SCHOOL OF ECONOMICS AND MANAGEMENT

Department of Economics

Master Thesis NEKP01

Spring 2022

An Assessment of the Riksbank's Corporate Bond Purchase Program on the Yield Spread and Firm's Debt Structure

Author:
Najmeh Hajimirza
Nichawan Thamrongsak

Supervisor:
Marta Giagheddu

Abstract

We study the effect of Riksbank's corporate bond purchase program on the yield spread of bonds and firm-level debt structure. We find evidence that the Riksbank's corporate quantitative easing announcement reduces the yield spread of eligible bonds compared to the non-eligible bonds. The effect is significant for high-quality and low-quality IG-rated bonds; however, the AAA-A-rated bonds react more than BBB-rated ones. Similarly, the liquidity of eligible bonds improves more than non-eligible groups post-announcement. On the firm-level debt structure data, our result suggests that the corporate purchase program motivates firms to increase capital financing through bonds, while the effect is significant among the non-property sector and those eligible with the AAA-A rating group. The yield spread of bonds purchased by the program experiences a doubled reduction after the statement of the policy. However, the effect of the program introduction on leverage ratios of firms that the Riksbank has purchased their bonds is almost likewise to the impact on the eligible firms. Finally, we performed several robustness tests, and the overall results are consistent with our main findings.

Keywords: Quantitative easing, Corporate bond purchase program, Yield spread, Debt structure, Intention-to-treat, Treatment-on-treated

Acknowledgments

First and foremost, we would like to express our sincere gratitude to our supervisor, Marta Giagheddu, who has advised our paper, provided helpful comments and guided us throughout the project. Her knowledge and expertise have inspired us to develop this work to the best of our efforts and capabilities. We are also very grateful to our classmates during this time; working on this research is much more enjoyable when we have a group of people to share and discuss. Our sincere thanks also go to each other for our contribution, dedication, care, patience, and strength in overcoming all the difficulties together. During this time, we have created a memorable period of encountering variously enjoyable, enthusiastic, hopeful, disappointed, stressful, and relieving stages. Lastly, we would like to pay our special regard to our friends and family for their continuous support. Without them, we would not sustain this far.

Table of Contents

List of Tables

List of Figures

1 Introduction

This paper aims to investigate the effects of the corporate bond purchase program by the Riksbank as a part of the asset purchase program applied in response to the Covid-19 pandemic in 2020 on the corporate bonds and companies in Sweden. In this regard, this paper evaluates how the Riksbank corporate purchase program's announcement in March 2020 affects the yield spread as a measure of credit risk among Swedish corporate bonds. Besides, we investigate how the Swedish corporate debt structure changes in response to the policy announcement. To the best of our knowledge, this is the first study that evaluate the efficacy of the Riksbank corporate bond purchase program announcement by considering the heterogeneity reaction of firms.

The asset purchase program by central banks as an unconventional monetary policy has become a common approach in many countries to ease the economy when the conventional policy rates fail to overcome the obstacle of the effective lower bound. This type of policy was pioneered in Japan in the early 2000s and widely adopted by other economies in the wake of the financial crisis in 2008 (Jonathan, 2018). Along with the growth of corporate bond markets over the past decade in several advanced-economies countries, the purchase of corporate bond programs by central banks has become part of the quantitative easing (QE) policy. Some monetary authorities, including the Bank of Japan (2013), Bank of England (2016), and European Central Bank (2016), started to purchase corporate bonds as part of the quantitative easing policy in response to the recession after 2008; however, many central banks launched or expanded the size of corporate bond purchases in 2020 due to the Covid-19 shock.

With the spread of Covid-19, many countries went into lockdown, which limited business activities and caused a shortfall in firms' cash flow. Banks also have entered a credit crunch due to a decrease in purchasing power, scarcity in the funding supply of banks, and higher interest rates. This potential negative feedback loop has increased the concern related to the rise of corporate default risk, which necessitated swift intervention by monetary authorities. For the first time, the Riksbank corporate bond purchase program (CBPP)[1] on March 19, 2020, in response to the global pandemic affecting many sectors' stagnation, was implemented in September 2020. Only non-subordinated, investment grade (IG) bonds issued by Swedish non-bank issuers are eligible for the Riksbank CBPP.[2] This policy aims to fund large corporations in different industries and potentially stimulates favorable movement of the Swedish corporate

[1] Throughout this paper, we use the CBPP as an abbreviation for the Riksbank corporate bond purchase program.

[2] There are other criteria for being eligible for the program, which we explain in Section 2.4.2.

bonds market. However, the effect of this corporate bond purchase by the Riksbank remains uninvestigated by studies to illuminate whether this policy has successfully reached its goals.

Several studies have evaluated the announcement effect of the corporate purchase program of the European central bank (Abidi & Miquel-Flores, 2018; De Santis et al., 2018) and the Bank of England (Boneva, Roure & Morley, 2018; Belsham, Rattan, & Maher, 2017) in 2016. More recent studies investigate the efficiency of corporate purchase programs launched during the pandemic in 2020. Bordo and Duca (2022), Nozawa and Qiu (2021) study the credit spread analysis of the United States Federal Reserve's policy, and Nunn (2022) looks at the impact on Canada's program. The previous researches on corporate QE can generally be classified into different types of investigations; the policy effect on the risk premium of bonds (Abidi & Miquel-Flores, 2018; De Santis et al., 2018), the liquidity of bonds (Boneva et al., 2019; Nozawa & Qiu, 2021), the policy effect on the financing structure of firms (Gross-Rueschkamp, Steffen, & Streitz, 2019; Betz & De Santis, 2020), and the transmission channel of policy (Zaghini, 2019; Nozawa and Qiu, 2021). In contrast to other central banks' corporate purchase programs, there is much less information regarding the effect of the Riksbank corporate bond purchase program (CBPP) on the bond market and companies' financial choices.

The central purpose of this study is to investigate the efficacy of the Riksbank corporate bond purchase program. To evaluate the effect of Riksbank CBPP, we first concentrate on the announcement impact of the policy on corporate bonds yield spread and then investigate the transition effect of this policy on the debt composition of firms after the announcement. We investigate the announcement effect of Riksbank CBPP since studies show that the bulk of impact happens at the announcement date, while the effect on the actual date of implementation of the purchase is narrow (D'Amico & King, 2013; Joyce & Tong, 2012; Altavilla, Carboni, & Motto, 2015). As the outbreak of Covid-19 was with the shutdown of most economies, among other substantial issues, the possible rise of default risk of companies due to lack of liquidity has been a vital concern. Therefore, this paper attempts to observe Riksbank's CBPP effect on the financial leverage of companies to find out what changes this policy has made in the financing behavior of companies. In this regard, since debt financing rates affect corporate financing decisions, we first examined the impact of the policy on the credit spreads of bonds.

Recent research has established that the announcement of a corporate purchase bond by the central bank decreases the yield spread of the bonds through different channels. Some studies argue that the improvement in the market liquidity lowers the credit spread by improving the market participant and liquidity of investors (Nozawa & Qiu, 2021; Boneva, Roure & Morley, 2018; Abidi & Miquel-Flores, 2018). Goldberg and Nozawa (2020) argue that the liquidity channel has a supply and demand side, and QE policy affects the yield spread by reducing the liquidity demand since investors are less forced to go on a fire-sell. Nozawa & Qiu (2021)

mention the market segmentation feature of the liquidity channel in the bond market from the bondholders' point of view, in which investors maintain a portfolio of bonds irrespective of their risk-return trade-off. They argue that if a liquidity shock imposes on the investors of a segment, this can affect the price of assets in that part due to slow capital arbitrage to this part. Therefore, they assume that by improving the financial conditions of traders through QE policies, the yield spread of all bonds will decrease; however, this effect is more noticeable for bonds purchased by the central bank due to the increased liquidity of investors in that individual sector by the purchase. Besides, the QE announcement can enhance the economic perspective and lower the tension in the market by easing funding requirements, causing a decrease in the probability of borrowers defaulting and reducing the credit spread of corporate bonds consequently (Nozawa & Qiu, 2021; Boneva, Roure & Morley, 2018). Hence, we hypothesize that the announcement of the Riksbank CBPP shall lead to a decline in the bond yield spread of eligible bonds compared to those ineligibles, while this reduction is more conspicuous for the bonds purchased by Riksbank compared to those not purchased.

Several studies on the ECB's corporate sector purchase program (CSPP) show that in response to the decrease in the cost of the bond, firms increase their bond issuance and decrease their bank loans immediately after the announcement of corporate QE (Arce, Mayordomo & Gimeno, 2021; Gross-Rueschkamp, Steffen & Streitz, 2019). However, these analyses refer to the 2016 situation when the market was in a normal condition compared to the Pandemic period. Due to Covid-19 shock, companies have had limited business possibilities for earning revenue; hence, they have increased their debt levels to cover this decrease in income. If the bond yield spread drops due to the announcement of CBPP, bond financing becomes more interesting as the cost of finance by bond debt will decrease. In this case, firms finance their debt from longer-term bonds to recover their income deficiency rather than loan debt. This impact on the financing decisions of large companies can have a spillover effect so that these companies can reduce the pressure on the banking systems and provide the possibility of bank loans for other companies by not changing their demand for bank loans. Therefore, we hypothesize that eligible firms increase their bond debt leverage compared to non-eligible firms for the purchase program after the introduction of CBPP, while the CBPP announcement has no significant effect on the bank loan leverage of eligible firms. Also, we assume that we should observe a more pronounced impact on bond debt of firms that Riksbank has purchased their bonds compared to those that Riksbank has not.

To test these hypotheses, we use publicly listed Swedish firms between Q1 2019 to Q1 2021. As the Riksbank does not purchase all eligible bonds under the CBPP, the decision about a particular asset purchase relies on various observable and unobservable potentially endogenous variables. To see the effect of the Riksbank CBPP on the yield spread of purchased bonds and the debt structure of their firms among our sample, we use the instrumental variable (IV) method with heterogeneous treatment effects (Angrist & Pischke, 2019). We use the eligibility

for purchase as an instrument for the actual purchase of bonds and estimate the impact of the CBPP announcement on the eligible group as an intention-to-treat (ITT) effect through the difference-in-difference method. Then, we estimate the treatment-on-the-treated (TOT) effect as the average outcome of the policy announcement on the yield spread and debt arrangement of firms whose Riksbank has bought their bonds by a ratio of the estimated ITT effect and the estimated proportion of purchased bonds among eligible groups. In our framework, the identification of ITT and TOT is not perfect because the instrument is not as good as random assignment, and it could affect the outcome directly apart from its effect on the actual treatment. Our instrumental variable, i.e., eligibility by the Riksbank, depends mainly on the credit rating, which could affect the treatment and control group to behave differently in response to a shock. To check the sensitivity of the treatment effect, we include observable variables and different fixed effects and claim that our ITT estimates are likely to be in the upper bounds of the actual impact of CBPP introduction on the eligible firms.

We find that the Riksbank CBPP introduction lowers the yield spread of eligible bonds both for high and low-quality IG-rated bonds after Q1 2020, while the AAA-A-rated bonds experience more reduction by about 73 basis points (bps) versus 67 bps decrease of BBB-rated bonds over quarters after the CSPP announcement relative to pre-announcement quarters. The effect of the announcement is substantial for the yield spread of purchased bond compared to non-purchased ones by 129 bps. We also observe that the debt-to-assets ratio of eligible firms by considering time-industry fixed effect rises by 4 percentage points (pp) compared to non-eligible firms post-CBPP announcement, while the loan-to-asset ratio decreases insignificantly. We observe a heterogeneity effect among different industries and credit rating quality in which within the set of eligible firms, we find that only AAA-A rated companies and those not incorporated in the real estate sectors raise their bond debt leverage significantly by 9.4 pp and 4 pp, respectively. The effect of CBPP on the leverage ratios of firms whose bonds are purchased by the Riksbank is almost identical to the impact on the eligible firms, as 93 percent of public-qualified firms have sold at least one bond to the Riksbank.

This paper contributes to the growing literature analyzing the effect of central banks' asset purchase programs on the financial market. Our findings are consistent with the previous studies related to the corporate QE on the direct impact of this policy on the cost and issuing of bond assets. We employ a variety of tests and controls to minimize the effect of unrelated elements to the CBPP on our results. We identify the parallel trend in yield spread and different leverage ratios for eligible versus non-eligible firms pre-CBPP and check the possible composition change in the treatment and control groups. We also consider the economic condition in results interpretation which might have a non-similar impact on the low-risk relative to high-risk firms. We also apply some robustness checks such as the placebo-test and matching method based on observable variables to check the accuracy of results.

The remainder of this article is structured as follows. Section 2 discusses the background of unconventional monetary policy and related literature about the quantitative easing and corporate bond purchases program. Section 3 describes the data and econometric models we used in this paper. Section 4 presents the empirical results of the study, analytical discussion, and implications of the results. Finally, Section 5 concludes our study and findings.

2 Literature Review

This paper adds to the growing literature on the effects of central banks' asset purchase programs. We additionally specify our focus on a relatively new asset class of corporate bond purchases. In this section, we review previous literature on the quantitative easing policy by central banks and its effect on the economy. We begin our literature review with a history of quantitative monetary policy and then present previous research on the corporate bond purchase program. Further, we explain the possible transmission channels of asset purchasing and related studies regarding the mechanism. Finally, we present the Swedish bond market condition and the Riksbank policies regarding Covid-19, specifically the corporate bond purchase program under the institutional framework sub-section.

2.1 History of Quantitative Easing and Corporate Asset Purchase

The central bank's primary purposes are to maintain stable economic growth, maximize employment and stabilize prices. Hence, in response to the global financial crisis, quantitative easing has gained international prominence since late 2008 (Rochon & Rossi, 2015) to increase total spending, bring actual output closer to the potential output, and thus close the output gap (Louis-Philippe and Sergio, 2015). The large scale of asset purchasing by central banks as a quantitative easing method improves the economic conditions by increasing the liquidity of that particular asset in the market. While criticism over the QE exists on how it can be effective when various unobservable and observable factors during the crisis simultaneously exist (Maria, 2017; Tim, 2017), the assets purchase program nowadays has become a complementary tool to conventional policy to provide a monetary stimulus to the economy by the central banks.

As the economic climate has always changed from time to time, the form of an asset purchase by the central bank has also been adjusted accordingly. Types of asset purchases have expanded from traditional buying government bonds from financial institutions to purchase corporate bonds and commercial papers. The purchase of corporate bond programs as a tool by central banks represents a new and riskier class of asset under the quantitative easing policy, however, giving a more direct injection to firms. In the group of initiators, the Bank of Japan was the first to start announcing the commercial paper and corporate bond purchase program in 2013, in addition to accommodative policy measures in the aftermath of the global financial crisis. The European central bank, another lead pioneer, launched a corporate bond purchase program in 2015. Then, in 2016 the Bank of England also put in motion its corporate bond purchase

program to stimulate investing activities. The corporate bond purchase program is expanded again in 2020 when several central banks need an accommodative monetary policy to alleviate the economic situation arising from the global pandemic crisis. The Federal Reserve of the United States also began at the same time as the Riksbank to purchase its first-time corporate debt under quantitative easing measures in 2020 to cope with the pandemic crisis. While there is the widespread use of government bond purchases by central banks, there are limited corporate bond purchase programs launched in the past decade. Appendix A.1 lists major corporate bond purchase programs in advanced-economy countries starting from 2013. We refer to new advanced-economy countries which have recently launched a corporate bond purchases program, and in this paper, we choose to study the case of Sweden as there are no previous studies conducted on its program impact.

2.2 Related Literature on the Corporate QE

Many studies on corporate bond purchase programs have focused on the effect on the bond yield and bid-ask spread as a market-based measure for default risk and liquidity of bond assets on the announcement date. They find that the announcement of corporate QE lessens the yield and bid-ask spread of eligible bonds significantly compared to non-eligible bonds (Boneva, Roure & Morley, 2018; Boneva et al., 2019; Nozawa & Qiu; 2021). Boneva, Roure, and Morley (2018) analyze the change in yield spreads on the announcement of the Bank of England's CBPS by comparing eligible bonds based on the bank of England list as a treatment group with two different control groups. The first control group is non-eligible bonds denominated in sterling pound and the second control group is the non-eligible bonds of eligible firms in USD and Euro. They find that the yield spread of qualified bonds compared to bonds in other currencies of eligible firms has reduced more compared to the decrease of yield spread of eligible bonds relative to the non-eligible bonds.

Some findings related to the introduction of corporate QE show that corporate bonds have a heterogeneous impact and are segmented across ratings and sectors. For instance, Gross-Rueschkamp, Steffen, and Streitz (2019) find that only the yield spread of low-quality IG-rated bonds reacts to the CSPP announcement of the ECB in 2016 due to the portfolio rebalancing mechanism, which is consistent with the result of Todorov (2020) that finds the liquidity and yield spread of BBB-rated bonds with longer maturities are more affected by this announcement. They also use the matching method for the robustness of their results and observe that an increase in bond prices and liquidity remains of the same magnitude as without constructing the matched sample for heterogeneous characteristics of bonds. Further, in the analysis of the Federal Reserve announcement for the purchase of corporate bonds in 2020 by Nozawa and Qiu (2021), they report that only credit spreads of IG bonds that are the target of

purchase program decrease after the announcement on 23 March 2020, while high yield bonds do not react to it.

In contrast to these studies showing the effect of the announcement of policy is more on the eligible group, Bonfirm and Capela (2020) document that the decrease in bond yields was more pronounced for the ineligible group after ECB's CSPP announcement in 2016 for the European bond sample. Although, as they restricted their study to the Portuguese corporate bond market, they observed contradictory results. In another study by Abidi and Miquel-Flores (2018), they find that the bonds below IG-threshold experience more reduction in the yield spread. In this analysis, they consider two different cut-offs, the ECB and investors cut-off, which they call the rating interval between BB+ to BBB- a rating wedge. Then by applying a regression discontinuity method, they find that the decline in the cost of bonds for firms within the rating wedge is more pronounced, meaning that bonds that are slightly below the BBB cut-off gain more from the policy due to the portfolio rebalancing channel.

Some other studies extend their analysis by considering the effect of policy on the announcement and implementation date of the corporate QE policies (Zaghini, 2019; Arce, Mayordomo, & Gimeno, 2021). While Zaghini (2019) finds that the policy's direct effect on eligible firms is greater on the implementation date than its effect on the announcement date, several studies have drawn different conclusions (Arce, Mayordomo, & Gimeno; 2021, Damico & King, 2013; Joyce & Tong, 2012; Altavilla, Carboni, & Motto, 2015). For example, Arce, Mayordomo, and Gimeno (2021) show that the excess yield spread to a bank loan of eligible firms drops significantly after the announcement, while this effect has not been significant at the start of the purchase date. They also argue that purchased bonds face more reduction in their yield spread compared to similar eligible bonds not purchased under the program.

Another focus of the corporate bond purchase program research is on the new issuance of bonds and the substitution effects on the firm’s debt structure from bonds to loans. (e.g., Galema & Lugo, 2017; Betz & De Santis, 2019; Arce, Mayordomo & Gimeno, 2021; Ertan, Kleymenova, & Tuijn, 2020). In these studies, the authors argue that the announcement of the corporate QE raises a tendency for the issuance of bonds for eligible and even non-eligible firms either instantly or by a delay as an effect of reduction in the cost of bond financing (Abidi and Miquel-Flores, 2018; Arce, Mayordomo, and Gimeno, 2021; Zaghini, 2019). Some studies further evaluate the spillover effect of change in the financing behavior of eligible firms on the non-eligible firms' financing situation (De Santis et al., 2018; De Santis & Zaghini, 2021; Gross-Rueschkamp, Steffen, & Streitz, 2019). They find that the ECB's CSPP announcement in 2016 relaxed the financing conditions for European non-financial corporations by shifting the capital structure of eligible firms from bank loans to bonds debt, which in consequence, led to more lending supply on banks, and hence banks are lending out more to ineligible firms. Some

studies investigate the impact of corporate bond purchase programs on the real economy by evaluating improvement in the investment of eligible and non-eligible firms (De Santis & Zaghini, 2021; Gross-Rueschkamp, Steffen, & Streitz, 2019). De Santis and Zaghini (2021) find that the investment for both eligible and non-eligible firms has increased; however, Gross-Rueschkamp, Steffen, and Streitz (2019) observe that only the investment of firms that have not qualified for the program has increased due to improvement in the lending situations to non-eligible firms.

Recent studies have applied different models to evaluate the corporate bond purchase program from different perspectives, such as the effect of policy on the eligible compared to non-eligible bonds, the impact of policy on corporate bond yield spread and liquidity, or financial choices on the announcement date or the start of the purchase date. Several analyses apply the difference-in-difference approach for capturing the different reactions between two comparison groups and preventing confounding the consequences of corporate QE with unobserved shocks to the corporate bond market (Boneva et al., 2019; Ertan, Kleymenova, & Tuijn, 2020; Todorov, 2020; De Santis & Zaghini, 2021; Nozawa & Qiu, 2021; Gross-Rueschkamp, Steffen & Streitz, 2019). Besides, Abidi and Miquel-Flores (2018) apply a regression discontinuity design framework to capture a jump in the yield spreads among the group of different credit rating bonds, and Nozawa and Qiu (2021) apply event studies on the changes in credit spread at the security level on several various event dates.

2.3 The Transmission Channels of Quantitative Easing

It is worthwhile to know through which relevant mechanism the corporate QE affects the yield spread of bonds and the real economy. Therefore, we review the previous literature that suggests transmission channels for other asset purchases since corporate bond purchases are likely to operate through many of the same means. A large number of studies investigate the transmission channels of the central bank's assets purchase program to the real economy through its effect on the interest rates (Krishnamurthy & Vissing-Jorgensen, 2011; Gagnon et al., 2011; Bauer & Rudebusch, 2014; Christensen & Krogstrup, 2019; Krishnamurthy, Nagel, & Vissing-Jorgensen, 2018; Dunne, Mary, & Rebecca, 2015; Joyce et al., 2012).

Krishnamurthy and Vissing-Jorgensen (2011) present seven different transmission channels in their study about the Fed's purchase of long-term treasuries and bonds during the financial crisis in 2008. The first channel they argue is signaling, which works by changing market expectations about future rates by announcing the QE policy. The announcement of the purchase of long-term securities shows the intention of a central bank to keep the interest rate low which leads to lowering the yields on all types of bonds (Cormac & Marie, 2019; Dunne et al., 2015); however, the magnitude of the impact depends on the maturity of bonds

(Krishnamurthy & Vissing-Jorgensen, 2011). Similarly, Bauer and Rudebusch (2014) show that the asset purchase program announcement would reduce yields by lowering the average expected risk-neutral rate component of long-term rates.

Portfolio rebalancing is another channel that could affect asset prices. The central bank's government bond purchases decrease the risk premia of government bonds due to lowering the duration (Greenwood and Vayanos, 2014; Greenwood et al., 2018). Koijen et al. (2021) argue that investors, in response to a reduction in the risk premium, would rebalance their portfolio toward other risky instruments, consequently causing a drop in their risk premia. Gagnon et al. (2011) explain this channel through a reduction in the supply of assets purchased by the central bank. They argue that a central bank's purchase of a specific instrument reduces the number of assets that the private sector possesses, leading to the substitution of some investors and reduction in their holdings while causing the increase of short-term and risk-free bank reserves for private sectors. This reduction in the asset supply causes an increase in its price, which needs a decrease in asset expected return, i.e., yield, to motivate people for the substitution. The actual impact of this channel on the risk premia depends on the extent that investors substitute assets across different segments and various characteristics such as maturity (Krishnamurthy & Vissing-Jorgensen, 2011). In this manner, Vayanos and Vila (2009) show that if a market is segmented and investors have a preferred habitat in which assets with similar risk and return spectrum are not a perfect substitute for each other, then a change in the relative supply of an asset may influence its relative price.

Arslanalp and Botman (2015) analyze the portfolio rebalancing scenarios and suggest that the purchase of government bonds by the Bank of Japan led to a more pronounced portfolio rebalancing effect by insurance and pension funds, which may result in higher capital outflows and a declining home bias of Japanese institutional investors. Koijen et al. (2017) analyze the ECB asset purchase in 2015 and observe that the quantitative easing policy lowers the duration mismatch for pension funds, insurance companies, and banks in a way that banks be a seller of eligible government bonds while pension funds and insurance firms be a buyer of them. Christensen and Krogstrup (2019) state that the QE policy has a reserve-induced portfolio balance effect on the long-term interest rates, which are independent of asset purchases and depend on the impact of reserve expansions on bank balance sheets resulting in a rebalancing of bank portfolios. This rise in asset prices and declining yields on acquired assets may make it easier for many businesses to raise capital and ease credit conditions.

Some recent studies evaluate the portfolio rebalancing mechanism in corporate quantitative easing policies. For example, Zaghini (2019) focuses on the primary market and applies the market value price-quantity pairs as a measure of supply and demand shift to analyze the effect of the ECB's CSPP through this portfolio rebalancing channel. They find that the price and quantity of eligible bonds rise immediately after the announcement, while financial conditions

of non-eligible bonds improve after several months from the CSPP purchase through the rebalancing channel. Abidi and Miquel-Flores (2018) also find that the bonds with a rating slightly below the ECB cut-off enjoy more from the ECB CSPP in 2016 due to a rebalancing of portfolios toward riskier assets to earn more return.

Several studies have explained the effect of quantitative easing through bank lending channels by increasing or maintaining bank credit availability to the private sector and individuals. This channel suggests that banks as financial intermediaries would increase their lending to households and firms due to a proportion of their increased deposit arising from the asset purchase program. To this aim, the existence of well-capitalized banks is a requirement to ensure an effective bank lending channel for asset purchase programs (Cormac & Marie, 2019). In addition, a growing number of studies report that the unconventional policy of central banks increases bank lending through the substitution of bonds for bank loans which increase the availability of bank loan for small firms (Disyatat, 2011; Rodnyansky & Darmouni, 2017; Arce, Mayordomo, & Gimeno 2021; Becker & Ivashina, 2014; Gross-Rueschkamp, Steffen, & Streitz, 2019). D'Avino (2018) evaluates the international spillover of banks leading through quantitative easing by examining the behavior of global banks in the United States. He finds substantial liquidity spillovers through foreign lending as a consequence of the Federal Reserve's QE policy, indicating the presence of an international bank lending channel. In a study by Gross-Rueschkamp, Steffen, and Streitz (2019), they introduce a new channel for impact on the output of the economy, which works through the banking lending channel. They call this mechanism a capital structure channel that increases the investment of firms that are not eligible for the ECB's CSPP by improvement of their access to bank loans after the CSPP announcement.

Another channel that affects the interest rate of assets in response to the quantitative easing policy is the liquidity channel. Purchasing of securities by central banks injects more money into the markets, rising demand for those securities, leading to more market participation which increases the investors' liquidity, in the consequent. Several articles mentioned this mechanism of asset purchase program (Boneva et al., 2019; Abidi & Miquel-Flores, 2018; Nozawa & Qiu, 2021). The default risk channel is another transmission force that works through a reduction in the risk of borrower default by the purchase program, resulting in a decline in yields. Krishnamurthy and Vissing-Jørgensen (2011) document a default risk channel that lowered corporate bond yields. In a recent study by Nozawa and Qiu (2021), they find evidence that a substantial portion of corporate credit spreads changes corresponds to lower default risk due to the corporate bond purchase program, especially to the short-term corporate credit spreads.

There are other transmission forces, such as the duration risk channel and the inflation or uncertainty channel, that asset purchase programs affect the interest rates. The duration risk channel refers to the increase in the risk premium due to the most prolonged exposure of

bondholders to the risk of unexpected changes in future interest rates. The basic idea is that long-duration assets will reduce the average duration of bonds held by the private sector, potentially lowering the premium required to tolerate the duration risk (Joyce et al., 2012). The inflation or uncertainty channel refers to the increased expectation of inflation and hence could lead to a rise in uncertainty in interest rates. Krishnamurthy and Vissing-Jørgensen (2011) proposed looking at the implied volatility as the inflation uncertainty could lead to an interest rate volatility. Therefore, the asset purchases increase the rate on inflation swaps measured by the difference between nominal bond yields and treasury inflation-protected securities. In addition, the current market prices of swaptions could imply the expected volatility of the interest rates.

Among these different transmission channels, Nozawa and Qiu (2021) argue that the liquidity and default risk channels are the most relevant ones for corporate credit spreads. They state that the effect of signaling, and duration risk channels is more on risk-free rates with various maturities, and as yield spread is calculated as a difference between corporate bond yield and the risk-free rate, it could affect the yields on corporate bonds. However, their direct impact is probably small.

2.4 Institutional Framework

2.4.1 Swedish Corporate Bonds Market During Pandemic

The Swedish corporate bond market has experienced the fastest growth rate in the past five years, reaching a record SEK 510 billion in 2021, representing 40% of the total potential volume in the Nordic corporate market (Nordic Trustee, 2021). In 2020, when the coronavirus sent China and Italy into lockdown on 23 January and 23 February, respectively, the growth of the global economy faced a dire situation. Sweden's GDP fell by 8.3 percent in the second quarter of 2020 compared to the first quarter, which is the most significant drop in a single quarter since the 1940s. Consequently, the Swedish corporate bond market was negatively affected, as many business operations limited or temporarily closed their activities, leading to slow economic development. The Swedish corporate bond market is relatively small, with a limited number of players, and a slight amount of liquidity, which causes pressure on the sales market, resulting in significant price falls. Hence, the risk premiums of corporate bonds increased substantially, and the liquidity situation in the Swedish bond market deteriorated rapidly in March 2020. As a result, investors in corporate bonds preferred to shift their investment to safer assets like government bonds. In March 2020, the number of new corporate bond issuance in the Swedish corporate bond market was zero.

This concern caused Riksbank to announce on 19 March 2020 that it intends to buy corporate bonds and commercial papers after the general quarterly monetary policy meeting on 16 March 2020, to support the credit supply for Swedish companies. Riksbank released more information regarding the time of purchase and the budget for the purchase on 30 June 2020. They disclosed that they want to purchase SEK10 billion corporate bonds in a nominal amount from 1 September 2020 to 31 June 2021 under the corporate bond purchase program. While Riksbank purchased other types of assets previously in 2015 as an expansionary monetary policy, they intended to use commercial papers and corporate bonds for the first time. During the global pandemic period, the Riksbank increased the amount of all types of securities such as government bonds, covered or mortgage bonds, municipal bonds, commercial papers, and corporate bonds to a total amount of SEK700 billion from March 2020 until 31 December 2021. However, the share of corporate bonds from this total amount has been a nominal amount of SEK13 billion from September 2020 to 31 December 2021. In Appendix A.2. and Appendix C.1., we present the timeline of the coronavirus pandemic and the Riksbank's monetary policy reactions to the situation, and the aggregate purchases of all types of assets by the Riksbank, respectively.

2.4.2 The Riksbank Corporate Bond Purchase Program (CBPP) Criteria

Riksbank needs to specify the criteria and the purchasing mechanism to control any possible risk related to the corporate asset purchasing program. The purchase includes corporate bonds issued in Swedish krona and by Swedish non-financial companies. According to the policy, financial companies are the firms registered with Finansinspektionen or are under their supervision that are not eligible for the purchase. Eligible bonds for the program should be senior non-subordinated bonds with a remaining maturity of over six months and less than five years with a credit rating equal to Baa3/BBB- or higher, i.e., an investment grade bond. The bond credit rating should be from Standard & Poor's (S&P), Moody's, Fitch Ratings, Nordic Credit Rating, or Scope Rating agencies, and in case the issue does not have a credit rating, the issuer rating should be at least Baa3/BBB- from the same credit rating institutes. If bonds (firms) have several credit ratings, the lowest rating should not be less than the accepted credit rating threshold. Riksbank can purchase corporate bonds in the secondary market, and at each purchased time, it shall not possess more than 50 percent of the total outstanding corporate bonds of an individual issuer or more than 50 percent of a particular bond.

Despite notable characteristics of the Swedish corporate bond market, the Riksbank established two methods of purchase mechanism, the bilateral proceedings and the bid procedures. These two methods handle particular market conditions and identify potential sources of low liquidity without overlooking the requirement to achieve a broad and market-neutral impact. The bilateral proceedings, as the most common form of purchase under the Swedish corporate

market, allow for greater flexibility in the choices of bonds. Bilateral procedures entail the Riksbank carrying out a transaction without a tender with one or more counterparties. The purchase through bilateral proceedings is beneficial for the Riksbank to develop a position in the market and, consequently, can influence pricing in the market. In bid procedures, before each auction, the Riksbank will specify which business bond or bonds it desires to purchase, and only the monetary policy counterparties of the Riksbank will be allowed to participate and bid.

3 Data and Methodology

The following parts describe the data selection and the methodology used in the thesis. In this respect, the first part presents the samples we construct for the analysis and provides the definition, motivation, and data source used for each variable. The second part introduces the empirical methods of our study and the assumptions required for the validity of models.

3.1 Data Selection

Our study focuses on the Swedish non-bank sector to evaluate the effect of the Riksbank's CBPP announcement on the yield spread of purchase bonds and its spillover effect on the debt financing of corporates whose bonds have been purchased by Riksbank. Our purpose is to create a representative sample of corporate bonds that meet all the CBPP criteria defined in Section 2.4.2. This type of sample construction is consistent with other studies that evaluate the announcement causality effect of corporate bond purchase programs by various central banks, e.g., Abidi and Miquel-Flores (2018), Ruesch, Boneva, Roure, and Morley (2018), and Gross-Rueschkamp, Steffen, and Streitz (2019). We construct two datasets, one for the study of the corporate bond yield spreads and another for the study of the changes in the composition of debt structure of companies at firm-level variables.

According to the Riksbank announcement regarding the inclusiveness of the purchase bond program, our sample for the debt structure analysis consists of non-bank public Swedish companies having non-subordinated bonds issued in Swedish krona with a remaining maturity of more than six months and fewer than five years. The treatment group of our study includes all public firms that are eligible for the Riksbank's purchase of corporate bonds program with an IG rating (BBB- and higher).[3] The control group contains all remaining firms with Swedish krona bonds that are not eligible for the Riksbank's program, consisting of non-IG rated or not-rated firms. The sample period is from Q1 2019 to Q1 2021 to have four quarters before and after the announcement in March, identical to the study by Gross-Rueschkamp, Steffen, and Streitz (2019). The post-CBPP period begins in Q2 2020, the first quarter after the policy statement, as the financial statement data takes more time to react (De Santis & Zaghini, 2021). We acquire quarterly financial statement data for all public firms incorporated in Sweden from

[3] The list of firms with bonds that meet the Riksbank criteria is available from their webpage: https://www.riksbank.se/en-gb/monetary-policy/monetary-policy-instruments/purchases-of-corporate-bonds/list-of-companies-with-bonds-that-meet-the-riksbanks-criteria/

Refinitiv Eikon Thomson Reuters.[4] For credit rating information, we collect data from Bloomberg, Refinitiv Eikon Thomson Reuters, and FactSet for the ratings by Standard & Poor's, Moody's, Fitch Ratings, Nordic Credit Rating, and Scope Rating agencies.

We calculate the bond-outstanding data for each firm as a sum of bonds and notes based on the bond issuance data of firms from Refinitiv Eikon Thomson Reuters. Appendix A.3 explains the process for calculating the bond-outstanding variable in more detail. We get the difference in long-term debt from the calculated bond-outstanding data for having a proxy for the bank loan data. We retrieve the long-term debt from the Refinitiv Eikon Thomson Reuters, which shows the sum of long-term bank borrowing and bonds debt.[5] According to the Gross-Rueschkamp, Steffen, and Streitz (2019) study, we incorporate four control variables into our analysis. The first control is the size of the firm representing the natural logarithm of their total assets; the second control is the profitability of the firm showing the ratio of EBITDA to total assets; the third control is the tangibility of firms calculated as tangible assets over total assets, the last control is the market-to-book ratio. We present the detail of all dependent, independent, and control variables in Appendix A.4.

We focus only on public firms because balance sheet information on private firms is not available on a quarterly basis. We concentrate on Swedish firms as specified by headquarters and place of incorporation. To attain non-bank public Swedish companies, we eliminate firms whose SIC code starts with 60 (depository institution) and 61 (non-depository credit institution) to remove firms registered with Finansinspektion or under their supervision according to the policy body. We exclude firms that do not have total assets data as variables are essential for computing different leverage ratios. In addition, we remove firms that have not had any bond outstanding in SEK during the time that policy has been applicable to eliminate those firms which are not active in the bond market initiated in SEK to mitigate the systematic differences. Therefore, our final sample consists of 117 public non-bank firms, of which 29 firms are eligible for the purchase program based on the Riksbank list, and the remaining 88 firms are in our control group.

To analyze the yield spread reaction to the policy announcement, we construct a sample of non-subordinated bonds issued in Swedish krona with a remaining maturity above six months and less than five years belonging to non-bank public Swedish companies. The treatment group contains all public IG-rated bonds, while the control group includes all remaining bonds not eligible for the Riksbank's program, consisting of non-IG rated or not-rated bonds. The time interval of the sample is from Q1 2019 to Q1 2021, and the post-CBPP period begins

[4] Quarterly data means the last business day of March, June, September and December in each year.

[5] We choose the long-term debt over the total long-term debt data because Eikon's total long-term debt represents the long-term debt plus capital leases obligation.

immediately after the announcement in Q1 2020 since the yield spread is a market-based variable reflecting the effect more rapidly than financial statement data. We collect bond level data such as ISINs, Issuance, and Maturity data from Refinitiv Eikon Thomson Reuters and the quarterly data of Yield-to-Maturity, and Bid-Ask prices from Bloomberg. When the credit ratings at bond levels have not been available, we use the credit rating of an issuer according to the guideline of the policy. To form the yield spreads, we use Mid-Yield-to-Maturity relative to a Sweden treasury bill with the same maturity obtained from the Refinitiv Eikon Thomson Reuters. Our bond sample consists of just bonds and notes instruments. The yield spread analysis sample consists of 562 publicly traded non-subordinated unsecured bonds denominated in SEK, with a minimum maturity of six months and a maximum of five years belonging to 103 non-bank issuers.

Table 1 provides the sample distribution by industry and rating. We use the 2-digit Standard Industrial Classification (SIC) code to consider the firms' industry characteristics. Our data set includes 27 sectors in which real estate has the most numbers of observations, with 44.70%, followed by holding & other investment offices (7.58%), paper & allied products (5.14%), business services (4.70%), and communications (4.35%). The most significant part of the sample, with 49.5%, consists of BBB-rated bonds (bonds with BBB, +BBB, and -BBB ratings), and 10.6% account for the AAA-A (bonds with A to AAA) ratings. While high-yield bonds constitute only 5.1% of the total sample, the bonds which are not rated or belong to non-rated firms account for 34.8% of the whole bonds sample. The high rate of non-rated firms in the Swedish bond market is a transparent distinction relative to the European bond market (Frohm et al., 2020). The distribution of bonds' credit ratings in our sample is consistent with a report of Riksbank on the Swedish corporate bonds in 2020 (Riksbank, 2020).

3.2 Methodology

To investigate the impact of the Riksbank corporate bond purchase program (CBPP) introduction, we first evaluate the impact of the policy announcement on bond yield spread, then we examine the transmission effects of this policy on the arrangement of debt structure (bonds versus bank loans). As the Riksbank has not bought all the CBPP's eligible bonds, and its decision regarding purchasing specific corporate bonds depends on potentially endogenous (unobservable) variables, we use the eligibility for purchase as an instrument for the actual purchase of bonds according to Arce, Mayordomo and Gimeno (2021), Gross-Rueschkamp, Steffen, and Streitz (2019), and Boneva, Roure and Morely (2018) to perform the 2SLS analysis.

Table 1- Sample Breakdown by Industry and Rating in our Sample over the Period Q1 2019 to Q1 2021

Panel A: Bond sample breakdown based on industry

Industry	Freq.	Percent	Industry	Freq.	Percent
Real Estate	1,121	44.7	Wholesale Trade – Durable Goods	34	1.36
Holding & Other Investment Offices	190	7.58	Instruments & Related Products	30	1.2
Paper & Allied Products	129	5.14	Services, Not Elsewhere Classified	28	1.12
Business Services	118	4.7	Automotive Dealers & Service Stations	18	0.72
Communications	109	4.35	Food & Kindred Products	16	0.64
Engineering & Management Services	95	3.79	Electric, Gas, & Sanitary Services	15	0.6
Fabricated Metal Products	88	3.51	Amusement & Recreation Services	12	0.48
Industrial Machinery & Equipment	88	3.51	Metal, Mining	11	0.44
Transportation Equipment	88	3.51	Transportation by Air	9	0.36
General Building Contractors	75	2.99	Chemical & Allied Products	8	0.32
Electronic & Other Electric Equipment	65	2.59	Oil & Gas Extraction	7	0.28
Tobacco Products	55	2.19	Health Services	7	0.28
Security & Commodity Brokers	49	1.95	Transportation Services	5	0.2
Primary Metal Industries	38	1.52	Total	2,508	100

Panel B: Bond sample breakdown based on credit rating

Detailed Credit Rating	Freq.	Percent	General Credit Rating Categories	Freq.	Percent
AA-	2	0.08	AAA-A	267	10.65
A+	111	4.43	BBB-Rated	1241	49.48
A	30	1.20	High Yield	127	5.06
A-	124	4.94	No Rating	873	34.81
BBB+	684	27.27	Total	2,508	100
BBB	369	14.71			
BBB-	188	7.50			
BB+	47	1.87			
BB	58	2.31			
BB-	13	0.52			
CC	9	0.36			
No Rating	873	34.81			
Total	2,508	100			

This table exhibits the distribution of 2,508 observations of 562 Swedish Krona bonds of 103 non-bank public firms among 27 industries between Q1 2019 and Q1 2021 based on industry and credit rating on the company and/or bond level. Panel A shows the distribution of issuer industries among our sample of bonds in descending order. In the first part of Panel B, we present the distribution of credit rating of bonds in detail. Appendix A.5 shows a table of credit rating scales based on the top 3 credit rating agencies. In the table, we use S&P's scoring system as a representative. In the second part of Panel B, we categorize all different credit ratings into four general groups based on our study. AAA-A is the sum of observations from AAA to A-, which in our sample is the sum of AA-, A+, A, and A-. BBB is the sum of BBB+, BBB, and BBB-. High yields are rated bonds below IG rating, which in our sample is the sum of BB+, BB, BB-, and CC.

First, we apply the intention-to-treat (ITT) analysis as a reduced form equation to evaluate the treatment effect on the eligible firms. In many circumstances, experiments do not intend to treat all the individuals in the treatment group, and only a fraction of the individuals qualified for the treatment take it up. In this experiment, we evaluate partial compliance, and the estimated coefficient shows the ITT estimates, which shows the probability of an individual being exposed to the treatment rather than the actual treatment (Duflo, Glennerster, & Kremer, 2007). The ITT analysis even can provide a better causal interpretation of the firms' decision regarding the capital structure due to the potential spillover effect of policy on the bonds being eligible but not acquired by the central bank through the portfolio rebalancing channel or market premium (Gross-Rueschkamp, Steffen, & Streitz, 2019). Then, we examine the treatment-on-the-treated (TOT) effect as the average outcome of the policy announcement on the yield spread and debt composition of firms whose Riksbank has bought their bonds by considering the actual purchase rate of qualified firms.

To evaluate ITT, we cannot look at the difference in the mean outcome in the treatment group before and after the policy. In this situation, we cannot distinguish whether this change is due to the CBPP announcement or is some unobserved time effects that affect the outcome of treated firms irrespective of the policy. The difference between the mean outcome in the treatment group and the control group after the announcement also cannot provide the effect of policy because some unobserved heterogeneity could be responsible for this change. However, comparing the treatment group with the control group before and after the CBPP announcement through the difference-in-difference method might provide a better insight into whether this quantitative policy alter the yield spread of bonds and the debt structure in the subsequence. This control group is a group that is not exposed to the policy and has been subject to similar unobserved or observed time-varying factors of the treatment group.

While the ITT approach presents an unbiased assessment of the average treatment effect on the group of eligible firms in a perfect randomized environment (Angrist & Pischke, 2009), the estimation is not ideal in our model because the instrument (eligibility) depends on a potentially endogenous variable like the credit rating of firms which is not as good as randomly assigned. We will discuss this issue in Section 3.2.4 in more detail. In this regard, in the following, we will first discuss the method we employ to estimate the impact of CBPP on yield spread and capital structure of eligible firms. Then, we will present the model we incorporate to evaluate the policy effect on the firms whose bonds were purchased under CBPP by the Riksbank.

3.2.1 CBPP and Yield Spread of Eligible Bonds (ITT)

In this analysis, we use the eligibility of bonds based on the Riksbank's list as an instrument for the actual purchase of bonds to evaluate the impact of the policy on the eligible bonds. To

identify the effect of the CBPP of the Riksbank on the yield spread of qualified bonds, we investigate how the policy announcement affects the yield spread of eligible bonds compared to non-eligible bonds by running the following difference-in-difference specification:

$$Y_{it} = \alpha_i + \mu_t + \beta\ (Post\_Yield \times Treated)_{it} + \theta\ BidAskSpread_{it-1} + \varepsilon_{it} \qquad \text{Eq. (1)}$$

where Y_{it} is the Mid-Yield-to-Maturity relative to a government bond yield with the same maturity for bond i on day t. $Treated_i$ is a dummy variable that takes the value of one, if bond i is included in the Riksbank CBPP, and $Post\_Yield_t$ is a dummy variable that takes the value of one after the announcement of the policy in Q1 2020. β captures the value of our interest by implying how the policy announcement affects the yield spread of eligible bonds compared to non-eligible bonds after controlling for bond-fixed effect (α_i) and time-fixed effect (μ_t). We also use bid-ask spreads as a control variable for liquidity, according to Boneva, De Roure and Morley (2018). The theoretical premise articulate that the yield spread considers the liquidity of the bond because illiquid assets will exchange less often, causing lower price, which translates into a higher yield spread (Chen, Lesmond, & Wei, 2007). In our setting, we include the quarterly bid-ask spreads as the ask minus bid price divided by the average of bid and ask price as a control variable with one period lag due to the possible simultaneous effect between the yield spread and liquidity. Also, we adjust our standard errors by clustering standard errors at the bond level for statistical inference.

Further, we include dynamic leads and lags around the announcement of the CBPP to know how the pre-and post-treatment effects vary over time based on Angrist and Pischke's (2009) method. In this regard, we suppose that D_{it} presents the policy variable of interest, which occurs at different times. We evaluate the variation in the yield spread at the past D_{it} and future D_{it} through the following equation:

$$Y_{it} = \alpha_i + \mu_t + \sum_{\tau=1}^{m} \beta_{-\tau}\, D_{i,t-\tau} + \sum_{\tau=1}^{q} \beta_{+\tau}\, D_{i,t+\tau} + \theta\ BidAskSpread_{it-1} + \varepsilon_{it} \qquad \text{Eq. (2)}$$

where m in the sum represents post-CBPP impact or lags and q stands for the pre-CBPP impact or leads. In this estimation, we use 12 quarters, including eight quarters before the CBPP announcement and four quarters after it. We exclude Q1 2020 and evaluate the dynamic effect of Riksbank CBPP on the yield spread of eligible bonds relative to the announcement quarter.

While for other asset purchase programs, the gap time between the announcement and the purchase time is almost negligible, the purchase of a corporate program takes place for more than a month from the announcement time. Therefore, in the analysis of the corporate purchase program distinguishing the effect of announcement and purchase time is meaningful. To investigate the impact of the CBPP announcement and the start of the purchase program, we run the following equation:

$$Y_{it} = \alpha_i + \mu_t + \beta_1 \, (Ann\_CBPP \times Treated)_{it} + \beta_2 \, (Pur\_CBPP \times Treated)_{it} + \theta \, BidAskSpread_{it-1} + \varepsilon_{it} \quad \text{Eq. (3)}$$

where Ann_CBPP$_t$ and Pur_CBPP$_t$ are dummy variables, which respectively take value one for the announcement date (Q1 2020), and the beginning of the purchases (Q3 2020) onwards. In this regard, coefficient β_1 represents the average excess yield on eligible bonds versus non-eligible corporate bonds from the announcement of the program to the beginning of the purchases, while coefficient β_2 shows that from the beginning of the purchases to the end of the sample.

Further, to evaluate whether the policy announcement has an impact on the frequency of trade in the bond market we perform a basic diff-in-diff model on the bid-ask spread as a proxy for the liquidity of bonds on the announcement date.

$$BidAskSpread_{it} = \alpha_i + \mu_t + \lambda \, (Post\_Yield \times Treated)_{it} + \varepsilon_{it} \quad \text{Eq. (4)}$$

3.2.2 CBPP and Debt Capital Structure of Eligible Firms (ITT)

Along with other studies related to the effect of corporate bond purchase programs on the capital structure (e.g., Abidi and Flores, 2018; Arce, Mayordomo & Gimeno, 2020; Gross-Rueschkamp, Steffen, & Streitz, 2019), we hypothesize that the effect of the CBPP of Riksbank on the yield spread of eligible firms will transmit into the firm debt structure and they will increase their bond financing after the announcement. To investigate this hypothesis, we use the quarterly data of our sample on the public firms and run the following diff-in-diff equation:

$$Leverage_{it} = \alpha_i + \alpha_{St} + \beta \, (Post \times Treated)_{it} + \theta \, \gamma_{it-1} + \varepsilon_{it} \quad \text{Eq. (5)}$$

In this specification, leverage represents the ratio of different types of financing such as bond debt, bank loans, and long-term debt on the total assets of firm *i* at time *t*. The interaction of *Post* by *Treated* (*Post* × *Treated*) is a dummy variable that equals one if the time is after the Q2 2020 and the company is eligible for the program, and zero otherwise. The interaction term's coefficient, β, shows the effect of introducing CBPP on the eligible company's debt capital structure compared to non-eligible ones. To consider firms' characteristics that might affect the demand for bonds by firms, we incorporate a set of control variables with one period lag captured by γ_{it-1} as firm size, firm profitability, firm tangibility, and the market-to-book ratio (Gross-Rueschkamp, Steffen, & Streitz, 2019). Also, we include firm fixed effect (α_i) and industry-time fixed effect (α_{St}) in our model to control for other systematic differences. All standard errors are clustered at the firm level, which is the level of treatment in this model.

To evaluate the dynamic of the CBPP effect over time we use Eq. (6) with the eight lags (m) and four leads (q) in the sense of Eq. (2) to see the behavior of the impact as time passes.

$$Leverage_{it} = \alpha_i + \alpha_t + \sum_{\tau=1}^{m} \beta_{-\tau} D_{i,t-\tau} + \sum_{\tau=1}^{q} \beta_{+\tau} D_{i,t+\tau} + \theta\, \gamma_{it-1} + \varepsilon_{it} \qquad \text{Eq. (6)}$$

$D_{i,t+\tau}$ and $D_{i,t-\tau}$ are dummy variables which are one for eligible firms in the respective pre- and post-CBPP quarters, and zero otherwise. $\beta_{+\tau}$ captures the pre-treatment, and $\beta_{-\tau}$ shows the post-treatment effect.

3.2.3 CBPP Announcement Effect on the Actual Purchased Group (TOT)

Most published analyses of the corporate bond purchase programs focus on ITT effects by using the initial list of eligible bonds and firms and not the actual treatment group purchased by the central banks. It is plausible because there could be some transmission effect on the debt structure of qualified firms whose bonds are not acquired by the central bank; accordingly, on the debt structure of non-eligible firms and the real economy. However, we also can get the average causal effect of policy announcement on the purchased bonds and their firms, those whose treatment status was changed by the instrument but would not have been changed otherwise. We call these groups of bonds and firms compliance groups in our study. As Riksbank cannot buy any bond in the control group, non-compliance could only be among the treated. Therefore, the general local average treatment effect is equal to treatment-on-the-treated (TOT) effect in our case. To estimate the CBPP effect on the yield spread of bonds purchased by the Riksbank in actuality, we run a 2SLS model, which is like Eq. (1) as following:

$$Y_{it} = \alpha_i + \mu_t + \beta\, (Post\_Yield \times \widehat{Purchased})_{it} + \theta\, BidAskSpread_{it-1} + \varepsilon_{it} \qquad \text{Eq. (7)}$$

where $\widehat{Purchased}$ is the estimated purchase based on the first stage equation, which evaluates the effect of being eligible on the probability of being purchased by the Riksbank. The rest of the variables are analogous to Eq. (1). The β captures the TOT effect, which is identical to the Wald estimator. The Wald estimator is a ratio of the reduced-form impact of the randomly assigned instrument to the first-stage effect. In our setting, the ITT analysis represented by Eq. (1) captures the reduced-form effect, while the first-stage impact is the rate of purchase of eligible bonds by the Riksbank.

In a similar specification, we are able to evaluate the impact of policy on the capital structure of firms in which Riksbank has purchased their bonds through the following equation:

$$Leverage_{it} = \alpha_i + \alpha_{St} + \beta\ (Post \times \widehat{Purchased})_{it} + \theta\ \gamma_{it-1} + \varepsilon_{it} \quad \text{Eq. (8)}$$

where in the same analogy, β shows the TOT effect of the introduction of the CBPP on the leverage of firms whose bonds were actually purchased by the central bank, which is equal to the ratio of the ITT effect to the percentage of firms that sold at least one bond to the Riksbank out of all eligible firms.

3.2.4 Validity Assessment of the Intention-to-treat (ITT) Estimate

The essential assumption for the diff-in-diff method is that the trends of the outcome variable would be the same in the treatment and control groups in the absence of treatment. First, we investigate the parallel trend assumption by plotting the means of the outcome over time for both groups. If the variable paths are parallel before the treatment, the treated and control groups likely continue to move in the same trends in the absence of treatment. Then we try to test whether there is a treatment effect in anticipation of the treatment. To test this assumption for the bond yield spread and leverage of firms, we fit a Granger-type causality model in format of Eq. (2) and Eq. (6), respectively, where we augment our model with dummies for each pre- and post-treatment period and for treated observations. The null hypothesis states that a joint test of the coefficients on pre-treatment dummies is zero, and if we cannot find evidence to reject the assumption, we can conclude that no anticipatory effects have occurred (Angrist & Pischke, 2009).

To check whether the treatment has changed the composition of the treatment and control group in our diff-in-diff estimation, we test whether any trends in the observable characteristics of companies are the same across both treatment and control groups. We run a following model and present the result in Appendix B.1.

$$Firm\_Char_{it} = \alpha_0 + \alpha_1\, Post + \alpha_2\, Treated + \beta\ (Post \times Treated)_{it} + \varepsilon_{it} \quad \text{Eq. (9)}$$

where $Firm\_Char_{it}$ are indicators for size, profitability, tangibility, and market-to-book ratio of firm *i* at time *t*, which we incorporate as control variables in our diff-in-diff equation for leverage study. The *Post* and *Treated* variables are identical to our previous models. If we notice that firms' observable characteristics have altered systematically following the introduction of CBPP, we should consider this selection when assessing the effects of CBPP on capital structure.

The instrument must also satisfy further assumptions for a meaningful and unbiased ITT estimate (Angrist & Pischke, 2009). The first assumption is that the instrumental variable is assigned randomly between the treatment and control groups. In our context, the eligibility of a company depends mainly on the credit rating of the company, which is not as perfect as a random variable. In this situation, there might be other variables that affect the treatment and

control group differently and correlate with our output at the same time. For example, consider an onset of Covid-19 shock which has overlapped with the CBPP introduction quarter or any other unobservable factor, which might make eligible firms change their bond issuance behavior relative to non-eligible ones independent of CBPP announcement. The direction of our bias in the ITT estimate depends on the sign of the correlation between the treatment variable and the unobservable factor; however, there is no official test to determine the direction of bias. So, we may look at the correlation between our unobservable factor and credit rating, along with the correlation between the unobservable factor and our outcome variable. Khwaja and Mian (2008) state that for finding the direction of bias, we can compare the unbiased coefficient of the endogenous variable with a biased coefficient, while in our setting, we do not have an unbiased estimation of our endogenous variable. Therefore, we reason the potential direction of bias in our study through intuitive argument and by observing how the coefficient of our variable changes among different specifications in the analysis considering the movement of R-squared based on Oster (2019) and the Gross-Rueschkamp, Steffen, and Streitz (2019) studies.

The second assumption is an exclusion restriction meaning there should be no direct association between the instrument and the dependent variable, and it should affect the outcome variable only through treatment status. In our setting, eligibility for the CBPP should affect yield spreads and debt structures only through being bought or not bought by the Riksbank and not through other channels. While there is no official test to investigate the exclusion condition, this condition can be violated if being eligible or non-eligible for CBPP affects the potential outcomes directly. Since the eligibility of bonds mainly depends on the credit rating of bonds, it is difficult to argue that our instrument has no direct impact on the yield spread and debt structure since better rating bonds are less risky, and their issuers have better access to different debt markets compared to the low rated ones. In this case, our TOT effect is biased by changes in outcomes among those bonds that are eligible for the program, but Riksbank has not acquired their bonds. However, we may argue the direction of bias according to Jones (2015). In our case, the Wald estimator of the TOT can represent as follows:

$$True\_TOT = Biased\_TOT + \frac{\pi_{NT}}{\pi_C}\,\eta_{NT} \qquad \text{Eq. (10)}$$

Where the π_{NT} is the share of never-takers, those are eligible but not purchased by Riksbank, and π_C is the share of compliers in which Riksbank has purchased their bonds under CBPP. The η_{NT} stands for the effect of eligibility on the outcomes of never-takers. The bias direction depends on the sign of eligibility effect on the never-takers group, and all things equal is increasing in the share of never-takers and decreasing in the compliers rate. While evaluation of the direct impact of eligibility on the group being eligible but not purchased may not be possible, we will discuss the sign of relationship intuitively in Section 4.4.

Another necessary assumption for the validity of the treatment effect on the treated group is the homogeneity assumption, which means that the instrument should impact the affected group similarly. In our analysis, the homogeneity assumption is valid because, with eligibility for CBPP, the purchase probability only increases. The last assumption is the validity of first stage impact, which we can check by looking at the coefficient and standard errors of the instrument in the first stage regression.

4 Empirical Results and Discussions

4.1 Summary Statistics

Panel A of Table 2 presents summary statistics of the dataset used for the corporate bond yield spreads analysis, split into eligible- and non-eligible bonds based on before and after the CBPP announcement by Riksbank in Q1 2020. Treatment bonds, on average, have a lower yield spread and bid-ask spread compared to control bonds both before and after the introduction of the policy. These differences all are significant at a 1% level. The average yield spread of CBPP non-eligible bonds rises to 3.3% after the policy statement compared to 2.6% before the announcement, while that of eligible bonds increases negligibility.

Panel B of Table 2 contains descriptive statistics for our firm-level variables set, comparing eligible- and non-eligible firms before and after the CBPP announcement period. We observe a significant degree of heterogeneity in our sample of firms. The treatment group tends to be, on average, significantly larger in size, more profitable and has a higher degree of tangible assets to total assets relative to the control group. The average long-term debt-to-asset ratio of CBPP-eligible firms is 28%, including a 20% average bond debt-to-assets ratio and a 9% average loans-to-assets ratio before the announcement. Whereas that of non-eligible firms is 26% which is 16% of that is related to the average bond debt-to-assets ratio and 12% to the average loans-to-assets ratio before the announcement. On average, treatment firms have a significantly higher bond debt-to-asset ratio (20% versus 15%) and a lower proportion of loan-to-asset (9% versus 12%) before the statement of Riksbank CBPP. This trend also holds for periods after the first quarter of 2020. The difference between the average market-to-book ratio and the bond-outstanding debt denominated in SEK is non-significant among eligible and non-eligible firms both before and after the announcement. We put the descriptive statistics for the overall sample in Appendix B.2.

Table 2- Descriptive Statistics for Key Variables in Our Sample

Panel A: Bond-level Data

Before CBPP Announcement	**Non-eligible Bonds**				**Eligible Bonds**				**Difference in Mean**
	N	**Mean**	**SD**	**Median**	**N**	**Mean**	**SD**	**Median**	
Yield-to-Maturity (%)	435	2.184	3.305	0.972	617	0.882	0.587	0.768	-1.302***
Yield Spread (%)	435	2.604	3.306	1.379	617	1.302	0.589	1.196	-1.301***
Bid price	435	100.367	3.53	100.501	617	101.153	1.964	100.578	0.787***
Ask price	435	100.866	3.385	100.875	617	101.437	2.005	100.888	0.571***
Bid-Ask Spread (%)	435	0.503	0.581	0.323	617	0.28	0.164	0.266	-0.224***
After CBPP Announcement	**Non-eligible Bonds**				**Eligible Bonds**				**Difference in Mean**
	N	**Mean**	**SD**	**Median**	**N**	**Mean**	**SD**	**Median**	
Yield-to-Maturity (%)	567	3.137	4.119	1.809	889	1.189	0.818	0.95	-1.948***
Yield Spread (%)	567	3.276	4.121	1.948	889	1.328	0.824	1.079	-1.948***
Bid price	567	98.264	6.137	99.956	879	99.983	2.397	100.212	1.719***
Ask price	567	99.15	5.756	100.303	879	100.528	2.067	100.51	1.377***
Bid-Ask Spread (%)	567	0.929	1.474	0.451	879	0.551	0.732	0.326	-0.377***

Panel B: Firm-level Data

Before CBPP Announcement	**Non-eligible Bonds**				**Eligible Bonds**				**Difference in Mean**
	N	**Mean**	**SD**	**Median**	**N**	**Mean**	**SD**	**Median**	
Size	429	8.383	2.039	8.272	145	10.976	0.841	11.212	2.593***
Profitability	429	0.013	0.044	0.017	145	0.024	0.031	0.014	0.011***
Tangibility	412	0.141	0.2	0.053	144	0.183	0.231	0.103	0.042**
Market-to-Book	394	1.883	4.762	1.39	142	1.71	3.248	1.645	-0.172
LT debt/Assets	429	0.259	0.198	0.218	145	0.28	0.179	0.259	0.021
Total Bond Debt/Assets	429	0.159	0.19	0.112	145	0.202	0.215	0.135	0.044**
SEK Bond Debt/Assets	429	0.143	0.188	0.093	145	0.116	0.14	0.082	-0.027
Loan/Assets	381	0.121	0.16	0.049	137	0.092	0.088	0.06	-0.029**

(Continued on next page)

Table 2 (Continued)

After CBPP Announcement	Non-eligible Firms				Eligible Firms				Difference in mean
	N	Mean	SD	Median	N	Mean	SD	Median	
Size	346	8.537	1.965	8.675	116	11.069	0.811	11.281	2.532***
Profitability	346	0.015	0.032	0.015	116	0.027	0.028	0.013	0.012***
Tangibility	330	0.153	0.228	0.061	114	0.187	0.242	0.099	0.034
Market-to-Book	326	2.074	2.575	1.458	116	1.58	3.523	1.418	-0.494
LT debt/Assets	346	0.246	0.205	0.192	116	0.283	0.171	0.248	0.037**
Total Bond Debt/Assets	346	0.156	0.197	0.105	116	0.223	0.233	0.139	0.066***
SEK Bond Debt/Assets	346	0.141	0.191	0.086	116	0.117	0.128	0.091	-0.024
Loan/Assets	298	0.123	0.159	0.06	112	0.076	0.094	0.039	-0.047***

This table reports summary statistics of key variables before and after the CBPP announcement in Q1 2020. Panel A shows the statistics among our bond-level data. Non-eligible bonds are our control group, and Eligible-bonds are our treatment group containing IG-rated bonds. Panel B presents the descriptive statistics of variables in firm-level data. The Non-eligible firms are non-IG-rated Swedish firms in our control group, and Eligible firms comprised IG-rated Swedish in a treatment group. We define all variables in Appendix A.4.

4.2 CBPP Announcement Effect on Yield Spread of Eligible Bonds (ITT)

After trimming the data as described in Section 3.1, we reach 562 publicly traded bonds in SEK, of which 254 have an investment-grade rating issued by 29 eligible firms. We consider the post-treatment variable from Q1 2020 onwards. Panel A Figure 1 investigates the parallel trend for yield spread by plotting the means of the outcome over time for the treated and control group. Also, we performed a test in a Granger-type causality form based on Eq. (2) to see whether dummies for each pre-CBPP period for the treated observations are jointly significant. The test statistic in Appendix B.3. reveals that we cannot reject the null hypothesis of parallel trends. Therefore, visual inspection and test support the parallel-trends assumption for yield spread.

We plot the average quarterly yield spread among the high IG-rated firms (AAA-A) and low IG-rated ones (BBB-rated) in Panel B of Figure 1 to see their reaction to the policy based on the rating quality of eligible bonds. Visually we see that the yield spread of the IG-rated bonds and non-IG rated has dropped after Q1 2020 (Panel A). This decline has happened for both the

highest and lowest ratings of eligible bonds (Panel B). To analyze the reaction of credit spread of eligible bonds to the CBPP announcement, we run the diff-in-diff method defined in Section 3.2.1 and estimate Eq. (1).

Table 3 presents the summary results of the model. Columns 1 and 2 of Table 3 show the result in the base specification without any control variables. Then in column 3, we incorporate the lag of the bid-ask spread to control for the liquidity of bonds. The coefficients on the interaction term of *Post_Yield* variable by *Treated* (*Post_Yield* × *Treated*) in the third row change negligibly after inserting control variables and are still significant at a 95% confidence level. The result shows that by controlling for the liquidity of assets, the yield spread of eligible bonds decreased by 68 bps compared to the non-eligible bonds post-CBPP.

Further to analyze the reaction of yield spread of AAA-A and BBB-rated, in column 4, we separately analyze the program for high- and low-quality investment-grade bonds. According to the results, the policy announcement decreases the yield spread of BBB-rated and AAA-A corporate bonds compared to the non-eligible bonds by 67 bps and 73 bps, respectively. These results are significant at a 95% level and show that the magnitude of the impact is more for high-quality bonds. This result makes sense economically because high-rated bonds are less risky and are a better substitute for sovereign bonds, so they enjoy more from the program relative to the BBB-rated bonds, especially during prevailing situations. In the study by Gross-Rueschkamp, Steffen, and Streitz (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. They just discover that only the yield spread of BBB-rated bonds experiences a significant drop post-CSPP statement. This difference in the result can be plausible because that study evaluates the effect of ECB quantitative easing in 2016 when the market was more in a normal situation and investors had more risk appetite to invest in higher-risk assets than during the Covid-19 pandemic period.

Besides, to investigate the effect of the CBPP announcement and the beginning of the actual purchase of corporate bonds, we employ a model based on Eq. (3). Table 4 presents the results of this evaluation. Columns 1 of Table 4 evaluates the effect of policy between announcement and purchase time without control variables, while column 2 incorporates the bid-ask spread as a control variable for the liquidity of bonds. The average of bond spread for eligible bonds decreases by 75 bps compared to the nonqualified bonds on the announcement date. However, the yield spreads decline by 32 bps after the purchased date relative to non-eligible bonds. This result is consistent with the findings of previous studies showing the pronounced effect of the asset purchase program captured by the announcement of the policy (Altavilla, Carboni, & Motto, 2015). When the Riksbank starts to implement the CBPP, these purchased bonds are eliminated from the firm's financial statements, improving the debt potential of companies and facilitating the liquidity supply (Nozawa & Qiu, 2021). Hence, we see that the yield spread

decreases after policy implementation, but the magnitude of this effect is lower than the announcement effect.

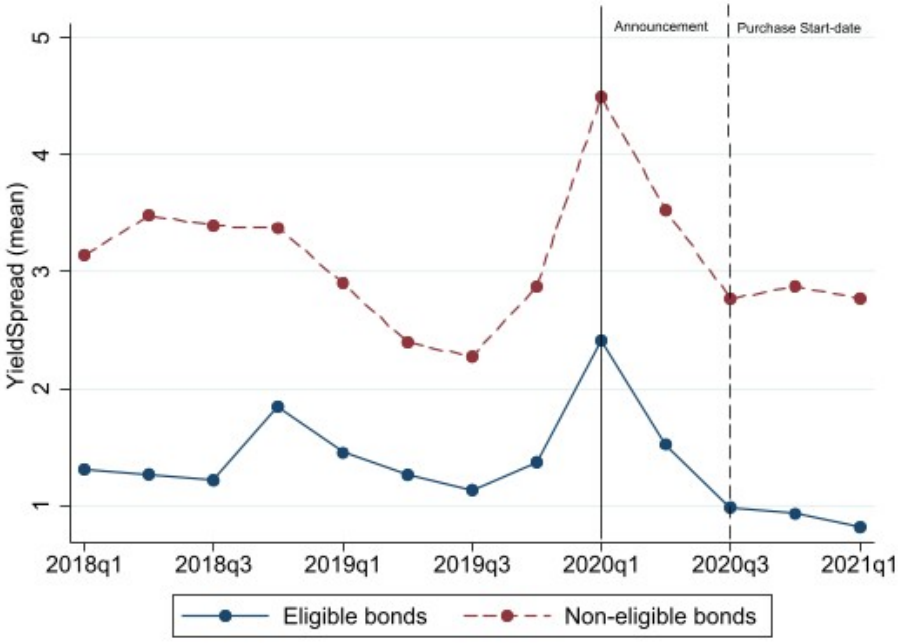
Table 3- Impact of CBPP on the Yield Spreads: Swedish Eligible Bonds vs. Swedish Non-Eligible Bonds

VARIABLES	(1) Yield Spread	(2) Yield Spread	(3) Yield Spread	(4) Yield Spread
Post_Yield	0.672** (0.286)	Omitted	Omitted	Omitted
Treated	-1.301*** (0.278)	Omitted	Omitted	Omitted
Post_Yield × Treated	-0.706 ** (0.309)	-0.685** (0.308)	-0.677** (0.303)	Omitted
AAA-A rating × Post				-0.733** (0.305)
BBB rating × Post				-0.666** (0.303)
Time FE	No	Yes	No	No
Bond FE	No	Yes	Yes	Yes
2digit SIC × Time FE	No	No	Yes	Yes
Controls	No	No	Yes	Yes
R-squared	0.105	0.246	0.520	0.608
Observations	2,508	2,508	2,065	2,065

*This table reports the effect of the Riksbank corporate bond purchases on the yield spread over the sample period of Q1 2019 to Q1 2021. Post_Yield equals one after the CSPP announcement, i.e., Q1 2020 onwards, and zero otherwise. Treated is a dummy variable equal to one for IG-rated bonds and zero for non-IG-rated bonds. We include bond fixed effects, time fixed effects, and bid-ask spread as a control for liquidity. We report robust standard errors clustered at the bond level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

To see how the CBPP announcement effect grows or fades as time passes, we employ a model as a form of Eq. (2). We report the estimated leads and lags, from eight quarters before to four quarters after the CBPP announcement in Appendix B.4, and plot the coefficients in Figure 2. The estimates indicate no impact in 8 quarters before the introduction of the Riksbank corporate bond purchase program in Q1 2020. However, the yield spread declines in the first quarter after the announcement, which then appears to flatten out with a lower rate of yield spread for eligible bonds. This pattern seems to be compatible with our previous results.

Panel A. Parallel Trend Identification for Yield Spread



Panel B. Yield Spread for AAA-A and BBB Issuance

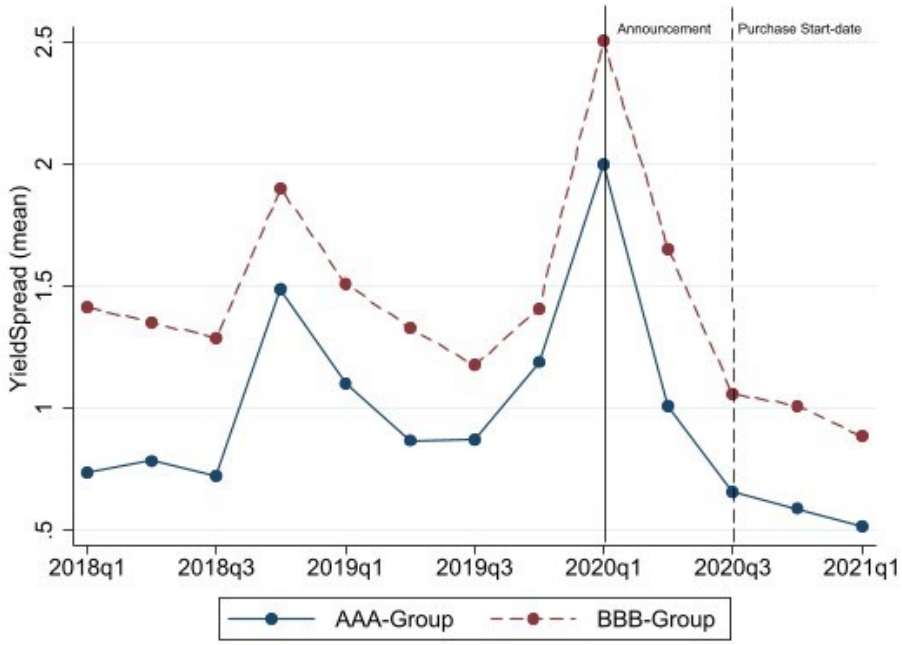


Figure 1. Parallel Trend Identification for Yield Spread

Panel A plots the average bond yield spreads for CBPP-eligible bonds (treatment group) and CBPP-non-eligible bonds (control group) in our sample from. Panel B compares the average yield spread of bonds among eligible bonds with a rating from A to AAA (AAA-A Issuance) and IG-rated bonds with lower quality of -BBB to +BBB (BBB Issuance). We extend the pre-CBPP to eight quarters before the CBPP announcement spanning from Q1 2018 to Q1 2021. The gray solid and dashed lines show the CBPP announcement and the start of CBPP in Q1 2020 and Q3 2020, respectively.

Table 4- Impact of CBPP on the Yield Spread on the Announcement and Purchase Date of CBPP

	(1)	(2)
VARIABLES	Yield Spread	Yield Spread
Ann_CBPP × Treated	-0.760**	-0.752**
	(0.352)	(0.352)
Pur_CBPP × Treated	-0.360**	-0.322**
	(0.158)	(0.148)
Time FE	Yes	No
Bond FE	Yes	Yes
2digit SIC × Time FE	No	Yes
Controls	No	Yes
R-squared	0.223	0.465
Observations	2,508	2,065
Number of bond-id	435	395

*This table reports the effect of the Riksbank corporate bond purchases on the yield spread on the announcement date and purchase date over the sample period of Q1 2019 to Q1 2021. Ann_CBPP takes value one for the announcement date (Q1 2020) till the start day of the purchase program, and Pur_CBPP equals one after the beginning of the purchases (Q3 2020). Treated is a dummy variable equal to one for IG-rated bonds and zero for non-IG-rated bonds. We include bond fixed effects, time fixed effects, and bid-ask spread as a control for liquidity. We report robust standard errors clustered at the bond level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

In addition, we investigate the liquidity of bonds among both treated and control groups in our sample to see whether CBPP affects the yield spread of eligible bonds through the liquidity channel. In this regard, first, we plot the average of the Bid-Ask spread in *Figure 3*, and second, we run a basic difference-in-difference model to see the effect of policy announcement on the Bid-Ask spread. Table 5 shows that the Bid-Ask spread of eligible bonds decreased by 14 bps after the introduction of Riksbank CBPP, representing that the bonds in the treatment group experienced better liquidity than the control group on the announcement. It is economically meaningful because investment-grade bonds are less risky, so investors are more willing to invest in this type of asset during an uncertain time.

As we have mentioned in Section 3.2.4, our result could be bias because credit rating is not randomized between the treatment and control group; hence, the reaction of bonds is not the same to unobservable variables or observable events such as Covid shock. The Covid shock happened in the same quarter as CBPP announced; therefore, we could not control this shock. As Covid makes the market notoriously volatile, the risk premium of riskier assets, i.e., the

yield spread of non-eligible bonds, could increase more than the eligible bonds. It may cause the amplification of the reduction effect of the CBPP announcement on the estimated yield spread and liquidity of IG-rated bonds compared to non-IG-rated bonds. By comparing the coefficient of interaction term of *Post_Yield* by *Treated* variable (*Post_Yield* × *Treated*) in Table 3 across different specifications, we can see that the absolute value of the coefficient is decreasing and R-squared is increasing as we control for more variables. It shows a potential negative correlation between omitting variables and the rating of bonds, so our estimated CBPP announcement effect on the yield spread value is in the lower bounds of the CBPP effect. In other words, we overestimate the negative impact of CBPP on the credit risk of bonds. This matter also holds for the effect of program introduction on the liquidly estimation.

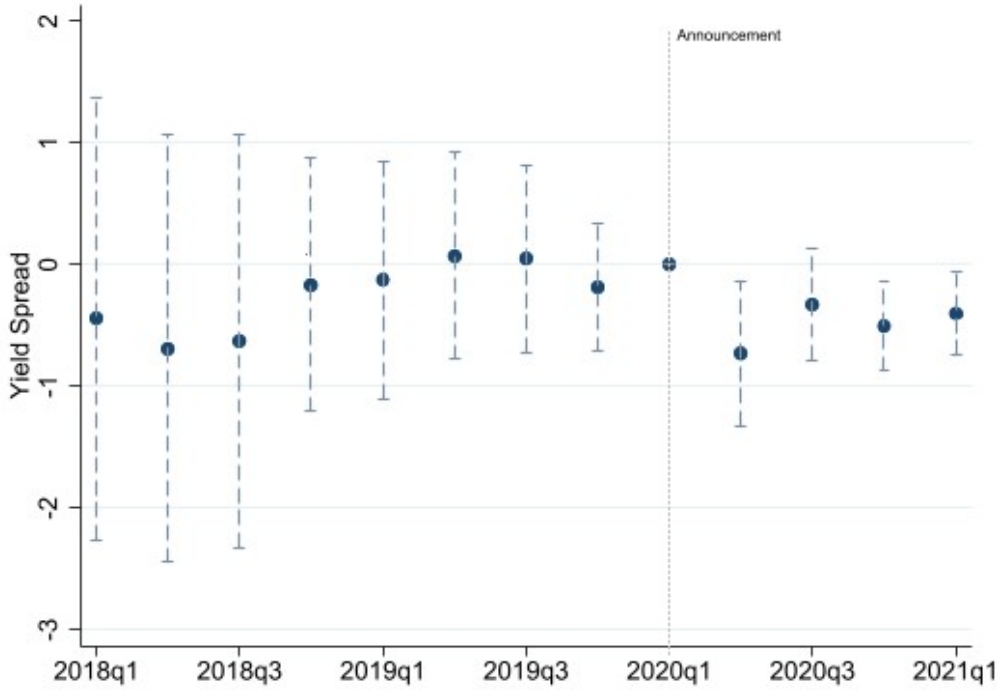


Figure 2. Pre- and Post-Intervention Effects of CBPP on the Yield Spread

This figure illustrates the impact of the Riksbank corporate bond purchases on the yield spread of bonds obtained from Eq. (2) We consider a 12-quarter window, from eight quarters before the CBPP announcement until four quarters after that. The dashed lines show 95% confidence intervals and cluster at the bond level. We remove Q1 2020 to estimate the dynamic effect of Riksbank CBPP on yield spread relative to the CBPP announcement quarter. We include bond fixed effects and bid-ask spread as a proxy for the liquidity of bonds. We define all variables in Appendix A.4.

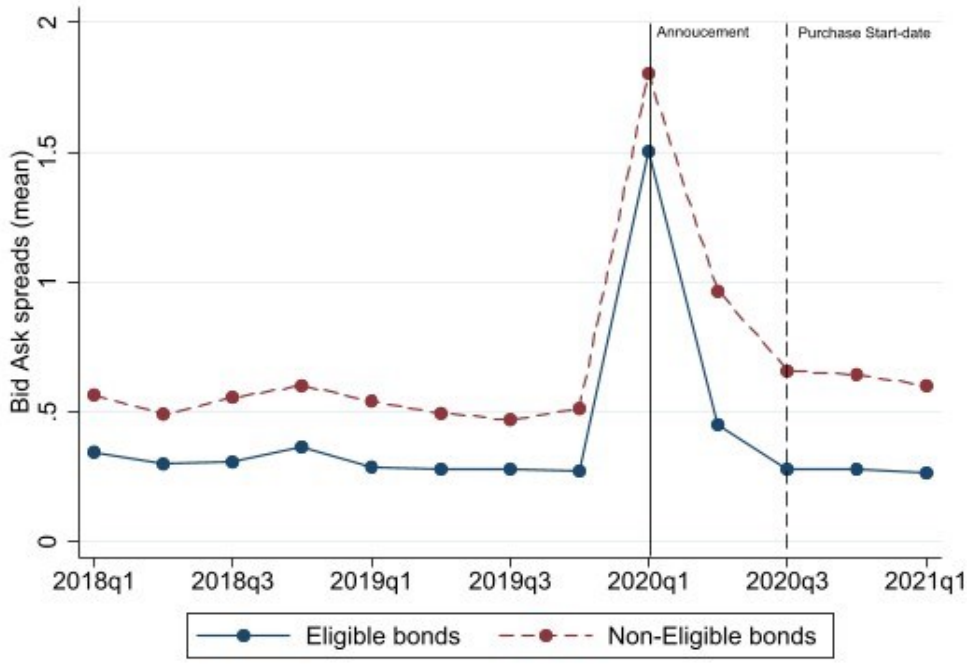


Figure 3. Bid-Ask Spread for Eligible Bonds and Non-Eligible Bonds

This figure plots the average bid-ask spreads for CBPP-eligible bonds (treatment group) and CBPP-non-eligible bonds (control group) in our sample from. We extend the pre-CBPP to eight quarters before the CBPP announcement spanning from Q1 2018 to Q1 2021. The gray solid and dashed lines show the CBBB announcement and the start of CBPP in Q1 2020 and Q3 2020, respectively.

Table 5- Impact of CBPP on the Bid-Ask Spread on the Announcement of CBPP

	(1)	(2)
VARIABLES	Bid-Ask Spread	Bid-Ask Spread
Post_Yield	0.425***	Omitted
	(0.0710)	
Treated	-0.224***	Omitted
	(0.0493)	
Post_Yield × Treated	-0.154**	-0.141**
	(0.0759)	(0.0722)
Time FE	No	No
Bond FE	No	Yes
2digit SIC × Time FE	No	Yes
Controls variables	No	No
R-squared	0.198	0.382
Observations	2,498	2,498

*This table reports the effect of the Riksbank corporate bond purchases on the bid-ask spread over the sample period of Q1 2019 to Q1 2021. Post_Yield equals one after the CSPP announcement, i.e., Q1 2020 onwards, and zero otherwise. Treated is a dummy variable equal to one for IG-rated bonds and zero for non-IG-rated bonds. We include bond fixed effects and time fixed effects in the model. We report robust standard errors clustered at the bond level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4*

4.3 CBPP Announcement Effect on Debt Capital Structure of Eligible Bonds (ITT)

In this part, we want to investigate the effect of policy on the issuance of new bonds after the CBPP announcement and see whether the purchase program motivates firms to change their financing method. To this aim, we perform a diff-in-diff analysis based on Eq. (5) in Section. 3.2.2 on an initial sample of quarterly data from 116 firms, of which bonds issued by 29 firms are eligible for the CBPP, and the rest are not entitled. Table 6 presents estimation results for the Bond Debt/Assets in Panel A, Bank Loan/Assets in Panel B, and Long-term Debt/Assets in Panel C from the basic diff-in-diff model (column 1) to a more inclusive model with firm characteristics variables and industry fixed-effect (column 4). The coefficient of the interaction of *Post* by *Treated* (*Post* × *Treated*) shows the effect of the CBPP on bond debt-to-asset, loans-to-asset, and long-term debt-to-asset ratios of eligible firms in Panel A, B, and C, respectively.

In Panel A of Table 6, columns 1 to 3 exhibit that the bond debt-to-assets ratio has decreased slightly after the CBPP announcement for the firms qualified for the CBPP, at the 10 percent level. However, after incorporating industry-quarter fixed effects (column 4) into the model, the magnitude of the policy effect not only has changed but also becomes significant at a 5 percent level. Economically it means that the bond debt-to-assets ratio of eligible firms compared to the non-eligible firms has increased after the announcement by 4 pp. Considering the mean of this ratio in our sample as 17%, it means that the CBPP announcement increases the bond debt-to-assets ratio of eligible firms by 24% relative to the unconditional mean. This result can show a heterogeneity effect among different industries; hence, we further check the impact of policy on the bonds of firms incorporated in the property industry and other industries. We split up the sample based on these two subsamples since the real estate segment is a large issuer of corporate bonds and represents 44 percent of all corporate bonds in SEK in our sample; therefore, it could be the reason for heterogeneity in our study.

Column 1 of Panel A in Table 7 presents the outcomes based on the splitting up of the effect of property and non-property sectors. It shows that the impact of policy on the increase of bond debt-to-assets ratio is just significant for the non-property sectors, which means that the property companies do not react immediately after the announcement. This result seems

reasonable because it takes time for the property sector to rebound instantly after the severe hit they found after the coronavirus pandemic, as this sector also has been exposed to the spillover effect of other industries (Riksbank, 2020). Moreover, in Column 2 of Table 7, we investigate the reaction of corporates with different credit rating quality. It shows that issuers with higher credit ratings (AAA-A) increase their bond debt-to-asset ratio by 9.4 pp compared to the non-eligible group and the pre-CBPP period after the announcement. However, firms with lower credit ratings reacted insignificantly to the policy announcement. These results are consistent with the risk-off risk-on theory, in which investors become more risk-averse during a period of risk and increase their investment in less risky assets. Thus, a rush for safe investments motivates more high-quality rating firms to issue more bonds relative to their assets. This analysis can show us that the different behavior of firms incorporated in the property sector and firms with lower credit ratings can drive the change in the results after including the industry-time trend in Table 6.

In Panel B and C of Table 6 we examine the effect of CBPP on the long-term loans-to-asset ratio and long-term debt-to-asset ratio, respectively. While a long-term loan of eligible firms scaled by their assets does not react to the CBPP announcement relative to control firms, the long-term debt ratio rises after the announcement by 3 pp in the model with control variables and fixed effects. In Panel B and C of Table 7, we evaluate the differential effect of policy based on being active in the property or non-property sectors and being a high IG rating or low IG rating. The results for the long-term debt leverage are consistent with the bond debt leverage in which only the effect is significant for the eligible firms in the non-property sectors and the firms with A to AAA ratings compared to non-eligible firms after the announcement.

The different leverage ratios among our eligible and non-eligible firms must have a common trend in the absence of an announcement to argue for causality effect of the policy announcement. *Figure 4* illustrates the parallel trend before the policy statement in Q1 2020, while the trend has changed afterward. Appendix B.3. presents the test statistics result for checking the anticipation change before the policy announcement. Generally, we can see visually and statistically that the parallel trend assumption holds for all three leverage variables. Figure 5 plots the pre-and post-intervention results of corporate bond quantitative easing treatment of the Riksbank on the bond debt-to-assets ratio. As we can see visually from the figure, all the leads that correspond to the pre-announcement are close to zero showing no considerable effects in the pre-treatment periods. However, we can see that the estimated coefficient in the first quarter after the policy announcement jumped to almost 2 pp, and in the third and fourth quarters post-CBPP, it reached the 3 pp level. In Appendix B.4. we present the numeric result of this investigation, indicating that the treatment effect is significant in lags 0, 2, and 3, which are the first quarter after the announcement, along with second and third quarters after the purchase date of CBPP, respectively.

Table 6- Impact of CBPP on the Bond Outstanding on the Announcement of CBPP

Panel A: Effect of CBPP on Bond Debt

VARIABLES	(1) Bond debt/Assets	(2) Bond debt/Assets	(3) Bond debt/Assets	(4) Bond debt/Assets
POST	-0.0022	Omitted	Omitted	Omitted
	(0.0099)			
Treated	0.0437	Omitted	Omitted	Omitted
	(0.0440)			
Post × Treated	0.0179*	0.0178*	0.0171*	0.0369**
	(0.0129)	(0.0147)	(0.0149)	(0.0157)
2digit SIC × 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	0.143	0.187	0.253	0.745
Observations	1,036	1,036	833	1,342

Panel B: Effect of CBPP on Bank Loan

VARIABLES	(1) Bank Loan/Assets	(2) Bank Loan/Assets	(3) Bank Loan/Assets	(4) Bank Loan/Assets
POST	0.002	Omitted	Omitted	Omitted
	(0.010)			
Treated	-0.036	Omitted	Omitted	Omitted
	(0.025)			
Post × Treated	-0.0171	-0.0039	-0.0045	-0.0040
	(0.011)	(0.010)	(0.009)	(0.014)
2digit SIC × 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	0.143	0.203	0.287	0.484
Observations	1,036	1,036	833	1,342

(Continued on next page)

Table 6 (Continued)

Panel C: Effect of CBPP on Long-term Debt

VARIABLES	(1) LT Debt/Assets	(2) LT Debt/Assets	(3) LT Debt/Assets	(4) LT Debt/Assets
POST	-0.0070	Omitted	Omitted	Omitted
	(0.0095)			
Treated	0.0203	Omitted	Omitted	Omitted
	(0.0390)			
Post × Treated	0.0140*	0.0179*	0.0216**	0.0292**
	(0.0114)	(0.0102)	(0.0101)	(0.0147)
2digit SIC × 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	0.091	0.286	0.443	0.703
Observations	1,036	1,036	833	1,342

*This table reports the effect of the Riksbank corporate bond purchases on bond financing, bank financing, and long-term leverage. The dependent variable in panels A, B, and C are Bond Debt/Assets, Bank Loan/Assets, and Long-term Debt/Assets, respectively. The sample period is Q1 2019 to Q1 2021. Post equals one after the CSPP announcement, i.e., Q2 2020 onwards, and zero otherwise. Treated is a dummy variable equal to one for Swedish IG firms and zero for non-IG-rated Swedish firms. We include firm fixed effects, time fixed effects, industry×time fixed effects, and firm-level controls (size, profitability, tangibility, and market-to-book) to control for the heterogeneity in firm characteristics. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

Table 7- Impact of CBPP on the Bond Outstanding on the Announcement of CBPP based on the Industry and Credit Quality of Firms

Panel A: Effect of CBPP on Bond Debt based on Industry and Quality of Credit

	(1)	(2)
VARIABLES	Bond debt/Assets	Bond debt/Assets
Non-Property × Post	0.0398**	
	(0.0187)	
Property × Post	0.0312	
	(0.0279)	
AAA-A rating × Post		0.0939***
		(0.0349)
BBB rating × Post		0.0171
		(0.0149)
2digit SIC × Time FE	Yes	Yes
Firm FE	Yes	Yes
Time FE	Yes	Yes
Controls	Yes	Yes
Observations	1,342	1,342
R-squared	0.814	0.815
Number of Firmid	113	113

Panel B: Effect of CBPP on Bank Loan based on Industry and Quality of Credit

	(1)	(2)
VARIABLES	Bank Loan/Assets	Bank Loan/Assets
Non-Property × Post	0.009	
	(0.013)	
Property × Post	0.012	
	(0.032)	
AAA-A rating × Post		-0.019
		(0.014)
BBB rating × Post		0.020
		(0.017)
2digit SIC × Time FE	Yes	Yes
Firm FE	Yes	Yes
Time FE	Yes	Yes
Controls	Yes	Yes
Observations	833	833
R-squared	0.423	0.427
Number of Firmid	110	110

(Continued on next page)

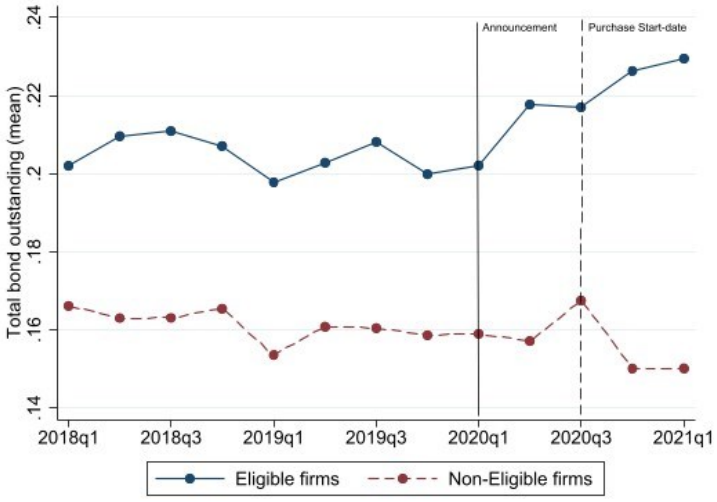
Table 7 (Continued)

Panel C: Effect of CBPP on Long-term Debt based on Industry and Quality of Credit

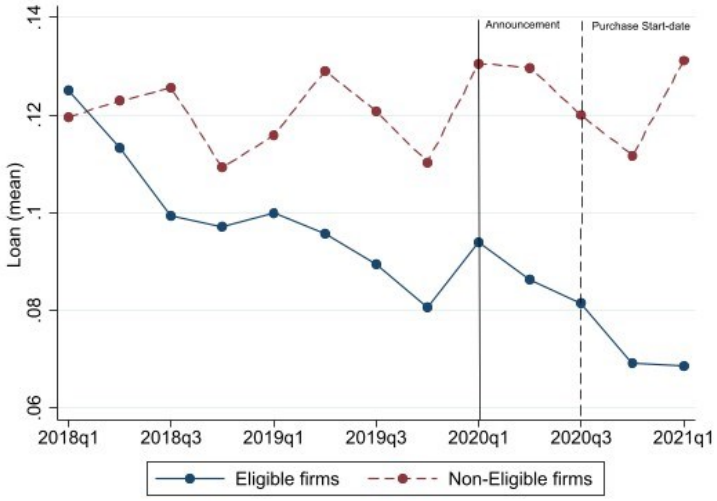
VARIABLES	(1) LT Debt/Assets	(2) LT Debt/Assets
Non-Property × Post	0.042**	
	(0.017)	
Property × Post	0.005	
	(0.027)	
AAA-A rating × Post		0.043**
		(0.025)
BBB rating × Post		0.024
		(0.015)
2digit SIC × Time FE	Yes	Yes
Firm FE	Yes	Yes
Time FE	Yes	Yes
Controls	Yes	Yes
Observations	833	833
R-squared	0.505	0.504
Number of Firmid	110	110

*This table reports the effect of the Riksbank corporate bond purchases on bond financing, bank financing, and long-term leverage. The dependent variable in panels A, B, and C are Bond Debt/Assets, Bank Loan/Assets, and Long-term Debt/Assets, respectively. The sample period is Q1 2019 to Q1 2021. Post equals one after the CSPP announcement, i.e., Q2 2020 onwards, and zero otherwise. Treated is a dummy variable equal to one for Swedish IG firms and zero for non-IG-rated Swedish firms. AAA-A rating equals one for Swedish firms with a rating ranging from A to AAA, and zero otherwise. BBB rating equals one for Swedish firms with a rating from -BBB to +BBB, and zero otherwise. Non-property is a dummy variable that takes one if the firm incorporates in the industry except real estate and, zero otherwise. Property equals one for the real estate, and zero otherwise. We include firm fixed effects, time fixed effects, industry×time fixed effects, and firm-level controls (size, profitability, tangibility, and market-to-book) to control for the heterogeneity in firm characteristics. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

Panel A: Bond Outstanding for Eligible Firms and Non-eligible Firms



Panel B: Bank Loan for Eligible Firms and Non-eligible Firms



Panel C: Long-term Debt for Eligible Firms and Non-eligible Firms

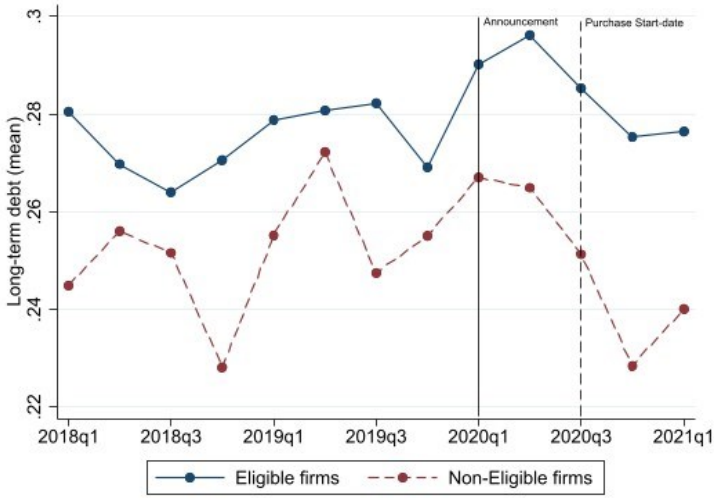


Figure 4. Parallel Trend Identification for Leverage Ratios

Panels A, B, and C plot the average Bond Debt/Assets, Bank Loan/Assets, and Long-term Debt/Assets for CBPP-eligible firms (treatment group) and CBPP-non-eligible firms (control group) in our sample, respectively. We

extend the pre-CBPP to eight quarters before the CBPP announcement spanning from Q1 2018 to Q1 2021. The gray solid and dashed lines show the CBBB announcement and the start of CBPP in Q1 2020 and Q3 2020, respectively.

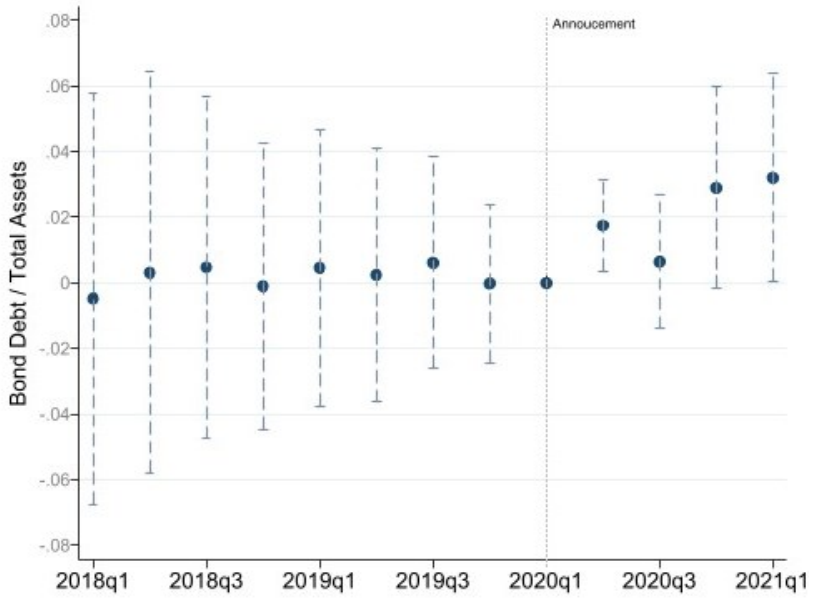


Figure 5. Pre- and Post-intervention Effects of CBPP on the Bond Debt over Asset Ratio

This figure illustrates the impact of the Riksbank corporate bond purchases on the bond financing of Swedish firms obtained from Equation (6). We consider a 12-quarter window, from eight quarters before the CBPP announcement until four quarters after that. The dashed lines show 95% confidence intervals and cluster at the bond level. We remove Q1 2020 to estimate the dynamic effect of Riksbank CBPP on bond financing relative to the CBPP announcement quarter. We include firm fixed effects, time fixed effects, industry×time fixed effects, and firm-level controls (size, profitability, tangibility, and market-to-book) to control for the heterogeneity in firm characteristics. We define all variables in Appendix A.4.

4.4 CBPP Announcement Effect on Actual Purchased Group (TOT)

So far, we have illustrated the effect of CBPP on the group of eligible firms (ITT). In our study, no bond can be bought by the Riksbank if it is not qualified; therefore, we can evaluate the average treatment effect on the treated group (TOT) by performing the 2SLS analysis as stated in Section. 3.2.3.

We use eligibility as an instrument for the purchase of bonds to compute the impact of the policy on the group that Riksbank has purchased their bonds. First, we run the first-stage regressions to see the effect of the eligibility on the probability of being purchased by the

central bank. Then by using the fitted value from the first stage, we run a diff-in-diff model. As mentioned in Section. 3.2.3 the TOT effect is identical to the Wald estimator, which is the ratio of the ITT effect to the first stage effect.

Table 8 and Table 9 present the total effect of CBPP on the yield spread and capital structure of the firms whose bonds are purchased by the Riksbank, respectively. The first stage analyses show that 53 percent of eligible bonds belong to the 93 percent of IG-rated public firms which the Riksbank has purchased their bonds after Q3 of 2020. Table 8 exhibits that the yield spread of bonds purchased by the Riksbank decreased by 129 bp after the announcement. This result implies that purchased bonds enjoy more from the program compared to the situation in that we examine the effect of the policy on the eligible firms. This result approves the liquidity channel effect of the corporate purchase bond program due to segmentation of the bond market, causing bonds that Riksbank has bought under CBPP to experience a more pronounced reduction effect in the yield spread compared to those that Riksbank has not purchased. However, the average impact of the CBPP announcement on all different types of debt-to-asset ratio of firms whose Riksbank has bought their bonds is almost likewise the effect of policy on the eligible firms in Table 6 because 93 percent of the qualified firms have sold at least one bond to the Riksbank.

Table 8- Impact of CBPP on the Yield Spread of Bonds (TOT)

	(1)	(2)	(3)
VARIABLES	Yield Spread	Yield Spread	Yield Spread
Second Stage:			
POST_Yield	0.672**	Omitted	Omitted
	(0.286)		
$\widehat{Purchased}$	-2.471***	Omitted	Omitted
	(0.529)		
$\widehat{Purchased}$ × POST_Yield	-1.341**	-1.302**	-1.286**
	(0.547)	(0.586)	(0.621)
Time FE	No	Yes	Yes
Bond FE	No	Yes	Yes
Controls	No	No	Yes
Observations	2,508	2,508	2,065
First Stage:			
Actual Purchase	0.5266 ***	0.5266 ***	0.5266 ***
	(0.0158)	(0.0158)	(0.0158)
Controls	No	No	No
Observations	2,508	2,508	2,508

This table reports the effect of the Riksbank corporate bond purchases on the yield spread of bonds purchased by Riksbank over the sample period of Q1 2019 to Q1 2021. The actual purchase is the first stage effect, showing the share of eligible bonds purchased by Riksbank under CBPP. $\widehat{Purchased}$ *indicates the estimated purchase based*

on the first stage equation. Post_Yield equals one after the CSPP announcement, i.e., Q1 2020 onwards, and zero otherwise. $\widehat{Purchased} \times POST\_Yield$ *captures the TOT effect, which equals the Wald estimator ratio. We include bond fixed effects, time fixed effects, and bid-ask spread as a control for liquidity. We report robust standard errors clustered at the bond level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

Table 9- Impact of CBPP on the Capital Structure of Firms (TOT)

Panel A: Effect of CBPP on Bond Debt

VARIABLES	(1) Bond debt /Assets	(2) Bond debt /Assets	(3) Bond debt /Assets	(4) Bond debt /Assets
Second Stage:				
POST	-0.0015	Omitted	Omitted	Omitted
	(0.0116)			
$\widehat{Purchased}$	0.0470	Omitted	Omitted	Omitted
	(0.0474)			
$\widehat{Purchased}$ × POST_Yield	0.0193*	0.0191*	0.0184*	0.0396**
	(0.0148)	(0.0158)	(0.0161)	(0.0168)
2digit SIC × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
Observations	1,036	1,036	833	833
First Stage:				
Actual Purchase	0.9310***	0.9310***	0.9310***	0.9310***
	(0.0165)	(0.0165)	(0.0165)	(0.0165)
Controls	No	No	No	No
Observations	498	498	498	498

Panel B: Effect of CBPP on Bank Loan

VARIABLES	(1) Bank Loan /Assets	(2) Bank Loan /Assets	(3) Bank Loan /Assets	(4) Bank Loan /Assets
Second Stage:				
POST	0.00213	Omitted	Omitted	Omitted
	(0.00960)			
$\widehat{Purchased}$	-0.0384	Omitted	Omitted	Omitted
	(0.0263)			
$\widehat{Purchased}$ × POST_Yield	-0.0184	-0.0042	-0.0048	-0.0043
	(0.0118)	(0.0104)	(0.00983)	(0.0150)

(Continued on the next page)

Table 9 Panel B (Continued)

2digit SIC × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
Observations	1,036	1,036	833	833
First Stage:				
Actual Purchase	0.9310***	0.9310***	0.9310***	0.9310***
	(0.0165)	(0.0165)	(0.0165)	(0.0165)
Controls	No	No	No	No
Observations	498	498	498	498

Panel C: Effect of CBPP on Long-term Debt

	(1)	(2)	(3)	(4)
VARIABLES	LT Debt /Assets	LT Debt /Assets	LT Debt /Assets	LT Debt /Assets
Second Stage:				
POST	-0.00702	Omitted	Omitted	Omitted
	(0.00955)			
$\widehat{Purchased}$	0.0218	Omitted	Omitted	Omitted
	(0.0419)			
$\widehat{Purchased}$ × POST_Yield	0.0150	0.0192*	0.0232**	0.0314**
	(0.0122)	(0.0109)	(0.0109)	(0.0158)
2digit SIC × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
Observations	1,036	1,036	833	833
First Stage:				
Actual Purchase	0.9310***	0.9310***	0.9310***	0.9310***
	(0.0165)	(0.0165)	(0.0165)	(0.0165)
Controls	No	No	No	No
Observations	498	498	498	498

This table reports the effect of the Riksbank corporate bond purchases on bond financing, bank financing, and long-term leverage of firms that Riksbank has purchased their bonds over the sample period of Q1 2019 to Q1 2021. The dependent variable in panels A, B, and C are Bond Debt/Assets, Bank Loan/Assets, and Long-term Debt/Assets, respectively. The actual purchase is the first stage effect, showing the share of eligible firms that Riksbank has purchased their bonds under the CBPP. $\widehat{Purchased}$ *indicates the estimated purchase based on the first stage equation. Post equals one after the CSPP announcement, i.e., Q2 2020 onwards, and zero otherwise.* $\widehat{Purchased} \times Post$ *captures the TOT effect, which equals the Wald estimator ratio. We include firm fixed effects, time fixed effects, industry×time fixed effects, and firm-level controls (size, profitability, tangibility, and market-*

*to-book) to control for the heterogeneity in firm characteristics. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

4.5 Further Analysis and Robustness Check

Table 2 shows that the difference in the mean of the treatment group and control group is significant for some variables such as the size, profitability, and tangibility before the CBPP announcement. Therefore, to check the robustness of the result, we apply the matching method to the difference-in-difference analysis to form the control group, which has the nearest propensity score in terms of size, profitability, and tangibility to each eligible firm. We allow for the maximum 1 percent distance between the control and treatment observation's propensity score, i.e., caliper. This means that the compared individuals are a better match, reducing the bias in our estimations; however, the variance increases as the number of counterfactuals drops. In the Appendix B.5 compares the extent of balancing between the two groups before and after the matching showing that there are no remaining distinctions in the variables employed to match. We can see in Panel A of Table 10 that after performing the matching method, the diff-in-diff estimates are consistent with our initial outcome in Panel A of Table 6.

Table 10- Robustness Test for the Effect of CBPP on the Eligible Firms (ITT)

Panel A: Matching Method for Analyzing the Effect of CBPP on Bond Debt

	(1)	(2)	(3)	(4)
VARIABLES	Bond debt/Assets	Bond debt/Assets	Bond debt/Assets	Bond debt/Assets
POST	-0.007	Omitted	Omitted	Omitted
	(0.010)			
Treated	0.099*	Omitted	Omitted	Omitted
	(0.054)			
Post × Treated	0.028*	0.019*	0.017*	0.032**
	(0.015)	(0.010)	(0.010)	(0.015)
2digit SIC × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
Observations	483	483	413	413

(Continued on the next page)

Table 10 (Continued)

Panel B: Placebo Test for Effect of CBPP on Yield Spread

VARIABLES	(1) Yield Spread	(2) Yield Spread	(3) Yield Spread	(4) Yield Spread
Post × Treated	-0.0592	-0.0622	-0.00263	-0.042
	(0.164)	(0.165)	(0.178)	(0.030)
AAA-A rating × Post				0.061
				(0.201)
BBB-rated × Post				-0.012
				(0.177)
2digit SIC × Time FE	No	No	Yes	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	No	No
Controls	No	No	Yes	Yes
Observations	2,237	2,237	1,868	1,868

Panel C: Placebo Test for Effect of CBPP on Bond Debt

VARIABLES	(1) Bond debt/Assets	(2) Bond debt/Assets	(3) Bond debt/Assets	(4) Bond debt/Assets
POST	0.017	Omitted	Omitted	Omitted
	(0.018)			
Treated	0.051	Omitted	Omitted	Omitted
	(0.048)			
Post × Treated	-0.002	-0.003	-0.007	-0.042
	(0.027)	(0.027)	(0.029)	(0.030)
2digit SIC × Time FE	No	No	No	Yes
Firm FE	No	Yes	Yes	Yes
Time FE	No	Yes	Yes	No
Controls	No	No	Yes	Yes
Observations	2,237	2,237	1,868	1,868

This table reports the robustness test for the effect of the Riksbank corporate bond purchases on the yield spreads of bonds along with the bond financing and long-term debt leverage of firms. Panel A reports the Effect of CBPP on Bond Debt by nearest neighbor matching for each treatment for the control firm that is closest in terms of size, profitability, tangibility, and bond debt in the pre-CBPP period. Panels B and C present the placebo test on the Yield spread and bond outstanding, respectively. We bound the sample span to Q1 2018 and Q4 2019, in which Post equals one after Q2 2109, and zero otherwise. For panels A and C, we include firm fixed effects, time fixed effects, industry×time fixed effects, and firm-level controls (size, profitability, tangibility, and market-to-book) to control for the heterogeneity in firm characteristics. We report robust standard errors clustered at the firm level in parentheses. In Panel B, we include bond fixed effects, time fixed effects, and bid-ask spread as a control for

*liquidity in the model. We report robust standard errors clustered at the bond level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

The Riksbank also announced an expansion of the purchase of government bonds and covered bonds on 16 March 2020. While it is difficult to distinguish whether our results are the consequence of the CBPP or other quantitative easing policies of the Riksbank, we run a placebo test to evaluate the changes in yield spread and bond financing by computing a diff-in-diff estimate around the announcement of the Executive Board in April 2019 regarding the purchase of government and cover bonds to check if cause occurs before consequences. We bound the sample span to Q1 2018 and Q4 2019, which POST equals one after Q2 2019. We find no distinctive effect for the yield spread and bond debt-to-asset ratio for eligible compared to non-eligible firms.

While we restrict our sample to firms active in SEK bonds, those firms could also be engaged in other currencies such as Euro. To see whether firms reacted to the CBPP announcement by increasing their bond issuance in SEK, we check the model only for the bonds initiated in SEK to disentangle the effect of the Riksbank policy on the bond issuance in SEK and other currencies. Table 11 presents the results of this estimation. In columns 1 to 3 of Table 11, we can see that the SEK bond debt-to-asset ratio of eligible firms increased after the announcement compared to the non-eligible firms, although this rise is not statistically significant. In the most saturated model considering the industry-time effect, the impact of CBPP on the increase of the bond initiated in SEK currency of eligible firms turns economically and statistically stronger and becomes significant at a 10 percent level. This result shows that the eligible firms raise their share of bond outstanding to assets more through other currencies, especially the Euro rather than SEK. It makes sense as these eligible firms are large companies with a good credit rating, making them qualified to participate in other foreign markets and take advantage of participating in large markets like the Euro market, which is more liquid and has longer maturities compared to the SEK bonds (Frohm et al., 2020). By checking the heterogeneity in the firms incorporated in the property sector and those who are active in other industries, we find similar results as Panel A in Table 7, in which only eligible firms who are not engaged in the property-related sectors and those with AAA-A rating rise their SEK bond debt-to-asset ratio after the announcement.

Table 11- Impact of CBPP on the SEK Bond Debt of Eligible Firms

VARIABLES	(1) SEK Bond debt /Assets	(2) SEK Bond debt /Assets	(3) SEK Bond debt /Assets	(4) SEK Bond debt /Assets	(5) SEK Bond debt /Assets	(6) SEK Bond debt /Assets
POST	-0.009	Omitted	Omitted	Omitted		
	(0.011)					
Treated	-0.026	Omitted	Omitted	Omitted		
	(0.032)					
Post × Treated	0.012	0.017	0.021	0.026*		
	(0.013)	(0.0137)	(0.0143)	(0.016)		
Non-Property × Post					0.036**	
					(0.017)	
Property × Post					0.006	
					(0.0221)	
AAA-A rating × Post						0.089***
						(0.033)
BBB rating × Post						0.004
						(0.011)
2digit SIC × Time FE	No	No	No	Yes	Yes	Yes
Firm FE	No	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	No	No	No
Controls	No	No	Yes	Yes	Yes	Yes
Observations	1,036	1,036	833	1,342	833	833

*This table reports the effect of the Riksbank corporate bond purchases on bond financing denominated in SEK of eligible firms over the sample period of Q1 2019 to Q1 2021. The dependent variable is the amount of bond outstanding of Swedish firms related to their bonds issued in SEK. Post equals one after the CSPP announcement, i.e., Q2 2020 onwards, and zero otherwise. Treated is a dummy variable equal to one for Swedish IG firms and zero for non-IG-rated Swedish firms. AAA-A rating equals one for Swedish firms with a rating ranging from A to AAA, and zero otherwise. BBB rating equals one for Swedish firms with a rating from -BBB to +BBB, and zero otherwise. Non-property is a dummy variable that takes one if the firm incorporates in the industry except real estate and, zero otherwise. Property equals one for the real estate, and zero otherwise. We include firm fixed effects, time fixed effects, industry×time fixed effects, and firm-level controls (size, profitability, tangibility, and market-to-book) to control for the heterogeneity in firm characteristics. We report robust standard errors clustered at the firm level in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

5 Conclusion

This paper employs a sample of 562 publicly traded bonds denominated in SEK belonging to 103 public non-bank Swedish issuers over the period Q1 2019 to Q1 2021 to investigate how Riksbank's corporate bond purchase program (CBPP) announcement in March 2020 affected the bond yield spread, and debt structure arrangement of firms.

We find that the yield spreads of IG-rated bonds drop after the Riksbank CBPP announcement both for BBB-rated and AAA-A ones; however, this effect is more noticeable on the bonds purchased by the Riksbank compared to those that are not purchased. Results show that most of the effect on the yield spread of eligible bonds for the purchase program is captured by the announcement date, and the effect on the implementation date is lower than the announcement effect. The decrease in bid-ask spread post-CBPP shows liquidity improvement in the bond market, which might stimulate the reduction of bond credit premium of IG-rated bonds compared to the non-IG-rated bonds through the liquidity channel. Furthermore, we find that the long-term debt-to-asset and bond debt-to-assets ratios have increased slightly for eligible firms after the announcement, whereas the reduction in the bank loan ratio has been insignificant for eligible firms. These findings suggest that eligible firms increase their long-term debt to sustain their business operations during pandemic times by increasing bond debt leverage rather than financing through bank loans due to the lower cost of bond financing. Results show that Sweden's bond market has heterogeneous effects among industries and credit ratings regarding bond issuance. The Riksbank corporate QE only significantly affects eligible firms in sectors unrelated to real estate and high-quality IG-rated ones.

Our results show the upper bound of the true effect of the Riksbank's CBPP announcement on the eligible and purchased group due to the endogeneity problem in our estimate; however, they have relevant implications for the Riksbank regarding the effectiveness of their corporate purchase program on the bond market and corporates in response to the Covid-19 shock and their future decisions by considering heterogeneity in the market. Our study is limited to public firms as quarterly financial data is not available for most of private firms. We also face difficulties retrieving quarterly data for bond debt based on different compositions for the public firms; hence we try to compute them manually. Testing the reliability of our results with other databases would be beneficial. Also, with a difference in characteristics between public and private firms, it would be interesting to expand the analysis to the private firms' group when the data collection is allowed. Moreover, we have not evaluated how the policy contributes to the real economy or how non-eligible firms change their financing behavior along with the change in banking lending behavior. We leave these questions for future research.

References

Abidi, N. and Miquel-Flores, I. (2018). Who benefits from the corporate QE? A regression discontinuity design approach, working paper, no.2145, European Central Bank

Andrade, P., Breckenfelder, J., De Fiore, F., Karadi, P. and Tristani, O., (2016). The ECB's asset purchase programme an early assessment, working paper, no.1956, European Central Bank

Angrist, J. D., & Pischke, J. S. (2009). Mostly harmless econometrics: An empiricist's companion, Princeton: Princeton university press

Altavilla, C., Carboni, G., & Motto, R. (2015). Asset purchase programmes and financial markets: lessons from the euro area, working paper, no.1864, European Central Bank

Arce, O., Mayordomo, S., & Gimeno, R. (2021). Making room for the needy: the credit-reallocation effects of the ECB's corporate QE, *Review of Finance*, vol.25, no.1, pp.43-84

Arslanalp, M.S., & Botman, M.D.P. (2015). Portfolio rebalancing in Japan: constraints and implications for quantitative easing, *International Monetary Fund*, pp.15-186

Bauer, M. & Rudebusch, G.D. (2014). The signaling channel for Federal Reserve bond purchases, *International Journal of Central Banking*. Available online: https://ssrn.com/abstract=2334518 [Accessed 30 May 2022]

Becker, B., & Ivashina, V. (2014). Cyclicality of credit supply: Firm level evidence, *Journal of Monetary Economics*, vol.62, pp.76-93

Belsham, T., Rattan, A., & Maher, R. (2017). Corporate Bond Purchase Scheme: design, operation and impact, Bank of England Quarterly Bulletin, Q3

Betz, F., & De Santis, R.A. (2019). ECB corporate QE and the loan supply to bank-dependent firms, working paper, no.2314, European Central Bank, Available online: https://ssrn.com/abstract=3453159 [Accessed 15 July 2022]

Bordo, M.D., & Duca, J.V. (2022). How new Fed corporate bond programs cushioned the Covid-19 recession, *Journal of Banking & Finance*, vol.136, no.106413

Boneva, L., De Roure, C., & Morley, B. (2018). The Impact of the Bank of England's Corporate Bond Purchase Scheme on Yield Spreads. working paper, no.719, Bank of England, Available online: https://ssrn.com/abstract=3149766 [Accessed 30 May 2022]

Boneva, L., Elliott, D., Kaminska, I., Linton, O.B., McLaren, N., & Morley, B. (2019) The impact of corporate QE on liquidity: evidence from the UK, working paper, no.782, Bank of England, Available online: https://ssrn.com/abstract=3346331 [Accessed 30 July 2022]

Bonfim, D. & Capela, A. (2020). The effect of corporate bond purchases by the ECB on firms' borrowing costs, *Banco de Portugal Economic Studies*, vol.6, no.3, pp.1-25

Cormac, C., & Marie, F. (2019). Transmission Channels of Central Bank Asset Purchases in the Irish Economy, *Economies*, vol. 7, no. 4, pp. 98

Chen, L., Lesmond, D. A., & Wei, J. (2007). Corporate yield spreads and bond liquidity, *The Journal of Finance*, vol.62, no.1, pp.119-149

Chen, Q., Filardo, A., He, D., & Zhu, F. (2011). International spillovers of central bank balance sheet policies, BIS Paper, vol.66, pp.220-264

Christensen, J. H., & Krogstrup, S. (2019). Transmission of quantitative easing: The role of central bank reserves, *The Economic Journal*, vol.129, no.617, pp.249-272

D'Amico, S., & King, T. B. (2013). Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply, *Journal of Financial Economics*, vol.108, no.2, pp.425-448

D'Avino, C. (2018). Quantitative easing, global banks and the international bank lending channel, *Economic Modelling*, vol.71, pp.234-246

De Santis, R.A., Geis, A., Juskaite, A., & Cruz, L.V. (2018). The impact of the corporate sector purchase programme on corporate bond markets and the financing of euro area non-financial corporations, *European Central Bank Economic Bulletin Articles*, vol. 3

De Santis, R.A. (2020). Impact of the asset purchase programme on euro area government bond yields using market news, *Economic Modelling*, vol. 86, pp.192-209

De Santis, R. A., & Zaghini, A. (2021). Unconventional monetary policy and corporate bond issuance, *European Economic Review*, vol.135, no.103727

Dell'Ariccia, G., Rabanal, P., & Sandri, D. (2018). Unconventional monetary policies in the euro area, Japan, and the United Kingdom, *Journal of Economic Perspectives*, vol. 32, no. 4, pp.147-72

Disyatat, P. (2011). The bank lending channel revisited, *Journal of money, Credit and Banking*, vol.43, no.4, pp.711-734

Duflo, E., Glennerster, R., & Kremer, M. (2007). Using randomization in development economics research: A toolkit. *Handbook of development economics*, vol.4, pp.3895-3962

Dunne, P., Mary, E., and Rebecca, S. (2015). The Expanded Asset Purchase Programme: What, why and How of Euro Area QE, *Central Bank of Ireland Quarterly Bulletin, Q2*, pp. 61–71.

Ertan, A., Kleymenova, A., & Tuijn, M. (2020). Financial intermediation through financial disintermediation: Evidence from the ecb corporate sector purchase programme, Fama-Miller working paper, no.18-06, Chicago Booth Research Paper

Frohm, E., Grip, J., Hansson, D., & Wollert, S. (2020). Two-tier credit developments during the coronavirus pandemic, *Economic Commentaries*, no.6, Sveriges Riksbank

Gagnon, J., Raskin, M., Remache, J., & Sack, B. (2018). The financial market effects of the Federal Reserve's large-scale asset purchases. *International Journal of Central Banking*, vol.7, no.1, pp.3-45

Galema, R.J., & Lugo, S. (2017). When central banks buy corporate bonds: Target selection and impact of the European Corporate Sector Purchase Program, USE discussion paper series, vol.17, no.16, pp.1-33

Galema, R., & Lugo, S. (2021). When central banks buy corporate bonds: Target selection and impact of the European Corporate Sector Purchase Program, *Journal of Financial Stability*, vol.54, no.100881

Goldberg, J., & Nozawa, Y. (2020). Liquidity supply in the corporate bond market, *The Journal of Finance*, vol.76, no.2, pp.755-796

Greenwood, R., Hanson, S.G., & Liao, G.Y. (2018). Asset Price Dynamics in Partially Segmented Markets, *The Review of Financial Studies*, vol.31, no.9, pp. 3307–3343

Greenwood, R., & Vayanos, D. (2014). Bond Supply and Excess Bond Returns, *The Review of Financial Studies*, vol.27, no.3, pp. 663–713

Gross-Rueschkamp, B., Steffen, S. & Streitz, D., (2019). A capital structure channel of monetary policy, *Journal of Financial Economics*, vol. 133, no.2, pp. 357-378

Jack, M., & Feng, Z. (2011). The impact of recent central bank asset purchase programmes, BIS Quarterly Review, Available online: https://www.bis.org/publ/qtrpdf/r_qt1112h.htm [Accessed 5 May 2022]

Jones, D. (2015). The economics of exclusion restrictions in iv models, working papers, no. w21391. National Bureau of Economic Research

Jonathan, L., (2018). A Dictionary of Finance and Banking, 6th edition, London: Oxford University Press

Joyce, M. A., & Tong, M. (2012). QE and the gilt market: a disaggregated analysis, *The Economic Journal*, vol.122, no.564, pp. F348-F384

Joyce, M., Miles, D., Scott, A., and Vayanos, D. (2012). Quantitative easing and unconventional monetary policy–an introduction, *The Economic Journal*, vol. 122, no. 564, pp. F271-F288

Khwaja, A. I., & Mian, A. (2008). Tracing the impact of bank liquidity shocks: Evidence from an emerging market, *American Economic Review*, vol.98, no.4, pp.1413-42

Koijen, R. S., Koulischer, F., Nguyen, B., & Yogo, M. (2017). Euro-area quantitative easing and portfolio rebalancing, *American Economic Review*, vol.107, no.5, pp. 621-27

Koijen, R.S., Koulischer, F., Nguyen, B. and Yogo, M., (2021). Inspecting the mechanism of quantitative easing in the euro area, *Journal of Financial Economics*, vol.140, no.1, pp.1-20

Krishnamurthy, A., & Vissing-Jorgensen, A. (2011). The effects of quantitative easing on interest rates: channels and implications for policy, working papers, no.17555, National Bureau of Economic Research

Krishnamurthy, A., Nagel, S., & Vissing-Jorgensen, A. (2018). ECB policies involving government bond purchases: Impact and channels, *Review of Finance*, vol.22, no.1, pp.1-44

Rochon, L. P., & Rossi, S. (2015). The Encyclopedia of Central Banking, Cheltenham: Edward Elgar Publishing

Maria, C, M. (2017). The "Cambridge" critique of the quantity theory of money: A note on how quantitative easing vindicates it, *Journal of Post Keynesian Economics*, vol.40, no.2, pp.260-271

Nozawa, Yoshio., & Qiu, Yancheng. (2021) Corporate bond market reactions to quantitative easing during the COVID-19 pandemic, *Journal of Banking & Finance*, vol.133, no.106153

Nordic Trustee. (2021). Corporate Bond Market Report [pdf], Available at: https://nordictrustee.com/nordic-corporate-bond-market-report-2021/ [Accessed 30 April 2022]

Nunn, Sharon M. (2022) Canada: Corporate Bond Purchase Program, *Journal of Financial Crises*, vol. 4, pp.1480-1503

Riksbank. (2022). Sveriges Riksbank Monetary policy, Available Online: https://www.riksbank.se/en-gb/monetary-policy/ [Accessed 1 April 2022]

Rodnyansky, A., & Darmouni, O.M. (2017). The effects of quantitative easing on bank lending behavior, *The Review of Financial Studies*, vol.30, no.11, pp.3858-3887

Tim, C. (2017). The debate over “quantitative easing” in the UK’s Great Recession and afterwards, Money in the Great Recession: Did a Crash in Money Growth Cause the Global Slump?, Cheltenham: Edward Elgar Publishing, pp.57-77

Todorov, K. (2020). Quantify the quantitative easing: Impact on bonds and corporate debt issuance. *Journal of Financial Economics*, vol.135, no.2, 340-358

Vayanos, D., Vila, J.L. (2009). A preferred-habitat model of the term structure of interest rates, working paper, no. 154, National Bureau of Economic Research

Zaghini, A. (2019). The CSPP at work: Yield heterogeneity and the portfolio rebalancing channel, *Journal of Corporate Finance*, vol.56, pp.282-297

Appendix A: Descriptions

Appendix A.1

Table A.1- List of corporate bond purchase programs in advanced-economies countries

Program launched before the global pandemic

Central Bank	Program Name	Announcement Date	Period	Size	Asset Types
Bank of Japan	Outright purchases of commercial paper and corporate bonds	April 2013 (renewed quarterly)	May – Jun 2013	¥300bn	Commercial paper and corporate bonds with 1-3 years remaining maturity
European central bank	The corporate sector purchase program	10 March 2016	Jun 2016 – Mar 2017	€80bn/month	NFCs corporate bonds from eurozone firms with Six months – 30 years remaining maturity
Bank of England	The corporate bond purchase scheme	4 August 2016	Sep 2016 – Apr 2017	£10 billion	NFCs corporate bonds

Program launched during the global pandemic

Central Bank	Program Name	Announcement Date	Period	Size	Asset Types
Bank of Canada	Corporate bond purchase program	15 Apr 2020	May 2020 - May 2021	C$10bn	**Corporate bonds**
Bank of England	Asset purchase facility	19 Mar 2020	Jun -Dec 2020	£200bn	Government bonds and corporate bonds
Bank of Japan	CP and corporate bond purchases	16 Mar 2020	Apr – Sep 2020	¥2tn	Commercial paper and corporate bonds
European Central Bank	Pandemic emergency purchase program	18Mar 2020	Jun - Dec 2020	€1.35tn	Government bonds, commercial paper, Covid's bonds, mortgaged-backed bonds, corporate bonds
US Federal Reserve System	Primary market corporate credit facility	23 Mar 2020	Jun - Sep 2020	$500bn	Corporate bonds
US Federal Reserve System	Secondary market corporate credit facility	23 Mar 2020	Jun – Sep 2020	$250bn	Corporate bonds and others
Riksbank	The corporate bond purchase program	19 March 2020	Mar 2020 -Jun 2021	SEK10bn	Corporate bonds

sources: Central banks websites & BIS Bulletin No.21, 05 June 2020

Appendix A.2

Table A.2- Timeline of Covid-19 development and the Riksbank monetary policies

Date	Riksbank policies in response to Covid-19
9 January 2020	WHO announces mysterious Coronavirus-related pneumonia in Wuhan, China
23 January 2020	Wuhan lockdown
31 January 2020	WHO issues global health emergency
9 March 2020	Italy lockdown
16 March 2020	Announcement for purchase of municipal bonds, government bond, and covered bond, for up to SEK300 billion during March-December 2020
18 March 2020	First purchase of government bonds for SEK2.5 billion
19 March 2020	Announcement of the corporate bond purchase program (CBPP) and commercial paper purchase program
25 March 2020	First auction of covered bond
2 April 2020	First purchase of commercial paper issued by Swedish non-financial corporations for SEK4 billion
27 April 2020	First purchase of municipal bonds
30 June 2020	The Riksbank announced the main technical characteristics of CBPP, and they also announced the extension of the purchase of government bond, municipal bond, covered bond up to SEK500 till June 2021
31 August 2020	Remaining Details of the CBPP
14 September 2020	First purchase of the CBPP
25 November 2020	Announcement of second extending of the securities purchase program, period and total amount, to up to SEK700 and extend the program to December 2021

Sources: Riksbank website for the securities purchase program and CNN news for the Covid-19 timeline.

Appendix A.3

Bond Outstanding Calculations

Due to a limitation to obtaining the firm's bond outstanding data on a quarterly basis, we create a proxy for bond outstanding data in our analysis. Many firms only published their financial statements with the debt outstanding in the aggregation of bank loans and bond debts. Therefore, we use bond issuance data from the Refinitiv Eikon Thomson Reuters database. We choose bond issuance data because the amount of new bond issuance shall accumulate to the total bond outstanding upon the responding issuance and maturity date.

The retrieved data consists of all bonds, notes, and commercial papers, both active and inactive, issued for each company before the date of retrieving, April 2022. Each security has information about an issuance date, maturity date, currency, and amounts specified explicitly.

We first specify a period of data to construct our outstanding bond data. Our main sample period is from 2019 Q1 to 2021 Q1; however, we extend our proxy data to cover a period from 2017 Q1 to 2021 Q4. We exclude the commercial paper's data and arrange the data by categorizing bonds and notes based on the currency of issuance in SEK and other currencies. We, then, filter for the maturity date and only accumulate those bonds with a valid remaining maturity at the end of each specific quarter based on the group of currencies. Specifically:

Bond outstanding as of QqYY	=	Accumulation of bonds that were issued before QqYY and matured after QqYY
	=	Accumulation of bonds that (issued date ≤ QqYY) and (maturity date > QqYY)

*QqYY represents for each specific time at the end of quarter during the sample period. i.e., Q12017, Q22017.

This way, we can get a reliable proxy of the firm's outstanding bond. Nevertheless, we acknowledge that there shall be some gap in the data that could obtain directly from the firm's actual financial statements. One advantage of our data set is that we can distinguish outstanding bonds in SEK from other currencies.

Appendix A.4

Table A.4- Variable definitions

Variable	Description	Source
Assets	Total assets in a million SEK	Refinitiv Eikon Thomson Reuters
Property, plant, and equipment (PPE)	Total tangible long-term assets that have remaining usage of more than one year	Refinitiv Eikon Thomson Reuters
Total equity	Total assets minus total liabilities	Refinitiv Eikon Thomson Reuters
Market value	The current value of a firm in the market	Refinitiv Eikon Thomson Reuters
Profitability	The ratio of EBITDA to total assets	Refinitiv Eikon Thomson Reuters
Tangibility	The ratio of PPE to total assets	Refinitiv Eikon Thomson Reuters
Market-to-Book	The ratio of the market value of equity to total equity	Refinitiv Eikon Thomson Reuters
Long-term debt (LT debt)	Debt with maturities of more than one year may consist of long-term bank borrowing, bonds, convertible bonds, etc.	Refinitiv Eikon Thomson Reuters
Total Bond Debt	See Appendix A.3	Calculated
SEK Bond Debt	See Appendix A.3	Calculated
Long-term bank loan	Long-term debt minus bond outstanding	Calculated
Bid price	The bid price of a bond	Refinitiv Eikon Thomson Reuters, Bloomberg
Ask price	The asking price of a bond	Refinitiv Eikon Thomson Reuters, Bloomberg
Yield-to-maturity	The yield to maturity of a bond, as defined by Bloomberg fields "YLD_YTM_MID."	Bloomberg
Treasury-bills rate	The interest rate of short-term debt instrument issued by the Swedish National Debt Office	Refinitiv Eikon Thomson Reuters
Bid-Ask spread	Bid price minus ask price and divided by bid-ask price	Refinitiv Eikon Thomson Reuters, Bloomberg
Yield spread	Bond yield-to-maturity minus matched three months treasury bills rate.	Refinitiv Eikon Thomson Reuters, Bloomberg

This table lists variables that are used in this paper. We describe the definition of each variable as well as the source of data.

Appendix A.5

Table A.5- Table of credit rating scales

	Description	S&P	Moody's	Fitch
Investment Grade Bonds	AAA-A	AAA	Aaa	AAA
		AA+	Aa1	AA+
		AA	Aa2	AA
		AA-	Aa3	AA
		A+	A1	A+
		A	A2	A
		A-	A3	A-
	BBB	BBB+	Baa1	BBB+
		BBB	Baa2	BBB
		BBB-	Baa3	BBB-
Non-Investment Grade Bonds	High Yield	BB+	Ba1	BB+
		BB	Ba2	BB
		BB-	Ba3	BB-
		B+	B1	B+
		B	B2	B
		B-	B3	B-
		CCC+	Caa1	CCC+
		CCC	Caa2	CCC

This table lists the credit ratings from major credit rating agencies and group them into general rating group. We refer to information available from Investopedia, 2022.

Appendix B: Tables

Appendix B.1

Table B.1- Changes of composition among treatment and control group

	(1)	(2)	(3)	(4)
Variables	Size	Profitability	Tangibility	Market-to-Book
Post × Treated	-0.0408	-0.0036	-0.0100	0.0831
	(0.0899)	(0.0039)	(0.0136)	(0.2890)
Observations	1,036	1,036	1,000	978
R-squared	0.282	0.018	0.007	0.002

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix B.2

Table B.2- Descriptive statistics for key variables of overall sample over the period Q1 2019 to Q1 2021

Panel A: Firm-level Data				
Variables	**N**	**Mean**	**SD**	**Median**
Size	1036	9.098	2.104	9.469
Profitability	1036	0.017	0.037	0.016
Tangibility	1000	0.156	0.219	0.063
Market-to-Book	978	1.885	3.786	1.455
LT debt/Assets	1036	0.261	0.195	0.217
Total Bond Debt/Assets	1036	0.171	0.202	0.116
SEK Bond Debt/Assets	1036	0.136	0.178	0.089
Loan/Assets	1036	0.125	0.156	0.06
Panel B: Bond-level Data				
Variables	**N**	**Mean**	**SD**	**Median**
Yield-to-Maturity	2508	1.727	2.609	0.999
Yield Spread	2508	1.983	2.601	1.283
Bid price	2498	99.949	3.835	100.329
Ask price	2498	100.499	3.557	100.635
Bid-Ask Spread	2498	0.55	0.829	0.327

This table reports summary statistics of key variables over period Q1 2019 to Q1 2021. Panel A shows the statistics among our bond-level data and panel B presents the descriptive statistics of variables in firm-level data. We define all variables in Appendix A.4.

Appendix B.3

Table B.3- Test Statistics for the parallel trend (pretreatment time period)

H0: Linear trends are parallel

Variables	**F-test**	**Prob>F**
Yield Spread	F (1, 434) = 0.03	0.8746
Bond debt/Asset	F (1, 116) = 0.04	0.8417
Bank Loan/Asset	F (1, 108) = 0.01	0.9098
LT Debt/Asset	F (1, 116) = 0.00	0.9983

Appendix B.4

Table B.4- Coefficients of event studies

Panel A: Yield Spread Analysis

Yield Spread	Coefficient	Robust St. Err.	t	P>|t|	[95% conf.	interval]
_lead9	-0.4398226	0.9257575	-0.48	0.635	-2.25838	1.378735
_lead8	-0.6911353	0.8929551	-0.77	0.439	-2.44526	1.062985
_lead7	-0.6256253	0.8632985	-0.72	0.469	-2.32149	1.070238
_lead6	-0.167918	0.5295595	-0.32	0.751	-1.20818	0.872349
_lead5	-0.1251089	0.4971941	-0.25	0.801	-1.1018	0.851579
_lead4	0.0712638	0.4325001	0.16	0.869	-0.77834	0.920867
_lead3	0.0495868	0.3911568	0.13	0.899	-0.7188	0.817975
_lead2	-0.1849081	0.2690817	-0.69	0.492	-0.71349	0.343676
_lag0	-0.7316232	0.3001109	-2.44	0.015	-1.32116	-0.14209
_lag1	-0.3276244	0.23233	-1.41	0.159	-0.78401	0.128765
_lag2	-0.5051024	0.1879902	-2.69	0.007	-0.87439	-0.13581
_lag3	-0.4003116	0.1735217	-2.31	0.021	-0.74118	-0.05945

Panel B: Bond debt ratio Analysis

Bond debt /Assets	Coefficient	Robust St. Err.	t	P>|t|	[95% conf.	interval]
_lead9	-0.0048529	0.0315985	-0.15	0.878	-0.06744	0.057732
_lead8	0.003185	0.0308456	0.1	0.918	-0.05791	0.064279
_lead7	0.0047566	0.026356	0.18	0.857	-0.04744	0.056958
_lead6	-0.0009331	0.0220427	-0.04	0.966	-0.04459	0.042725
_lead5	0.0046917	0.0213102	0.22	0.826	-0.03752	0.046899
_lead4	0.0024047	0.0195146	0.12	0.902	-0.03625	0.041056
_lead3	0.0062363	0.0162605	0.38	0.702	-0.02597	0.038442
_lead2	-0.0002886	0.0121848	-0.02	0.981	-0.02442	0.023845
_lag0	0.0174561	0.0069686	2.5	0.014	0.003654	0.031258
_lag1	0.0063428	0.010279	0.62	0.538	-0.01402	0.026702
_lag2	0.0290366	0.0155035	1.87	0.064	-0.00167	0.059743
_lag3	0.032132	0.0159462	2.02	0.046	0.000549	0.063715

Appendix B.5

Table B.5- Matching quality of matched samples

Variable	Unmatched (U)/ Matched (M)	Mean		t-test		Difference in Mean
		Treated	Control	t	p>|t|	
Size	U	11.018	8.4519	20.08	0.000	2.5661***
	M	11.01	11.034	-0.31	0.756	-0.024
Profitability	U	0.02545	0.01418	4.24	0.000	0.01127***
	M	0.02556	0.02385	0.81	0.419	0.00171
Tangibility	U	0.18491	0.14609	2.46	0.014	0.03882**
	M	0.18491	0.1738	0.54	0.589	0.01111

*This table reports the statistical descriptive of matched sample in Table 10 of paper. We use a nearest neighbour method to match the nearest firms in the control group regarding Size, Profitability, and Tangibility over the period. We use 1% clipper as a maximum distance for propensity score. *, **, and *** denote significance at the 10%, 5% and 1%, levels respectively. We define all variables in Appendix A.4.*

Appendix C: Figures

Appendix C.1

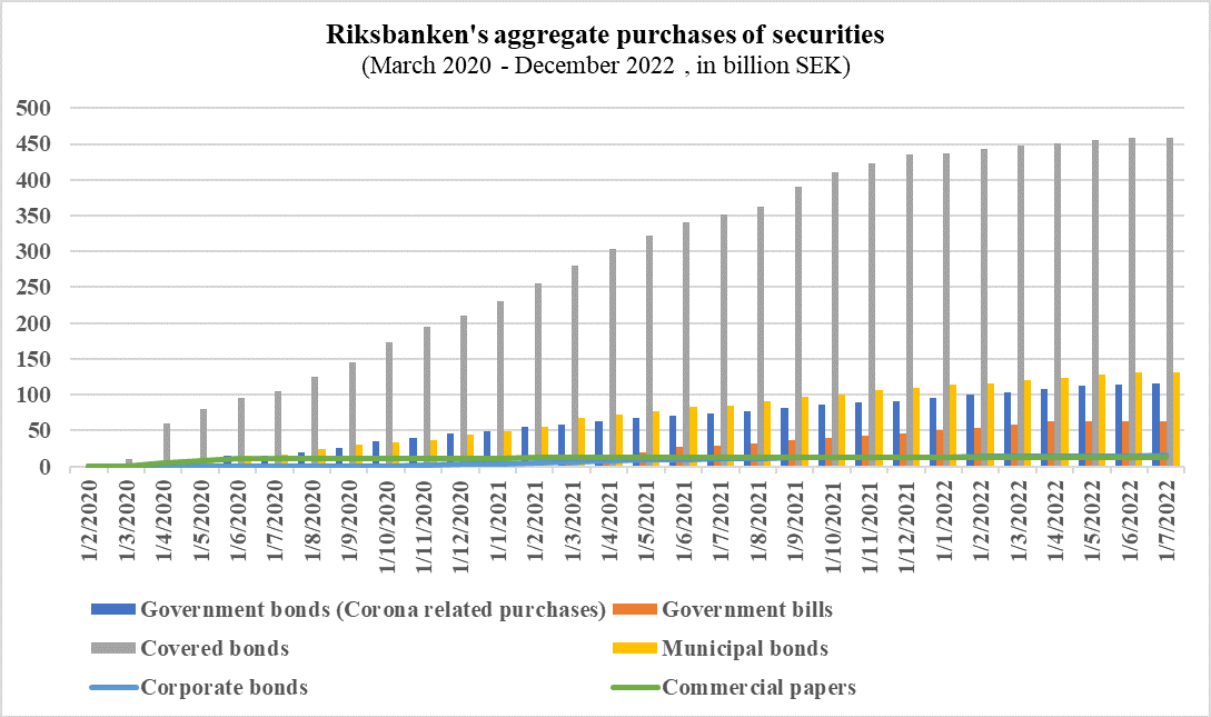


Figure C.1. The Riksbank's purchase of all types of securities in monthly data, aggregated.

This figure illustrates the number of asset purchases in billion Swedish kronor for each type of asset by the Riksbank during the global pandemic period, March 2020 to December 2022. The amount is reported monthly and aggregated from previous months starting from March 2020.