effects accounted for in column (2), the interaction term suggests a reduction in bid-ask spread of 29.8 bps, significant at the 1% level. Despite the statistical significance, the very low R-squared values, close to 0 in all specifications, suggest that any result should be carefully examined since the models only explain a minimal portion of the outcome in bid-ask spreads. The effect size moderates to a 19.1 bps reduction when industry time fixed effects are included, indicating some sensitivity to sector-specific dynamics.

Comparing these results, it appears that non-real estate bonds exhibit a more substantial liquidity response to the CBPP compared to real estate bonds, albeit the overall low explanatory power across both datasets calls for a conservative interpretation. The direction of the coefficient is the same for real estate and non-real estate bonds. Following the CBPP announcement the bid-ask spreads of eligible bonds decreases, indicating that the eligible bonds may possibly experience better liquidity than the control group as a result of the program. This is in line this study's hypothesis, that the eligible bonds are less risky and therefore can be more attractive to invest in during uncertain times like the Covid-19 pandemic. The differences in effect sizes and statistical significance between the two sectors might suggest varying degrees of sensitivity to policy changes, yet the reliability of these findings should be considered low.

I will further discuss limitations with my specifications, affecting the validity of the results, in section 7.1.

6.1.4 Placebo test

To evaluate the results from the yield spread analysis, as these despite low R-squared values, show a decrease in yield spreads for eligible real estate and non-real estate bonds, I conduct a placebo test to rule out that my results are not driven by other quantitative easing policies of the Riksbank. In April 2019, the Riksbank announced that they would purchase government and cover bonds. I run a simple placebo test where I bound the sample to Q1 2019 - Q4 2019, with the post period equal to one after Q2 2019. I find no significant effect for the yield spread for eligible compared to non-eligible bonds, in either the sample for the real estate bonds or non-real estate bonds. I report the results of the placebo test in table 15.

Table 15: Placebo test of the effect of the CBPP on yield spread

Placebo test, bonds issued by real estate firms: Effects on Yield Spread

Variables	(1) Yield Spread (bps)	(2) Yield Spread (bps)	(3) Yield Spread (bps)	(4) Yield Spread (bps)
Treated × Post	11.223	9.662	9.822	9.822
Industry × Time FE	No	No	No	Yes
Bond FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.24	0.00	0.02	0.02
Observations	907	907	907	907

Placebo test, bonds issued by Non-real estate firms: Effects on Yield Spread

Variables	(1) Yield Spread (bps)	(2) Yield Spread (bps)	(3) Yield Spread (bps)	(4) Yield Spread (bps)
Treated × Post	-13.634	-15.003	-16.026	-7.508
Industry × Time FE	No	No	No	Yes
Bond FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.04	0.02	0.44	0.07
Observations	490	490	490	490

Notes: This table reports the robustness test for the effect of the Riksbank CBPP on the yield spreads of eligible bonds. The sample is bound to 2019, in which *Post* equals one after Q2 2019. I run the same specifications as in the main analysis, where I include time fixed effects, bond fixed effects, and the interaction of time and bond fixed effects, as well as the bid-ask spread with one lag as a control for liquidity. Standard errors are clustered at the bond level. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

6.2 Results of the firm level analysis

In this section I will present the results of the firm level analysis. I will begin by examining the basic requirements of the data for conducting a difference-in-difference analysis: the parallel trends assumption evaluated both graphically and through statistical testing. After that I will move on to discuss the results of the DiD analysis of the effect of the CBPP on the debt structure of both real estate and non-real estate firms.

6.2.1 Parallel trends identification for the firm level analysis

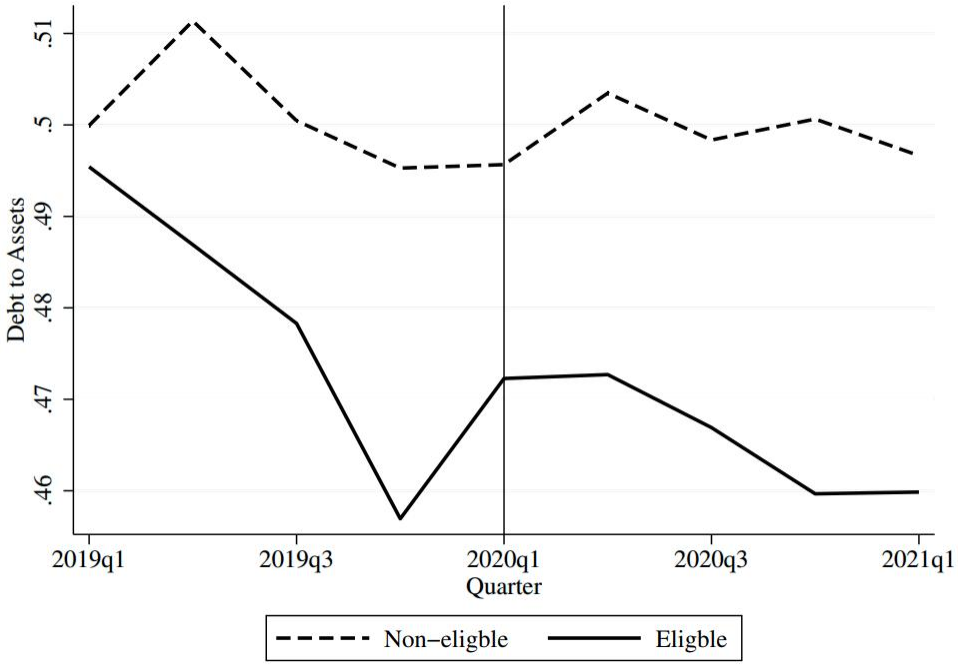
In this section I will investigate graphically whether there are parallel trends for my three proxies for leverage used as dependent variables in my firm-level analysis. First, I will look at the the CRE firms, investigating the parallel trends assumption for the long-term debt to asset ratio

between eligible and non-eligible bonds, the total bond to asset ratio, and the term loan to asset ratio. I then conduct the corresponding analysis for non-real estate firms.

Real estate firms

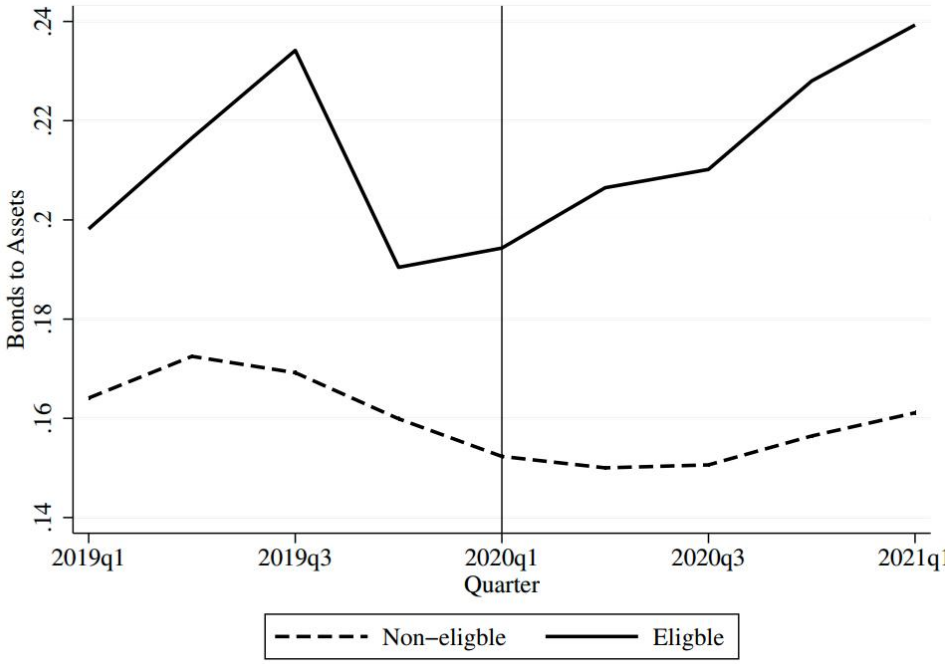
Figure 19 evaluates the parallel trends assumption in the long-term debt-to-asset ratio for eligible and non-eligible real estate firms. The observed divergence, marked by a significant decline in the ratio for eligible firms and a corresponding rise for non-eligible firms at the start of 2019, challenges the validity of the parallel trends assumption. The fact that the trends appear to move in different directions suggests that there are pre-existing differences in financial strategies or market conditions which may influence the results, potentially confounding the treatment effects in a difference-in-differences analysis. Further statistical tests for parallel trends and Granger causality will be conducted in the subsequent section. However, given the lack of support for parallel trends identified by graphical analysis, any results derived from applying difference-in-differences to this variable should be interpreted with caution.

Figure 19: Long-term debt to asset ratio for Eligible and Non-eligible real estate firms



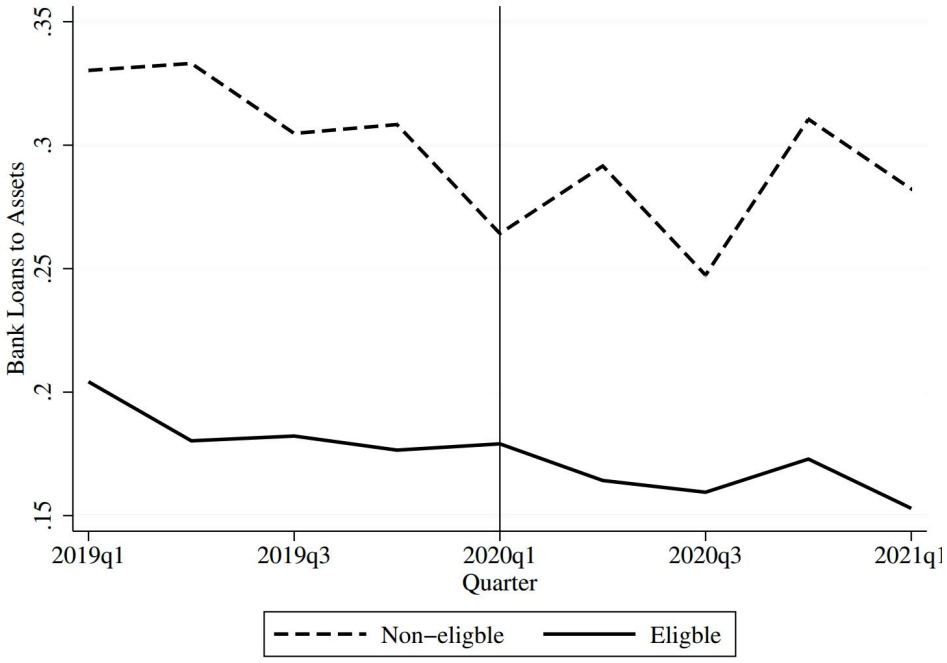
The plotted means for the total bond to asset ratio for eligible and non-eligible real estate firms before the treatment are presented in figure 20. The eligible firms show a volatile trend with a sharp peak in mid-2019 followed by a decline and subsequent stabilization before the treatment period. Non-eligible firms exhibit a slight increase in early 2019, thereafter displaying a gradual downward trend throughout the same period. The different patterns observed for the two groups suggests, as for the long-term debt to assets ratio, that the parallel trends assumption may be violated. The different trends indicate that other factors besides the announcement of the CBPP might be influencing these bond to asset ratio, complicating any the interpretation of any treatment effect observed in this analysis.

Figure 20: Total bond to asset ratio for Eligible and Non-eligible real estate firms



Similar to observations in Figures 19 and 20, Figure 21 displays difference in pre-treatment trends between eligible and non eligible real estate firms. Eligible firms maintain a stable, slightly declining term loan to asset ratio throughout most of the period, whereas non-eligible firms exhibit a more volatile trend. The trends are more similar compared to the other leverage variables investigated above, but they still display some differences. Thus, as with the previous variables, results from a straightforward difference-in-differences approach without methodological adjustments or the inclusion of control variables to address these pre-existing differences should be treated with care.

Figure 21: Term loan to asset ratio for Eligible and Non-eligible real estate firms



Despite the varied evidence in support of the parallel trends assumption presented in this section, it is important to note that these observations are based on a limited time frame. Examining the development of these variables for a longer period might reveal other trends between the groups. Additionally, the scale of the y-axis should be considered; the fluctuations, while visually apparent, represent relatively small changes in the actual ratios. As such, it is important not to draw too stark conclusions before the statistical testing of the parallel trends assumptions presented in the next section. However, the graphical visualisation clearly shows that there is a high possibility of violation of the parallel trends assumption for the real estate firm analysis.

Non-real estate firms

Figure 22 shows the trend in means for the long-term debt to asset ratio of eligible and non-eligible non-real estate firms over the study's time period. The eligible firms maintain a rather flat trend, whereas the non-eligible firms display a slight increase followed by a slight decrease. The differing trends before the treatment suggest non-parallel trends, similar to patterns observed in previous figures for the real estate firms.

Figure 22: Long-term debt to asset ratio for Eligible and Non-eligible non-real estate firms

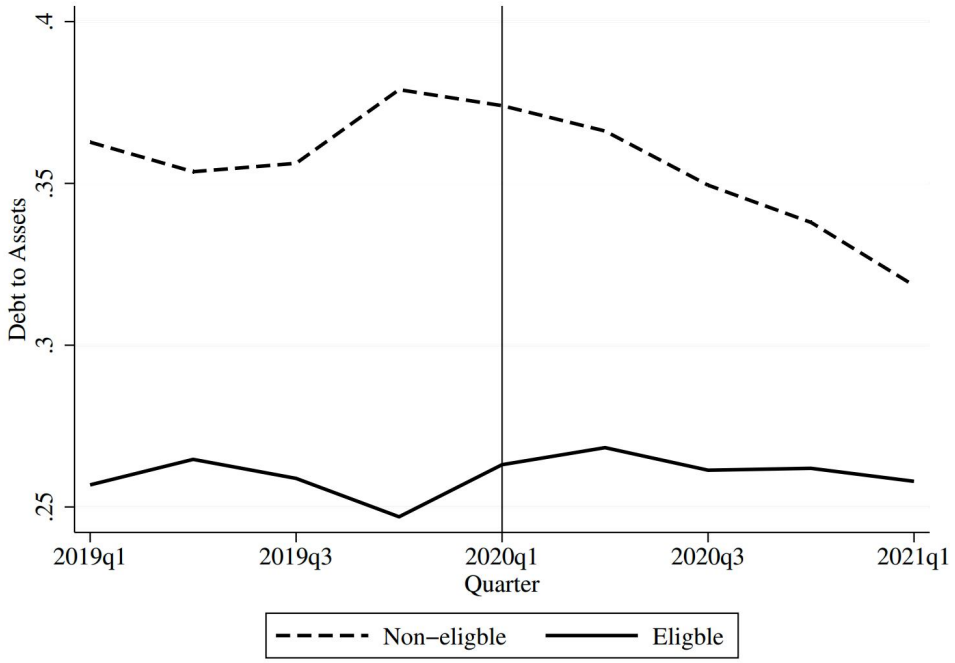
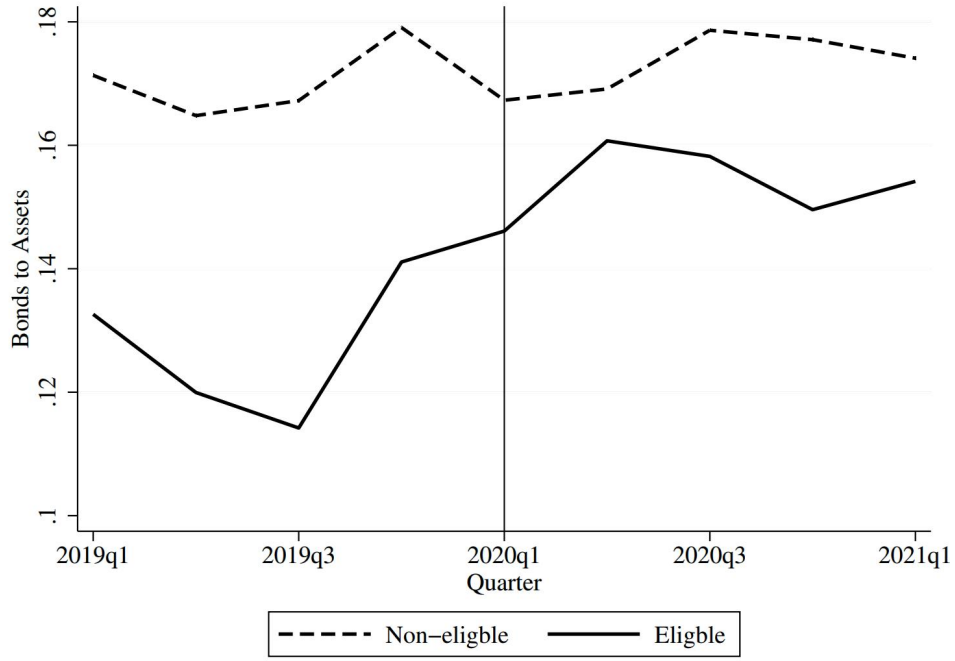


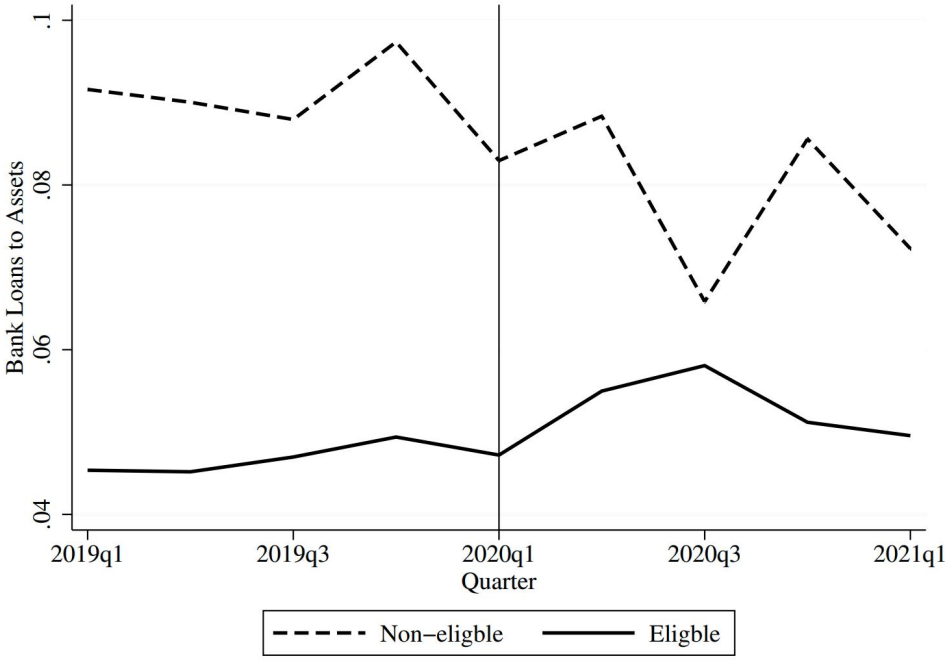
Figure 23 show that both eligible and non-eligible firms first exhibit a downward trend in Q1 2019, followed by upward trends and then a downward trend around Q4 2019 in their bond to asset ratios. The trends are not perfectly parallel, but the overall development of the variables do appear to display a similar pattern. Thus, there might be more evidence in favour of the parallel trends assumption in this variable compared to some of the ones previously discussed.

Figure 23: Total bond to asset ratio for Eligible and Non-eligible non-real estate firms



When looking at the means in table 24 of the term loan to asset ratio for eligible and non-eligible non-real estate firms, they demonstrate similar trends even if the non-eligible bonds show sharper fluctuations. Initially, both groups maintain relatively stable levels throughout early 2019. Subsequently, there is an increase, peaking in the second half of 2019. After this peak, both ratios decline as they approach the treatment period. The graphical interpretation suggest a potential compliance with the parallel trends assumption.

Figure 24: Term loan to asset ratio for Eligible and Non-eligible non-real estate firms



6.2.2 Statistical tests for parallel trends identification

The graphical analysis of parallel trends indicated that there were several variables which may violate the assumption. Similar to my approach in the capital market analysis, I test the parallel trends assumption statistically in Table 16 as well as through a Granger causality test, presented in Table 17.

As with the capital market analysis, the firm level analysis does have some missing values - not for the dependent variable, but for some of the controls. When testing for parallel trends and Granger causality, I want to employ my most refined specification, i.e. including fixed effects and controls to reflect my main analysis (see Equation (4)). Given Stata's limitations hindering the deployment of a parallel trends test and the Granger causality test with an unbalanced dataset, I needed complete data across all variables and observations. Consequently, the real estate sample for these tests excludes 45 observations, representing five firms in total, and 20 firms were excluded from the non-real estate dataset. This restriction of the dataset impacts the validity of the test results in table 16 and 17, and together with the questionable outcomes from the graphical visualization of trends, suggests that these findings should be approached with caution.

The results of the parallel trends test in Stata shows that there is not sufficient evidence to reject the null hypothesis of parallel trends for all three variables across the two datasets, hence supporting the parallel-trends assumption. Furthermore, I conduct a Granger causality test in Stata for the same variables, which shows that we do not have sufficient evidence to reject the null hypothesis of parallel trends prior to the treatment period.

Table 16: Parallel trends test

H0: Linear trends are parallel		
Real estate firms	F-test	Prob>F
Long-term debt to assets	F(1, 12) = 0.00	0.9803
Total bond to asset ratio	F(1, 12) = 1.37	0.2652
Total term loan to asset ratio	F(1, 12) = 0.14	0.7176
Non-real estate firms	F-test	Prob>F
Long-term debt to assets	F(1, 44) = 1.62	0.2095
Total bond to asset ratio	F(1, 44) = 0.21	0.6475
Total term loan to asset ratio	F(1, 44) = 0.00	0.9623

Table 17: Granger causality test

H0: No effect in anticipation of treatment		
Real estate firms	F-test	Prob>F
Long-term debt to assets	F(4, 12) = 0.25	0.9070
Total bond to asset ratio	F(4, 12) = 1.15	0.3810
Total term loan to asset ratio	F(4, 12) = 1.02	0.4354
Non-real estate firms	F-test	Prob>F
Long-term debt to assets	F(4, 44) = 1.39	0.2547
Total bond to asset ratio	F(4, 44) = 2.21	0.0832
Total term loan to asset ratio	F(4, 44) = 0.35	0.8398

The discrepancy between the statistical test results and the graphical trends underscores the need for a cautious interpretation of the firm-level results, especially since the datasets used in the statistical test for parallel trends and the Granger test is restricted to include firms with no missing values across the entire time period of my study. While the statistical tests do not reject the parallel trends assumption per se, the visible differences in trends between the groups for several variables indicate potential underlying differences between treatment and control groups that are likely to influence the results. However, as mentioned above, the lack of visual support for the parallel trends assumption may also be explained by a range of factors, including the short time period of the analysis, and the compressed y-axis, making any difference that in reality is small appear much larger in the figure.

6.2.3 Results from difference-in-difference

In this section, I look at the effect of the CBPP on firm's capital structure. As described in Chapter 5, the hypothesis for this study is that the lower yields for eligible firms is expected to

make bond financing a more attractive option for this group, potentially leading to a decline in other financing methods. Analysis of capital market data, presented in the preceding section, indicates that yield spreads for eligible bonds have indeed decreased in both the real estate and non-real estate sectors relative to non-eligible bonds. Consequently, this analysis focuses on assessing changes in the capital structures of eligible firms following the CBPP announcement, as per the research design by Grosse-Rueschkamp et al. (2019). Specifically, I investigate shifts toward increased bond financing, as well as changes in bank financing and overall debt burden.

I will begin with looking at the results pertaining to real estate firms, followed by those of non-real estate firms. Finally, I will address potential limitations of my specifications and dataset, which may impact the validity and interpretation of the findings.

Real estate firms

First, it is important to clarify that compared to the Capital Market analysis, I categorize the real estate firms into sub-groups within the real estate sector. Hence, adding industry time fixed effects is relevant in this analysis.

In Panel A1 of Table 18, the coefficients of the interaction terms throughout column (1) - (4) are all statistically insignificant. Looking at the coefficients for the specification, they exhibit a very small decrease in the long-term debt to asset ratio for eligible real estate firms, compared to non-eligible real estate firms. For all four specifications, the R-squared values are almost zero, indicating that the announcement of the CBPP has no or very low explanatory power of the outcome variable. Based on these results, the CBPP has no effect on the long-term debt to asset ratio for eligible real estate firms compared to non-eligible real estate firms.

Table 18: Results Firm Level Analysis (Real-estate firms)

A1: Real estate firms: Effects on Long-term debt to Asset ratio

Variables	(1) Long-term debt / Assets	(2) Long-term debt / Assets	(3) Long-term debt / Assets	(4) Long-term debt / Assets
Treated	-0.02	Omitted	Omitted	Omitted
Post	0.02	Omitted	Omitted	Omitted
Treated × Post	-0.01	-0.02	-0.00	-0.00
Industry × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.03	0.01	0.01	0.03
Observations	243	243	233	233

A2: Real estate firms: Effects on Total-bond debt to Asset ratio

Variables	(1) Total-bond debt / Assets	(2) Total-bond debt / Assets	(3) Total-bond debt / Assets	(4) Total-bond debt / Assets
Treated	0.04	Omitted	Omitted	Omitted
Post	-0.00	Omitted	Omitted	Omitted
Treated × Post	0.02	0.02	0.02	0.02
Industry × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.04	0.03	0.03	0.04
Observations	243	243	233	233

A3: Real estate firms: Effects on Term loan to Asset ratio

Variables	(1) Term loans / Assets	(2) Term loans / Assets	(3) Term loans / Assets	(4) Term loans / Assets
Treated	-0.14	Omitted	Omitted	Omitted
Post	0.00	Omitted	Omitted	Omitted
Treated × Post	-0.00	-0.00	-0.00	0.02
Industry × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.15	0.01	0.17	0.50
Observations	180	180	170	170

Notes: This table reports the effect at announcement of the Riksbank CBPP on long-term leverage, bond financing, and bank financing for real estate firms. The sample period spans from Q1 2019 - Q1 2021, and *Post* equals one in Q2 2020 and onwards. Treated is a dummy variable equal to one for IG-rated firms and zero for non-IG rated firms. I include time fixed effects, firm fixed effects, *industry x firm* fixed effects, and firm-level controls (size, profitability, tangibility, market-to-book value). Standard errors are clustered at the firm level. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

Moving on to Panel A2 of Table 18, which presents the effects on the total bond debt to asset ratio, the findings are consistent with those for the long-term debt to asset ratio. The coefficients across all four specifications are insignificant, reaffirming that the announcement of the CBPP had no observable effect on the total bond to asset ratio of eligible real estate firms in comparison to non-eligible firms. All coefficients are 0.02, hence indicating a 2% increase in the bond debt to asset ratio after the CBPP. However, since the differences are statistically insignificant and given the low R-squared for each specification, the results are in line with the previous finding that the CBPP's has very low explanatory power regarding changes in bond debt to assets both within and between firms.

In Panel A3 of Table 18, I look at the effect on the term loans to asset ratio. The results in this panel mirror those seen in earlier panels, with none of the interaction term coefficients being statistically significant. The coefficients are almost zero, except for a slightly positive value of 0.02 in column (4), representing a 2% increase in term loans to assets. Notably, the R-squared value in the fourth column, which includes industry time fixed effects, rises significantly to 0.50. This suggests that when we account for industry-specific trends over time, the model explains a larger portion of the variability in term loans to assets for eligible real estate firms. This indicates that there may be within-sector variations that affect the outcome variable. In summary, the results does not support a significant impact of the announcement of the CBPP on the term loan to asset ratio of eligible real estate firms compared to non-real estate firms.

In summarizing the results of the CBPP announcement on CRE firms, the analysis reveals no significant impact on any of the coefficients. Furthermore, the coefficients of the interaction terms are small in size, and the low R-squared values further underscore the lack of significant findings.

Non-real estate firms

Table 19 presents the results for non-real estate firms. In Panel B1, the effects on the long-term debt to asset ratio are similar to those observed for real estate firms, with all coefficients across the four specifications being insignificant and with R-squared values close to zero. A notable difference is that the interaction term coefficients are positive, indicating that, in contrast to real estate firms, eligible non-real estate firms might have slightly increased their long-term debt to asset ratios by 2-3% following the CBPP announcement. However, given that the difference is not statistically significant, this only provides an indication at best, and should not be viewed as a conclusive result of the analysis.

Table 19: Results Firm Level Analysis (Non-real estate firms)

B1: Non-real estate firms: Effects on Long-term debt to Asset ratio

Variables	(1) Long-term debt / Assets	(2) Long-term debt / Assets	(3) Long-term debt / Assets	(4) Long-term debt / Assets
Treated	-0.10	Omitted	Omitted	Omitted
Post	-0.01	Omitted	Omitted	Omitted
Treated × Post	0.03	0.03	0.03	0.02
Industry × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.03	0.00	0.06	0.01
Observations	612	612	603	603

B2: Non-real estate firms: Effects on Total-bond debt to Asset ratio

Variables	(1) Total-bond debt / Assets	(2) Total-bond debt / Assets	(3) Total-bond debt / Assets	(4) Total-bond debt / Assets
Treated	-0.04	Omitted	Omitted	Omitted
Post	-0.01	Omitted	Omitted	Omitted
Treated × Post	0.03*	0.03*	0.03*	0.03*
Industry × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.01	0.00	0.02	0.03
Observations	552	552	546	546

B3: Non-real estate firms: Effects on Term loan to Asset ratio

Variables	(1) Term loans / Assets	(2) Term loans / Assets	(3) Term loans / Assets	(4) Term loans / Assets
Treated	-0.04	Omitted	Omitted	Omitted
Post	-0.01	Omitted	Omitted	Omitted
Treated × Post	0.02	0.02	0.02	0.05
Industry × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
R-squared	0.01	0.00	0.00	0.91
Observations	612	612	603	603

Notes: This table reports the effect at announcement of the Riksbank CBPP on long-term leverage, bond financing, and bank financing for non-real estate firms. The sample period spans from Q1 2019 - Q1 2021, and *Post* equals one in Q2 2020 and onwards. Treated is a dummy variable equal to one for IG-rated firms and zero for non-IG rated firms. I include time fixed effects, firm fixed effects, *industry x firm* fixed effects, and firm-level controls (size, profitability, tangibility, market-to-book value). Standard errors are clustered at the firm level. *, ** denote significance at the 5% and 1% level respectively.All variables are defined in Appendix Table 22.

In Panel B2, examining the total bond debt to asset ratio, the interaction term coefficients are consistently 0.03 across all specifications and significant at the 5% level. Despite these significant findings, the low R-squared values suggest that the results should be interpreted with caution. In real terms, the results suggests a 3% increase in the bond to asset ratio for eligible non-real estate firms compared to their non-eligible counterparts post-CBPP.

Lastly, Panel B3 exhibit the effects on the term loan to asset ratio. In this analysis, all interaction term coefficients are insignificant. The coefficients are positive, which differs from those observed for real estate firms, suggesting a different direction of a potential effect. However, given the statistical insignificance and the variability in the results, one cannot draw any conclusions about the direction or magnitude of a potential impact of the CBPP. The low R-squared values in columns (1) - (3) further highlight the limited explanatory power of the models. However, there is an observable increase in the R-squared value for the fourth specification, which includes industry time fixed effects. As with the real estate results, this increase suggests that industry-specific factors might influence the term loans to asset ratio.

To summarize the results of the firm-level analysis, the findings indicate that, despite the expectations set forth in my hypothesis, the CBPP did not significantly affect the financing behaviors of eligible firms compared to non-eligible firms in terms of long-term debt, total bond debt, and term loans to asset ratios for the real estate sector. The coefficients were largely insignificant, and the R-squared values remained close to zero, highlighting a minimal explanatory power of the CBPP on these outcomes. While the results were similar for the non-real estate firms, with insignificant effects in most cases, the total bond debt to asset ratio showed a small yet statistically significant increase of 3%. This might suggest a mild shift towards bond financing post-CBPP for eligible non-real estate firms compared to non-eligible firms. However, this result should be treated with care given the low R-squared value indicating the limited ability of the model to explain any observed variation.

6.3 Results of the bank lending analysis

The purpose of this section is to investigate how the Riksbank's purchases of corporate bonds have impacted banks' lending, specifically lending to the CRE sector. By purchasing bonds issued by CRE firms, the Riksbank should contribute to a reduced need for these firms to rely on lending from banks to fill their credit needs. The question that is set out to be investigated in this chapter is whether this is visible in the banks' balance sheets. Do the banks change the composition of their lending portfolio following the large-scale purchases of corporate bonds by the Riksbank? And if so, does this change differ between banks that are more or less constrained in their lending. Given the composition of the banking sector in Sweden, it is difficult to get enough data points for an analysis of sufficient power. As such, any results from this analysis should be interpreted with care and viewed as correlational at best.

The results from the bank analysis is presented in Table 20. The table is divided into two main parts, based on the two ways in which I measure the constraint of their lending, first based on their Tier 1 capital ratio, second based on their share of non-performing loans of total loans. For both measure of constraint I examine the banks loan structure through four different measures:

total loans, household loans, corporate loans, and commercial real estate loans. For each measure, I look at the logarithm, the natural logarithm, and its share of total loans. The goal is to see whether the banks defined as more constrained in their lending have changed their loan structure following the CBPP announcement. In all specifications, I include bank fixed effects, and in line with Dhital et al. (2023), I control for Size (using the natural logarithm of Total Assets), Equity normalized for Assets, and Return on Assets (ROA).

Table 20: Results Bank Lending Analysis

Spillovers of central bank corporate bond purchases: bank constraints

Bank tier 1 ratio	**Total loans**			**Household loans**		
	ln()	of Total loans	d ln()	ln()	of Total loans	d ln()
Treated	Omitted	-	Omitted	Omitted	Omitted	Omitted
Post	-0.0556	-	0.0206	-0.0058	0.0290*	0.0208*
Treated × Post	0.0945	-	0.0147	0.0603*	-0.280	0.0038
Bank FE	Yes	-	Yes	Yes	Yes	Yes
Controls	Yes	-	Yes	Yes	Yes	Yes
R-squared	0.68	-	0.53	0.40	0.49	0.93
Observations	104	-	99	104	104	99
	Corporate loans			**Commercial real estate loans**		
	ln()	of Total loans	d ln()	ln()	of Total loans	d ln()
Treated	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
Post	-0.1632	-0.0323	0.0253	-0.1090	-0.0056	0.0021
Treated × Post	0.1567	0.0200	-0.0129	0.3135*	0.0248	0.0442
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.67	0.26	0.00	0.67	0.56	0.94
Observations	104	104	99	104	104	99
Non-performing loans	**Total loans**			**Household loans**		
	ln()	of Total loans	d ln()	ln()	of Total loans	d ln()
Treated	Omitted	-	Omitted	Omitted	Omitted	Omitted
Post	-0.0166	-	0.0326	0.0235	0.0136	0.0222*
Treated × Post	0.0098	-	-0.0076	-0.0005	0.0031	0.0007
Bank FE	Yes	-	Yes	Yes	Yes	Yes
Controls	Yes	-	Yes	Yes	Yes	Yes
R-squared	0.72	-	0.61	0.48	0.50	0.93
Observations	104	-	99	104	104	99
	Corporate loans			**Commercial real estate loans**		
	ln()	of Total loans	d ln()	ln()	of Total loans	d ln()
Treated	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
Post	-0.1980	-0.0519	0.0445	0.1925	0.0274	0.0505
Treated × Post	0.1699	0.0451	-0.0392	-0.2336	-0.0326*	-0.0417
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.76	0.02	0.00	0.72	0.56	0.91
Observations	104	104	99	104	104	99

Notes: This table reports the effect at announcement of the Riksbank CBPP on banks' lending. The treatment variable is defined based on whether the bank is constrained or non-constrained, with the division of treatment based on the banks tier 1 capital ratio and their non-performing loans. The dataset spans from Q1 2018 to Q1 2023. The *Post* is a dummy variable that equals one during the period following the CBPP announcement, from Q2 2020 to Q1 2023. In the analysis I control for a variety of bank characteristics: the logarithm of total assets, equity to assets, ROA, and I also include bank fixed effects. The standard errors are clustered at the bank level. *, ** denote significance at the 5% and 1% level respectively. All variables are defined in Appendix Table 22.

An initial examination of the results reveals that, for constrained banks divided according to their Tier 1 ratio and NPL ratio, significant effects on the coefficient of the interaction term (Treated x Post) are evident for CRE loans. This finding is noteworthy, given the relatively small dataset and the limitations of the Swedish banking market. Despite these constraints, there appears to be an observable effect on the proportion of commercial real estate loans. However, the direction of the coefficients varies depending on whether banks are classified as constrained based on their Tier 1 ratio or NPL ratio.

As outlined in Section 5.3.1, classification based on the NPL ratio seems to be the most reliable method for defining the treatment groups. Consequently, these results warrant closer attention. For commercial real estate loans, constrained firms defined by the NPL ratio have experienced a decrease of 3.3% in the share of commercial real estate loans to total loans relative to non-constrained firms in the post-CBPP period. In contrast, for constrained firms defined by the Tier 1 ratio, the corresponding coefficient is positive, at 2.5%, but it lacks statistical significance and thus cannot be regarded as a meaningful effect.

For constrained banks classified by the NPL ratio, all interaction term coefficients related to commercial real estate loans are negative. However, only the share of commercial real estate loans to total loans is significant, at the 5% level. Regarding constrained firms identified by their Tier 1 ratio, the coefficient for the natural logarithm of commercial real estate loans is 31.4%, also significant at the 5% level. This suggests a substantial increase in loans to commercial real estate firms. However, since the classification based on Tier 1 ratios is questionable, this result is likely skewed and overestimated.

Lastly, the relatively high R-squared across multiple specifications, despite insignificant effects following the CBPP announcement, raises valid concerns. One issue could be that there is heterogeneity present in the dataset, where treatment effects may vary significantly across different banks, leading to overall insignificant results despite high R-squared values. Another challenge is the small sample size, which in itself could result in limited statistical power.

To increase the dataset size, I extended both pre- and post-treatment periods compared to the capital market and firm-level analyses. However, the Swedish context is inherently challenging to analyze due to inconsistencies in data reporting between banks and the concentration of the market among a few dominant players. Nevertheless, as outlined in the methodology for the bank analysis, the sample represents approximately 70% of the market, highlighting the unique characteristics of the Swedish banking sector.

These challenges emphasize the need to carefully interpret the results. Further sensitivity analyses could help account for heterogeneity, and robustness checks may reveal insights that complement the existing findings.

7 Discussion of results

In this section, I will discuss the results of my three analyses, highlighting the implications of my findings and elaborating of the limitations of each part. I will also discuss potential avenues for further research.

7.1 Capital market analysis

The results from the capital market analysis suggest that there is indeed a decrease in the yield spreads of eligible bonds compared to non-eligible bonds following the announcement of the CBPP, for both CRE bonds and non-real estate bonds. These results indicate a consistent direction in the policy's effect: that eligible bonds "benefit" more from the CBPP than non-eligible bonds. Interestingly, when comparing the results for CRE bonds and non-real estate bonds, the effect size of the decrease in yield spreads is smaller for the eligible real estate bonds compared to the eligible non-real estate bonds. My results are in line with the research on the effect on yield spreads of central bank's corporate bond purchase programs, such as M. Joyce et al. (2011) and Abidi and Miquel-Flores (2018). A difference from the Grosse-Rueschkamp et al. (2019) study is that I find that the decrease in yield spreads are significant for eligible firms in general, and not only for BBB-rated firms. Furthermore, the effect size of the decreases in yield spread for non-real estate companies is larger compared to the findings in related research, while the decrease in yield spread of real estate firms are more in line with the effect size at announcement in other studies.

The larger effect size in the analysis of non-real estate bonds may be a result of one of the limitations of my study, the risk of bias due to credit ratings not being randomized between the treatment and control groups. This limitation prompts a cautious interpretation of the findings, as the bonds or firms in the treatment and control group may not react in the same way to external shocks or other unobservable variables. A significant external shock coinciding with the CBPP was the COVID-19 pandemic, occurring in the same quarter as the policy's implementation. This timing complicates the analysis, as I am not able to isolate the effects of the CBPP from those of the pandemic. Hence, as discussed in section 4.4, the results are likely to show the upper-bound of the CBPP effect which could explain the larger effect size in my specifications.

The absence of analysis on non-eligible firms in particular also limits the understanding of the broader market reactions to the CBPP. The pandemic introduced unprecedented volatility into the financial markets and one might suspect that the volatility in the market affected the yield spreads of riskier assets, like those represented by non-eligible bonds, which could have experienced more pronounced increases in yield spreads compared to their eligible counterparts. Such an external shock might amplify the apparent effect of the CBPP on the yield spreads of eligible bonds, potentially distorting the true impact of the policy. Similarly, the same reasoning could be applied to the analysis of the bid-ask spreads, although this analysis showed inconsistent results. The inconsistency itself might hint at underlying complexities introduced by the same market shock, or by other unobserved variables.

Given that real estate companies represent a larger segment of the Swedish bond market compared to other sectors, it's plausible that trading in these bonds might be inherently more stable. Such stability could mean that, in the face of shocks like COVID-19, real estate bonds might not exhibit the same level of volatility as seen in other sectors. This relative stability could, in turn, explain why we observe a smaller effect on the yield spreads for real estate companies compared to non-real estate bonds.

Consequently, the differences noted in my results might not solely be attributable to the effects of the CBPP. Instead, they could also reflect underlying industry-specific variations within the bond market. These variations might cause distinct responses to the COVID-19 shock and its associated market volatility, as opposed to representing a genuine disparity in how different sectors respond to the CBPP itself. In the study by Grosse-Rueschkamp et al. (2019), they find no significant difference between the yield spread of eligible relative to non-eligible bonds after the announcement of the corporate purchase program of ECB in Q1 of 2016. This difference in the result is plausible because that study evaluates the effect of ECB quantitative easing in 2016 when the market was in a more normal situation and investors had more risk appetite to invest in higher-risk assets than during the COVID-19 pandemic period.

An interesting observation from the graphical visualization of the parallel trends is that the decline in the yield spread and bid-ask spread appears to begin in Q2, rather than in Q1 when the CBPP was announced. When looking at the graphs, initially, there is an increase in both the yield and bid-ask spreads, followed by a sharp decline around Q2. This pattern is noteworthy considering that, as outlined in Section 2.4.1, it was in June that the Riksbank released more detailed information about the specific types of bonds to be included in the CBPP.

A potential refinement of this analysis could therefore be to explore whether the initial announcement of the CBPP in March or the subsequent specifications provided in June have differing impacts. However, this study adheres to the approach used by Grosse-Rueschkamp et al. (2019), focusing on the immediate effects following the CBPP announcement. It would be interesting for a subsequent study to specifically investigate the timing of the observed effects—whether they are larger at the announcement, upon the detailed specification in June, or at the point of actual purchase in September.

7.2 Firm level analysis

The results of my firm level analysis differ from those of Grosse-Rueschkamp et al. (2019), De Graeve and Iversen (2017), and De Santis and Zaghini (2021), as I generally could not find significant effects on the financing behaviors of firms post-CBPP. Furthermore, my results highlighted that the CBPP had low explanatory power on the real estate firm's capital structure. However, it is important to acknowledge what my analysis focuses on: whether there are any significant differences in the effect of the CBPP on eligible firms versus non-eligible firms. For the real estate firm analysis, my results could indicate that the difference between eligible and non-eligible group is not significant, but instead that both eligible and non-eligible firms may have increased their bond financing in tandem after the CBPP. However, I do not evaluate this in my study but leave it for further research. It would be interesting to look into the research

design of Galema & Lugo (2017) and Arce et al. (2020), who noted an increase in bond issuance also by non-eligible firms following corporate QE announcements, implying substitution effects from loans to bonds even for non-eligible firms.

While the results were similar for the non-real estate firms, with insignificant effects in most cases, the total bond debt to asset ratio showed a small yet statistically significant increase of 3%. This might suggest a mild shift towards bond financing post-CBPP for eligible non-real estate firms compared to non-eligible firms. However, this result should be treated with care given the low R-squared value indicating the limited ability of the model to explain any observed variation.

In the firm-level analysis, the pandemic's overlapping impact could be hiding or distorting the changes attributed to the CBPP, supported by largely inconsistent and insignificant results with low R-squared values across. Furthermore, when controlling for industry time fixed effects, one could see that the R-squared values increased, suggesting that changes might be more closely tied to sector-specific responses to the pandemic or other unobservable within-sector variations.

Moreover, the limitation of only analyzing public firms due to scarce data availability of private firms may not fully capture the effects of policies like the CBPP on the broader Swedish firm landscape. A more comprehensive analysis including private firms could potentially reveal distinct results across the market. Despite these limitations, my research design, which is based on the methodology of Grosse-Rueschkamp et al. (2019), aims to assess the impact of eligibility for Riksbank purchases. While it is overall true that investment-grade firms are mainly public firms, and that the summary statistics exhibit varying characteristics between the eligible and non-eligible groups in my study, the exclusivity to public firms might not reflect the full market dynamics.

Replicating the study of Grosse-Rueschkamp et al. (2019) within a Swedish context also presents additional challenges. The dataset is notably smaller, and dividing firms into real estate and non-real estate categories further reduces the number of observations, which may hinder robust statistical analysis. Moreover, the scale of ECB purchases in the study by Grosse-Rueschkamp et al. (2019) was much larger, and the market conditions were more stable during their study period (2015-2017) compared to the volatility encountered during the pandemic, which could skew comparative results between my study and the results of the study by Grosse-Rueschkamp et al. (2019).

For example, one possible explanation to why we cannot see any clear effect on the leverage ratios in the firm analysis, is that the effects of the CBPP may manifest later than Q2 2020 as firms might take longer to react. This could be particularly true for real estate companies, which typically carry higher average debt ratios and face long loan maturities. Hence, adjustments to their debt capital structure might take more time post-announcement. However, these are only my speculations and, ultimately, the main conclusion from this analysis is that the CBPP has not influenced the debt capital structure of eligible real estate firms compared to non-eligible real estate firms.

Building on this theme, further nuances could be added to the analysis by examining how the effects on the capital market and firm's debt structure evolve over time. Such an investigation could look at when the effects intensify or diminish, providing deeper insights into the temporal dynamics of market reactions to policy interventions.

7.3 Bank lending analysis

There are several limitations to the bank lending analysis. First of all, given the structure of the Swedish banking sector where a few larger banks dominate, it is difficult to get sufficient data for this type of analysis. Both analyses which I use as my starting point for this study are using bank data from banks from different countries (Dhital et al., 2023; Grosse-Rueschkamp et al., 2019). Since my focus is only on the Swedish market, this was not an option to me. Compounding this issue is that several of the banks operating in Sweden (including Danske Bank) did not report specific enough lending data to enable use in this analysis. This further hindered my analysis and undermined the ability to get enough statistical power to support any relevant conclusions.

Another limitation is in terms of how the bank constrains are defined. Since there are only five banks in my sample, the division of what would be considered constrained would be quite arbitrary regardless of the method used - two or three banks would have to be coded as constrained to enable a comparison that did not single out any one bank. As such, it is most likely that the differences are not large enough between the different groups for them to be considered constrained or non-constrained. The inclusion of two measures of constraint are intended to address some of the uncertainty related to this issue, but of course it does not solve it. As such, any inconclusive results may simply be due to the fact that the banks are too similar in the measure of constraint, and either all or none should actually be considered constrained in their lending.

However, focusing on the results from the bank lending analysis, it is interesting that where we can see significant coefficients in both of the datasets of constrained bank's lending is for the commercial real estate loans. This could indeed indicate that there is an impact on the lending to real estate firms. Specifically, banks constrained by their NPL ratios shows a 3.3% decrease in the share of commercial real estate loans relative to total loans post-CBPP, compared to unconstrained banks. A plausible explanation for the observed reduction in commercial real estate loans among NPL-constrained banks may relate to the strong presence of real estate firms in the Swedish bond market. Even non-eligible real estate firms might opt for bond financing over bank financing. These findings diverge from those of Grosse-Rueschkamp et al. (2019), who discovered that constrained banks increase lending to real estate firms. Whether this discrepancy reflects a genuine difference in results or the narrower scope of the analysis within the Swedish banking context remains uncertain, but it is nevertheless intriguing and a potential avenue for further research.

8 Conclusion

This study has examined the effect of the Riksbank's CBPP announcement in March 2020 on Swedish commercial real estate firms financing opportunities and debt structure. My sample consists of 349 publicly traded real estate bonds and 185 publicly traded non-real estate bonds denominated in SEK, 27 Swedish commercial public real estate firms and 68 Swedish non-financial and non-real estate public firms, as well as five of the major banks in Sweden representing roughly 70% of the total lending to the Swedish public.

The results show a decline in the yield spreads of eligible bonds compared to non-eligible bonds following the CBPP announcement, in line with the theory of signaling as a channel for how monetary policy impacts markets. This effect is observed across both CRE and non-real estate bonds, though the reduction in yield spreads is smaller for eligible CRE bonds. The bid-ask spreads of non-real estate bonds also declined significantly, indicating that the CBPP impacted the market through the liquidity channel as well, while no such effect was found for real estate bonds. At the firm level, my analysis did not find significant changes in eligible CRE firms' capital structures post announcement. For non-real estate firms, however, there was a slight increase in the bond debt-to-asset ratio, suggesting a rise in bond financing post-CBPP for eligible non-real estate firms. The results of the firm level analysis suggests that there are no spillover effects from the CBPP on the capital structure of eligible CRE firms, when compared to non-eligible real estate firms, while eligible non-real estate show a slight increase in bond financing compared to non-eligible firms.

The results for the bank lending analysis should be viewed with caution, as there are many limitations to the dataset and analysis. However, the results found indicate that there has been an effect on constrained bank's lending towards commercial real estate after the announcement, where banks constrained by their NPL ratios showed a slight decrease in their share of commercial real estate loans to total loans, compared to unconstrained banks.

Despite these results, several limitations must be considered. The study period coincided with the COVID-19 pandemic, making it challenging to distinguish the specific effects of the CBPP from those caused by the pandemic itself, potentially amplifying its perceived impact on eligible bonds. Furthermore, the study's reliance on credit ratings raises concerns regarding the randomization of treatment. Additionally, the study did not investigate the effects on non-eligible firms, and limiting the sample to only public firms further constrains the generalizability of the analysis. Lastly, the bank lending analysis faced limitations due to the unique characteristics of the Swedish banking sector, where the market is dominated by a handful of large banks. The lack of granular lending data further restricted the conclusions that could be drawn from the analysis.

Future research is needed to disentangle the CBPP effects from those of the pandemic, possibly by examining a more extended timeline. Additionally, exploring non-eligible firms' market reactions and expanding the analysis to include private firms would offer a more comprehensive view. Such studies could enhance our understanding of the CBPP's effects on CRE firms, capital markets, corporate debt structures, and bank lending practices.

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10 Appendix

Table 21: Credit Rating Scale

Scale	Moody's	Standard & Poor's (S&P)	Description
Investment grade	Aaa	AAA	Lowest level of credit risk
	Aa1	AA+	Very low credit risk
	Aa2	AA	
	Aa3	AA-	
	A1	A+	Low credit risk
	A2	A	
	A3	A-	
	Baa1	BBB+	Moderate credit risk
	Baa2	BBB	
	Baa3	BBB-	
High Yield / Speculative Bonds	Ba1	BB+	Substantial credit risk
	Ba2	BB	
	Ba3	BB-	
	B1	B+	High credit risk
	B2	B	
	B3	B-	
	Caa1	CCC+	Substantial credit risk with high possibility of default
	Caa2	CCC	
	Caa3	CCC-	
	Ca	CC	Very high level of credit risk
	C	SD/D	Default

Notes: Categorization inspired by Berk and DeMarzo (2020).

Table 22: List of variables

Variable	Source	Description
Yield-to-Maturity	Refinitiv Eikon	The mid yield to maturity of a bond, as defined by Refinitiv Eikon
Yield Spread	Refinitiv Eikon	Yield-to-maturity of a bond minus matched three months treasury bills rate
Bid price	Refinitiv Eikon	The bid price of a bond at close
Ask price	Refinitiv Eikon	The ask price of a bond at close
Bid-Ask Spread	Refinitiv Eikon	The bid price of a bond at close minus the ask price of a bond at close, divided by the ask price
Total assets	S&P Capital IQ	Total assets in SEKm
Size	S&P Capital IQ	The natural logarithm of total assets
Total equity	S&P Capital IQ	Total assets minus total liabilities
Long-term debt	S&P Capital IQ	Debt with maturities of more than one year
Total bond debt	S&P Capital IQ	Sum of outstanding senior bonds, subordinated bonds, and commercial paper
Term loans	S&P Capital IQ	Total term-loans in SEKm
Profitability	S&P Capital IQ	The ratio of EBITDA to total assets
Tangibility	S&P Capital IQ	The ratio of property, plant, and equipment to total assets
Market-to-Book	S&P Capital IQ	Ratio of market value of equity to book value of equity
Long-term debt/assets	S&P Capital IQ	Ratio of market value of equity to book value of equity
Total bond debt/assets	S&P Capital IQ	Ratio of total bond debt to total assets
Term loans/assets	S&P Capital IQ	Ratio of term loans to total assets
Tier 1 ratio	S&P Capital IQ	The ratio of a bank's core tier 1 capital to its total risk-weighted assets
Tier 1 common ratio	S&P Capital IQ	The ratio of a bank's core equity capital to its its total risk-weighted assets
Total capital ratio	S&P Capital IQ	The ratio of a bank's total capital to its total risk-weighted assets
Equity/assets	S&P Capital IQ	The ratio of a bank's total equity to total assets
NPL/total loans	S&P Capital IQ	The ratio of a bank's non-performing loans to total loans
Loan loss reserves/loans	S&P Capital IQ	The ratio of a bank's provision for loans losses to total loans
ROA	S&P Capital IQ	Bank return on assets
ROE	S&P Capital IQ	Bank return on equity
Loans/deposits	Banks (BS), S&P Capital IQ	The ratio of a bank's total loans to total deposits
Total assets	S&P Capital IQ	The ratio of a bank's total equity to total assets
Household loans/assets	Banks (BS)	The ratio of a bank's household loans to total assets
Corporate loans/assets	Banks (BS)	The ratio of a bank's corporate loans, excluding commercial real estate, to total assets
CRE loans/assets	Banks (BS)	The ratio of a bank's commercial real estate loans to total assets

Notes: Variable definitions used in this thesis, as well as their data source.