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The Effect of ECB's Corporate Sector Purchase Programme on CDS Premia - An Empirical Analysis

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Abstract

In response to the intensification of economic crises in the euro area, the European Central Bank (ECB), along with other central banks, has conducted both conventional and unconventional monetary policy. The most recent unconventional measure has been outright asset purchases under the corporate sector purchase programme (CSPP) targeting euro-denominated investment-grade bonds issued by non-financial corporations in the euro area. Using a Difference-in-Differences (DID) approach on a sample of euro-zone data I find that the CSPP initiative has consistently contained credit risk. In contrast, spillover effects to firms not subject to the CSPP policy are limited.

Keywords: quantitative easing; unconventional monetary policy; asset purchase program; credit default swaps; corporate sector purchase program

1. Introduction

> 'Likewise, the credit easing components of our expanded asset purchase programme (APP), namely the asset-backed securities (ABSPP), covered bond (CBPP3) and corporate sector (CSPP) purchase programmes, further boost the pass-through of our monetary policy by directly lowering the financing costs for crucial actors in our economy. [. . .] the CSPP directly lowers the cost and improves the availability of market-based funding for non-financial corporations.' - Mario Draghi, ECB President, Brussels, 26 September 2016

After the failure of Lehman Brothers in September 2008, confidence in the world economy collapsed and international financial markets became severely disrupted. Soon the European sovereign debt crisis followed, posing further challenges for the euro area. In response, the ECB not only implemented a drastic cut in its official interest rates, but also introduced a package of non-standard monetary policy measures. These measures were motivated by the need to ensure the continued effectiveness of the transmission of the monetary policy stance to the real economy and ultimately to price developments (Giannone et al., 2011). Yet in Europe, financial markets remained dysfunctional with credit conditions tightening markedly, and the risk of depressed inflation rates. As a complement to existing unconventional measures the CSPP has been launched, with a first formal announcement in March 2016. In effect, the ECB has expanded its quantitative easing (QE) programme to include the purchase of non-financial corporate bonds. The CSPP commenced officially on June 8th, 2016, with the objective to provide further monetary policy accommodation and contribute to a return of inflation rates to levels below, but close to two percent (European Central Bank, 2016). On average seven billion euro corporate bonds are bought each month. By the end of November 2017, CSPP purchases had reached a total of € 128 billion.

According to the ECB, this QE programme accounts for a large decline in funding costs for both financial and non-financial corporations in the eurozone. At the same time, the programme contributes to the bypassing of financial intermediaries by an increased availability of credit. Thus, by means of the CSPP, the ECB has been able to lift credit constraints notably, in an environment where the financial system has been subject to considerable stress (European Central Bank, 2016). Empirical research, placing a special focus on the corporate bond market, further confirms the effective transmission of the monetary policy to the real economy. While the response of cash market instruments to unconventional monetary policy measures has been investigated thoroughly in the

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literature, especially for those measures longer in place, evidence on derivative markets is scarce. This paper contributes to the literature by documenting the effect of the CSPP on credit derivatives.

Indeed, it is inappropriate to focus only on the cash market when assessing the CSPP impact. As emphasized by Krishnamurthy and Vissing-Jorgensen (2011) and Eser and Schwaab (2016), QE programmes work through various channels. In this paper I will particularly address the default risk channel and the portfolio rebalancing channel. First, given the CSPP succeeds in stimulating the economy by lowering borrowing costs for corporates, one should observe a reduction in expected defaults and, as a result, a decline in corporate credit risk. Moreover, as the economic recovers, standard asset pricing models imply - beyond the compensation for expected defaults - a reduction in the average price for assuming exposure to corporate credit risk. In fact, investors' risk aversion is expected to decline, implying a lower default risk perception, and ultimately a lower default risk premium (Gilchrist and Zakrajšek, 2013). My second conjecture is that the CSPP policy may contribute endogenously through spillover effects, in line with the theory of the portfolio rebalancing channel (Altavilla et al., 2015). The sizeable compression of funding costs induced by the CSPP should be reflected in substantially lower costs of default insurance, especially for riskier credits. More specifically, this line of argument suggests that, while credit risk has reduced overall, the policy impact is not restricted to CSPP-eligible assets but extends beyond the eligibility criteria.

The objective of this paper is to quantify these impacts undertaken within the CSPP framework on market-based measures of corporate credit risk; in particular on credit default swap (CDS) spreads. In essence, I assess whether CDS show price reactions consistent with the intentions behind the monetary policy strategy of the ECB. The market of single name CDS is of particular interest because, by their nature, these innovative instruments equip researchers with a near-ideal way of directly measuring credit risk (Longstaff et al., 2005, Norden and Weber, 2009). In general, CDS[1] are bilateral contracts that provide protection against the risk of a credit event associated with a particular company or country. Hence, they serve as a vehicle through which market participants are able to isolate and transfer credit risk (Fontana and Scheicher, 2016).

Using a panel of eurozone CDS data, I seek to empirically investigate the effect of the CSPP event on firms' CDS spreads within a DID framework. The empirical strategy identifies the distinct CSPP purchase dates as the most important piece of information to causally link the CSPP with the outcome of interest. In fact, by exploiting the phased implementation of the CSPP policy, I am able to address the endogeneity concern of non-random assignment of CSPP-eligible bonds. In other words, the distinct purchase dates allow a comparison between the subsample of firms transferred primarily to the CSPP portfolio (treatment group) and firms transferred later (control group). In this vein, the full sample is restricted to CSPP firms only. The within CSPP-sample analysis then mitigates any concerns related to heterogeneity within the treatment group in response to the CSPP, and ultimately any concerns related to omitted variables. Apart from that, the DID estimation is undertaken on a set of firms within the same industry.

Consistent with the initial assumption, I find that the CSPP programme has contained credit risk across European non-financial corporates. The results indicate that credit market reactions to the CSPP event - measured by means of CDS prices - imply negative CDS rates throughout. The most pronounced impact in lowering credit risk can be observed for the sector of Basic Materials, accounting for a CDS spread decrease of approximately 8 percent. In contrast, the empirical support for the second conjecture is limited. Spillover effects to firms not yet subject to the CSPP are heterogeneous within and across industries, and if anything, rather bond specific. For example, within the Industrial sector, I observe considerable spillover effects of around 6 percentage points for a given reference firm. However, a precedent bond purchase referring to the same firm does not prompt any spillovers. Hence, the ECB's commitment to continue the CSPP is indeed helping to lift credit constraints overall, but according to my estimation the initiative seems to not have stronger effects on firms unaffected by the CSPP, as suggested by previous work.

The rest of this paper is organized as follows. Section 2 discloses the ECB's monetary policy strategy as a response to the global financial and the European sovereign debt crisis, with a special focus on the CSPP initiative. Section 3 provides a brief overview over corporate CDS and highlights their importance as a corporate credit risk measure. Section 4 introduces two hypotheses as well as describes the underlying empirical strategy and the sample data. In Section 5 the main empirical findings of the CSPP impact on corporate CDS are presented and discussed. The paper closes with a discussion in Section 6.

2. A New Wave of Unconventional Monetary Policy

The Governing Council of the ECB assesses economic and monetary developments and takes monetary policy decisions every six weeks (European Central Bank Website, 2018b). The primary objective of its monetary policy stance is to maintain price stability within the Eurozone. In particular, price stability is defined as a year-on-year increase in the Harmonised Index of Consumer Prices of below two percent (European Central Bank, 2011). Recent economic shocks have posed significant challenges for the euro area. In response, the ECB has not only cut its official interest rates

[1] Unlike multiname CDS, the underlying of single-name CDS refers to a single firm or entity. Multi-name CDS such as basket CDS or CDS indices, on the other hand, are written on a set of firms. Analysing multi-name CDS is beyond the scope of the present study. As my focus is on singlename CDS, in the following, I will use the terms single-name CDS and CDS interchangeably.

significantly, but also has adopted a series of unconventional monetary policy measures such as the CSPP.

2.1. ECB's Unconventional Monetary Policy Measures

In general, conventional monetary policy operates by steering nominal short-term interest rates at which commercial banks can borrow funds from and deposit funds at the central bank (Joyce et al., 2012). The underlying economic rationale is to lower these key interest rates during economic downturns and to increase them during economic upturns.[2] In this manner, the central bank effectively manages the liquidity conditions in money markets. For decades the ECB has successfully relied on this standard interest rate channel to fulfil its price stability mandate over the medium term.

However, such measures are no longer sensible when interest rates are already close to the zero bound. The zero lower bound describes the notion that interest rates cannot be below zero percent. If so, agents in the economy would hold zero interest cash instead (Keynes, 1936). Hence, as soon as interest rates are close to the effective lower bound, conventional interest rate targeting will cease to be effective and central bank authorities will have to opt for unconventional measures to stabilize price levels in particular and the economy in general (Eggertsson and Woodford, 2003, Bernanke and Reinhart, 2004, Hamilton and Wu, 2012, Woodford, 2012).

Indeed, in the wake of the global financial crisis - soon followed by the sovereign debt crisis in several euro area countries - interest rates quickly approached the effective lower bound. Nonetheless, given the scale of losses incurred in the aftermath of the crisis the financial system remained dysfunctional. In fact, shortly after the collapse of Lehman Brothers, interbank market liquidity virtually dried up. Banks abandoned making loans and asset prices dropped dramatically leaving the financial system as a whole exposed to the risk of a liquidity trap, in which each economic agent is keen to hoard liquidity (Beirne et al., 2011, Joyce et al., 2012). The spread between the three-month risky interbank rate (EURIBOR) and the overnight interest rate (EONIA) - a key factor to evaluate the health of the European interbank market - rose to a new all-time high of 156 basis points in October 13, 2008 (Bini Smaghi, 2009). This ongoing tension within financial markets left the monetary policy transmission process severely impaired. Thus, the ECB was eager to provide additional monetary stimulus to the economy beyond the standard interest rate channel (Joyce et al., 2012, Fawley and Neely, 2013).

Broadly speaking, unconventional measures are defined as those policies that directly cope with funding needs of banks, households and non-financial companies. Financial support by the central bank authority can be provided in the form of central bank liquidity, loans, fixed-income securities or equity. Principally, as the cost of external finance is traded at a premium, the set of unconventional measures can be regarded as an attempt to reduce specific risk premia. Particularly, the central bank may reduce term spreads between short and long-term rates and/or credit spreads between risk-free assets and risky assets, eventually influencing wealth, cost of borrowing, spending and income (Joyce and Tong, 2012, Mertens, 2017).

In general, central bank authorities can select from a wide range of unconventional measures which are not necessarily mutually exclusive. Typically, they also serve as a complement to standard interest rate decisions rather than to substitute for them (Giannone et al., 2011). The final choice depends on institutional features, the structure of the financial system, the degree of disruption within markets and most importantly the intermediate objectives. A stylized representation of potential measures is shown in Figure 1. As demonstrated, unconventional monetary policy can be allocated to two broad categories: forward guidance or balance sheet measures. Forward guidance represents the central bank's commitment to the public to maintain its accommodative monetary policy over an extended period, such as to keep short-term interest rates low for a significant period of time.[3] In fact, the speech by the ECB's president Mario Draghi on July 26, 2012, in which he stated that 'the ECB is ready to do whatever it takes to preserve the Euro', may be interpreted as a forward guidance tool (Draghi, 2012).

In stark contrast, balance sheet measures affect explicitly the size or the composition of the central bank's balance sheet, officially known as quantitative easing or credit easing. The subset can be further differentiated into direct and indirect measures. With direct measures in place, the central bank engages in direct acquisition of assets, until maturity or resale, and thus assumes the associated risks[4] on its balance sheet. In standard literature outright asset purchase programmes such as the CSPP are identified as a direct QE policy, see for example Draghi (2016), Abidi et al. (2017) and Arce et al. (2017). Through the indirect approach the central bank lends to other banks at longer maturities in exchange for collateral, including assets whose markets are temporarily impaired. By this means the central bank does not assume any risks on its balance sheet (Woodford, 2012). Usually, indirect measures lead to a relatively small or even no increase of the central bank's balance sheet, whereas asset purchase programmes within the QE framework are undertaken in large and highly liquid market segments, that in turn lead to a substantial expansion of the central bank's balance sheet (Mertens, 2017). A deeper investigation into each unconventional measure conducted by the ECB is beyond the scope of this paper. For a detailed overview, see the contributions by the former ECB executive board member Lorenzo Bini Smaghi (Bini Smaghi, 2009).

[2]In particular, the ECB sets the target overnight interest rate in the interbank money market, in this manner, signaling the desired policy rate. Hereof, the prominent Taylor rules provide guidelines regarding the level of short-run benchmark rates (Taylor, 1993).

[3]In principle, this communicative instrument can be conditional or unconditional. For more details see Bernanke and Reinhart (2004).

[4]Potential risk sources to the balance sheet may materialize through interest rate risk, market risk, sovereign risk or credit risk.

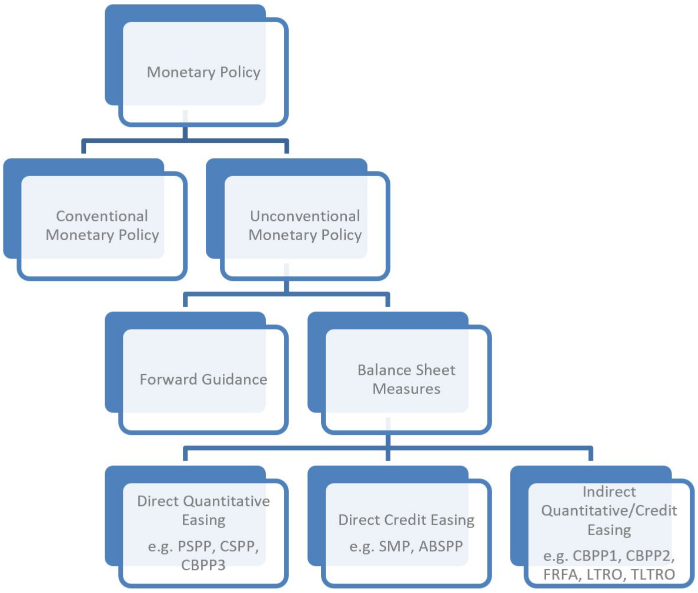

Figure 1: Unconventional Monetary Policy; Source: Bernanke and Reinhart (2004), Bini Smaghi (2009), Draghi (2016).

Unconventional monetary policy is based on the idea that the central bank can stimulate the economy, even when short-term interest rates are at or close to zero. The figure shows the different measures that central banks may adopt. Broadly, these measures can be differentiated between forward guidance and balance sheet measures. All policies related to quantitative easing and credit easing are a subset of balance sheet measures.

Given that the European Economic and Monetary Union (EMU) is a bank-based economy, the first set of unconventional measures adopted by the ECB - officially known as the 'Enhanced Credit Support' - was directed at banks (Fawley and Neely, 2013, Mertens, 2017). In this context, the former ECB President Jean-Claude Trichet stressed that the ECB would neither involve in direct credit easing nor in direct quantitative easing, as implemented by other major central banks at that time, but focus on endogenous measures.[5] The policy comprised five building blocks: fixed-rate full-allotment (FRFA), expansion of eligible collateral, longer-term liquidity provision, liquidity provision in foreign currencies and financial market support through purchases of covered bonds (CBPP1).[6] At some later stage, the ECB also decided to offer accommodative refinancing facilities for banks over longer periods of time by means of its longer-term refinancing operations (LTRO) programme. Overall, this indirect approach was intended to primarily alleviate growing tensions in interbank money markets, to expand bank-lending operations and ultimately to ensure the transmission of the ECB's policy stance to the real economy (Trichet, 2009, Joyce et al., 2012, Fawley and Neely, 2013, Szczerbowicz et al., 2015, Eser and Schwaab, 2016).

Yet, in spite of these efforts, the European debt crisis deepened further as banks were heavily exposed to risky sovereign debt issued by periphery Eurozone countries (Szczerbowicz et al., 2015). At its height in 2012, the ECB eventually decided to extend its unconventional policy toolkit and resort to direct measures. The ECB was able to calm financial markets by announcing conditional support by means of a sovereign state bailout programme, namely Outright Monetary Transactions (OMT). In addition, purchases in sovereign debt markets within the Securities Markets Programme (SMP) framework had been announced. Nonetheless, the SMP was not deliberately designed as a QE-type programme (Eser and Schwaab, 2016, Schlepper et al., 2017).

The trend-breaking effect in ECB's monetary policy stance was actually induced in January 2015, with the introduction of the expanded asset purchase programme (APP). Eventually, the ECB joined several other central banks in implementing QE with outright purchases of EMU government bonds on an unprecedented scale. Since then the programme has been

[5] Japan has become known for its QE policy with the expansion of the monetary base through outright purchases of government bonds from the banking sector. By contrast, the Bank of England has bought British government bonds from the non-bank private sector. The US Federal Reserve was initially rather engaged in credit easing by providing direct lending facilities to market participants but over the course of time it has resorted to QE initiatives as well, buying securities from government agencies (Trichet, 2009, Joyce et al., 2012).

[6] For instance, the CBPP1 as an indirect measure was initiated to alleviate the potential risk of a bank run given the maturity mismatch banks are exposed to when granting long-term loans, financed by short-term deposits (Joyce et al., 2012, Fawley and Neely, 2013).

modified and amended several times. For example, in October 2017, the public sector purchase programme (PSPP) - as one pillar of the APP - was reduced from a monthly purchase pace of € 60 billion to € 30 billion (Andrade et al., 2016, European Central Bank, 2017b). While the APP policy was initially launched to restore the smooth functioning of financial markets, concerns soon shifted to stimulate real growth and contain undesirable disinflation (Fawley and Neely, 2013).

In general, when central banks opt for direct purchases of securities in the capital market, they have to set at least five key parameters to define their programmes. First, they need to decide on the asset class to be bought. Second, they are required to choose the respective volume in order to define the impact of the programme. Finally, with the selection of the remaining three parameters, the central bank can fine-tune the QE policy, particularly, in terms of maturity, rating and liquidity (Mertens, 2017). Over time, the ECB has implemented a wide range of purchase programmes varying these parameters to target specific risk premia. However, all of them share the common goal of easing funding conditions for financial and non-financial corporations. Table 1 summarizes the ECB's purchase programmes since 2009 in a chronological order.

The most significant shift in ECB's monetary policy has been the launch of the CSPP in March 2016, as a part of the APP. In contrast to previous purchases programmes, primarily focusing on the economy or the public sector in general, the key feature of the CSPP is that it is specifically directed at assets in the non-financial sector (Mertens, 2017). Basically, the CSPP represents a suitable alternative in providing credit to corporates by bypassing the banking system (Arce et al., 2017, Grosse-Rueschkamp et al., 2017). Despite the extra liquidity facilities provided by the ECB, banks have frequently been unable to adequately provide credit to the real economy due to, inter alia, the non-performing loan burden, higher regulatory requirements and ongoing restructuring. Faced with declining incomes, tightening prudential regulation[7] and high levels of debt, banks rather have utilized the additional funds to deleverage their own debt positions (Joyce et al., 2012, Demertzis and Wolff, 2016).

As a consequence, the CSPP has been carried out - jointly with a further cut in the deposit facility rate and a new series of four targeted longer-term refinancing operations (TLTRO II) - to address these transmission failures. In this way the ECB can take on the risk that banks are currently unable or unwilling to take. Hence, the CSPP is to be understood as complementary to the main thrust of the APP supposed to enhance the impact of previous QE policies (European Central Bank, 2016, Abidi et al., 2017). Figure 2 displays the dynamics of the APP policy. While the Eurosystem's total holdings have increased constantly over time, the CSPP share over total APP holdings is comparatively small. In fact, the outstanding volume under the CSPP (€ 128 billion) accounts solely for 6 percent of total APP holdings (€ 2,243 billion) by November 2017.

Addressing CSPP's effectiveness will almost inevitably be part of a bigger picture that includes insights into recent global monetary policy developments. Given this goal, it is useful at the outset to dig deeper into the technical features of the CSPP policy.

2.2. ECB's Corporate Sector Purchase Programme

The Governing Council of the ECB announced at its March 10, 2016 meeting the launch of the CSPP as an extended leg of its QE programme.[8] Operations commenced three months later, on June 8th as demonstrated in Table 1. Under the CSPP, the Eurosystem buys debt securities issued by non-financial corporations with the goal of consolidating the pass-through of the monetary policy stance to the real economy. The Governing Council is committed to continue CSPP purchases without imposing any temporal restrictions. In conjunction with other non-standard measures in place, the CSPP is intended to stimulate spending and thereby maintain inflation rate levels below, but close to, two percent in the medium term (European Central Bank, 2016).

The programme is coordinated by the ECB, but carried out by six national central banks acting on behalf of the Eurosystem. These include the central banks of Belgium, Finland, France, Germany, Italy and Spain. Each central bank is responsible for purchases from issuers in a particular region of the euro area (Abidi et al., 2017). Hereby the ECB acts as a buy-and-hold investor. Assets purchased under the programme are held until maturity and the principal is reinvested even after a possible termination of the purchase programme (Grosse-Rueschkamp et al., 2017). As a necessary condition, assets must be acceptable as collateral for Eurosystem credit operations,[9] subject to further criteria as explained hereafter (European Central Bank, 2016, Abidi et al., 2017). As mentioned previously, asset purchase programmes are carefully designed by central bank authorities to ensure that the bond portfolio purchased under the CSPP has a reasonable level of risk and a certain degree of diversification.

As part of its plan, the ECB buys only euro area bonds issued by non-financial corporations denominated in euro. The ultimate parent company may as well be located outside the eurozone region, however the issuer must be established within the euro area. Public undertakings and credit institutions that are subject to banking supervision are excluded altogether. This rule also applies to issuers that have any

[7] Basel III has strengthened the capital adequacy and liquidity rules, upon which banks are required to adhere to.

[8] Note that the main technical parameters of the programme were announced on April 21, 2016 (Abidi et al., 2017).

[9] In compliance with its statute, the ECB provides credit only against adequate collateral. Collateral comprises both marketable and non-marketable assets. In general, assets that are accepted as collateral by the Eurosystem are labelled as 'eligible' and the eligibility is assessed by national central banks according to the criteria specified in the Eurosystem's General Documentation (Tamura and Tabakis, 2013). The list of marketable eligible collateral is updated daily and published on the ECB's website.

Table 1: ECB's Purchase Programmes; Source: European Central Bank (2015), Andrade et al. (2016), European Central Bank (2017b), Mertens (2017).

The table lists all purchase programmes conducted by the ECB since 2009. The column 'End' states the termination date of the programme. As some purchase programmes are still in place, corresponding rows are yet empty. This is true for CBPP3, asset-backed securities purchase programme (ABSPP), PSPP and CSPP which are all part of the APP. The abbreviation p.m. in the Volume column indicates that purchases are carried out per month. Note that except for the CSPP all asset purchase programmes have been initiated to stabilize banks' balance sheets.

	Start	End	Asset Class	Volume	Rating	Maturity
CBPP1	July 2009	June 2010	Covered Bonds	60	AA	unlimited
SMP	May 2010	Sep 12	Government Bonds	unlimited	unlimited	unlimited
CBPP2	Nov 11	October 2012	Covered Bonds	40	BBB-	≤10.5y
CBPP3	October 2014		Covered Bonds	unlimited	BBB-	unlimited
ABSPP	Nov 14		Asset Backed Securities	unlimited	BBB-	unlimited
PSPP	March 2015		Public Sector Assets	30 p. m.	BBB-	2-30y
CSPP	June 2016		Corporate Bonds	80 p. m.	BBB-	6m-30y

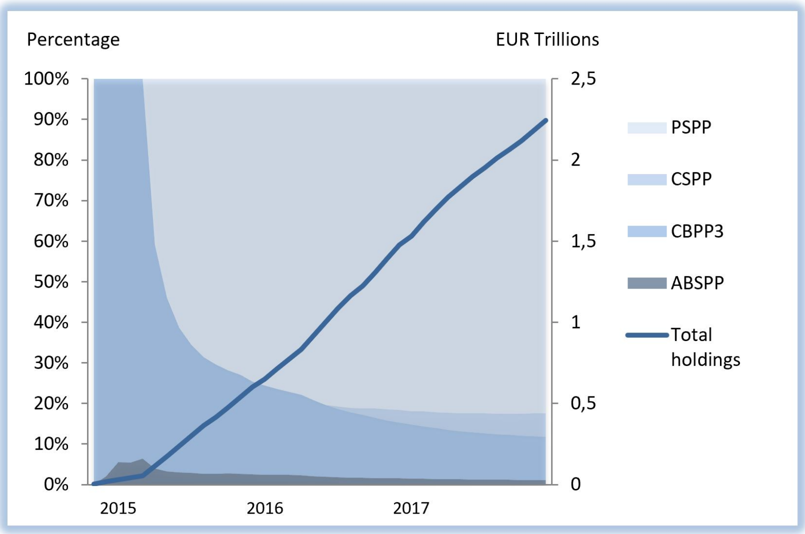

Figure 2: ECB's Expanded Asset Purchase Programme Holdings; Source: ECB Statistical Data Warehouse (author's own computations).

The figure shows the Eurosystem's total holdings under the APP at the end of the month, represented by the right scale and denominated in euro. Moreover, the breakdown of the APP by each subprogramme is illustrated. The observation window ranges from October 2014 to November 2017.

parent undertaking which is a credit institution (Abidi et al., 2017, Grosse-Rueschkamp et al., 2017). [10]

Moreover, in order to qualify for purchase under the CSPP, securities must satisfy a minimum credit rating of at least investment grade (BBB-/Baa3/BBBL) assigned by an external rating agency. In accordance with the practice followed under its collateral framework, the Eurosystem recognizes credit assessments by only four credit rating agencies such as Standard & Poor's (S&P), Moody's, Fitch Ratings and Dominion Bond Rating Services. Most noteworthy, in the event of a deterioration of the issuer's credit quality, the ECB is not obliged to sell its holdings (Grosse-Rueschkamp et al., 2017). Within this context, the first-best credit rating is relevant. More precisely, a bond that is rated below investment grade by three rating agencies except for one will still be eligible for admission to the CSPP programme (Abidi et al., 2017).

The maturity spectrum of debt securities can range between six months to less than 31 years at the date of the purchase. The upper bound is in line with that applied under the PSPP framework. The lower bound ensures that bonds

[10] More precisely, bonds issued by an entity which is supervised under the Single Supervisory Mechanism are not eligible for purchase under the CSPP. At the same time, in order to ensure a level playing field between euro area and foreign issuers, issuers with a parent company that is subject to banking supervision outside the euro area are excluded as well (European Central Bank, 2016).

issued by small and medium-sized corporations are also included in the universe of qualifying debt instruments, while at the same time restraining the number of redemptions during the duration of the CSPP (European Central Bank Website, 2018a). In addition, the bond's yield to maturity has to exceed the level of the deposit facility rate at the time of the purchase (European Central Bank, 2016).[11]

Further, as the ECB seeks a market-neutral implementation of the CSPP, purchases are conducted according to a benchmark defined at the issuer group level. The benchmark applied for purchases mirrors proportionally the market value of all eligible assets outstanding whereas the market capitalization serves as a weighting factor for the different jurisdictions within the benchmark. The purpose of issuer group level limits is to ensure a certain degree of diversification and neutrality in the allocation of purchases across corporations such that the overall portfolio is sufficiently heterogeneous (European Central Bank, 2017a, European Central Bank Website, 2018a). Total purchases under the CSPP should not exceed 70 percent of the issued value of each bond. At the same time there is no minimum issuance volume for eligible assets. This implies that bonds issued by small and medium-sized corporations with typically small issuance volumes can also be purchased (European Central Bank, 2016, European Central Bank Website, 2018a).

To sum up, there are seven conditions a bond must meet in order to qualify for CSPP purchases: eligibility as collateral for Eurosystem operations, a non-financial corporation issue, denomination in euro, an investment-grade rating, a yield of above the deposit facility rate, a maturity of between six months and 31 years, and an issue share limit of 70 percent per security.

In principal, under the CSPP the Eurosystem considers debt securities available in both the secondary and the primary market. In the latter case, it may participate in both public and private placements. In practical terms, these purchases take place concurrently and in competition with other investors, adhering to free-market principles (European Central Bank, 2016, Arce et al., 2017). The actual pace of purchases under the CSPP depends on prevalent market conditions. Monthly net purchases during the period from June 2016 to November 2017 have ranged between € 4 billion and € 10 billion. Overall, since the start of the programme in June 2016, on average corporate bonds worth € 7 billion have been bought monthly (see Figure 3). By the end of November 2017, CSPP purchases reached a total of € 128 billion, and were relatively diversified across ratings, sectors and countries. In general, CSPP holdings follow closely the CSPP-eligible bond universe, that is the composition of CSPP holdings mirrors that of the CSPP-eligible bond universe (European Central Bank, 2017a).

Although the ECB does not disclose the exact amount purchased for each bond, a recent ECB report states that, so far, medium credit quality companies within the utility and consumer sector have attracted the most CSPP demand. The majority of purchases have been undertaken in the secondary market, with issues mainly from Germany and France (European Central Bank, 2017a).

2.3. Impact of Asset Purchases Programmes: Theory and Evidence

Over the last few years, given their widespread use by central banks, there has been a surge of theoretical and empirical research that aims to shed light on the workings of asset purchase programmes. The standard view in macroeconomic theory is that, in general, these programmes will not have any effects on the macro-economy, as the monetary policy stance is fully described by the current and expected future level of the nominal short-term interest rate. In line with this notion, QE policies are assumed to present a mere reallocation of assets from the balance sheet of private investors to the balance sheet of the central bank, while the reallocation as such does not change asset prices. The main assumption underlying this model is that of perfect substitutability of assets. A single representative and rational agent, subject to an infinite horizon and no credit restrictions, would then be indifferent between assets held by the central bank and her own assets (Eggertsson and Woodford, 2003, Woodford, 2012). Within this theoretical framework, the CSPP should therefore be ineffective.

In reality, however, neither financial markets are frictionless nor market participants do behave economically rational. Under these circumstances, the central bank may purchase significant quantities of assets in specific market segments hereof limiting the supply relative to the demand. Reducing the amount of bonds outstanding - by displacing some investors and reducing the holdings of others - will create a scarcity effect that arbitrageurs may not be able eliminate. Given securities are not perfect substitutes, prices will rise and expected returns on the securities will fall, eventually suppressing the risk premia. Put differently, purchases will bid up the price of targeted assets thereby diminishing respective yields. As of the lower yields, the private sector will be incentivized to use the excess money in order to rebalance its portfolios. Private investors will demand assets that are similar in nature to the assets just sold to the central bank. Subsequently, the downward pressure on yields will not necessarily be limited to the particular asset type purchased but spill over to other asset classes in neighbouring markets (Vayanos and Vila, 2009, Bernanke, 2010). Eventually, the underlying mechanism of this portfolio balancing effect will also lead to lower interest rates relevant to consumption and investment spending. In fact, depressed yields imply lower borrowing costs for firms and households, which in turn will stimulate spending. In addition, higher asset prices enhance spending by the implicit increase in the net wealth of asset holders (Joyce et al., 2011a,b).

While the majority of empirical studies affirm the successful transmission through the portfolio balance effect, some researchers suggest the existence of novel channels that may

[11] The deposit facility rate is the interest banks receive for depositing money with the central bank overnight (Koijen et al., 2016).

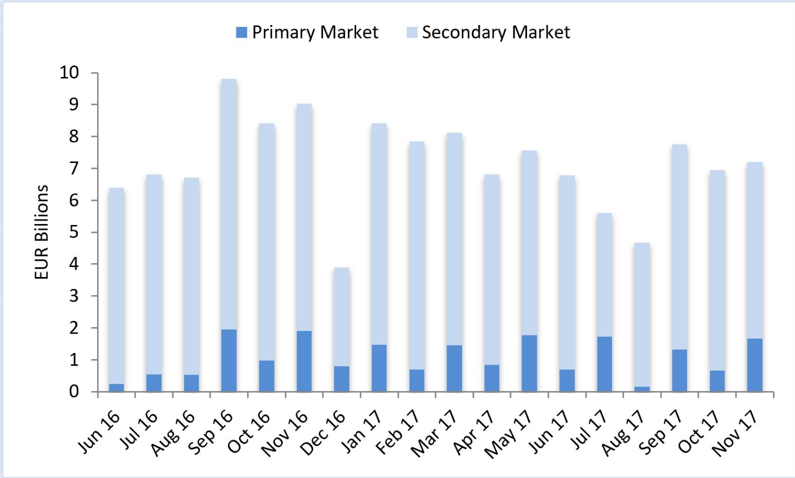

Figure 3: CSPP Monthly Net Purchases by Transaction Method; Source: ECB Data Statistical Warehousedata (author's own computations).

The figure shows the breakdown of primary and secondary market monthly net purchases under the CSPP, denominated in euro. The observation window ranges from June 2016 to November 2017.

be at work. For instance, recent literature has detected the signaling channel, through which asset purchases by monetary authorities may affect the economy. The mechanism of the signaling channel operates indirectly when market participants interpret and infer information from monetary policy announcements. Signals such as QE announcements may be viewed as a commitment by the central bank to keep expected short-term interest rates low for an extended period of time (Grosse-Rueschkamp et al., 2017). Alongside the signaling and portfolio rebalancing channel, Joyce et al. (2011b) address the liquidity and confidence channel. Similarly to Mertens (2017), they refer as well to the bank-funding channel aimed at increasing liquidity in the banking sector, which they, however, condemn as ineffective during times of severe financial crisis. Krishnamurthy and Vissing-Jorgensen (2011) have been able to make a pivotal contribution and extend the existent literature by launching in total seven channels through which unconventional monetary policy can transmit its effects. They discuss, for instance, the default risk channel that acts through reducing corporate default risk. If the CSPP indeed succeeds in stimulating the economy, it can be expected that the credit default risk of corporations will drop. Standard asset pricing models predict that investors' risk aversion will also fall as the economy recovers. More specifically, favourable market conditions are related to an increase in investors' risk appetite, underscoring the lower default risk perception, and ultimately implying a lower default risk premium (Fontana and Scheicher, 2016, Krishnamurthy and Vissing-Jorgensen, 2011). Gilchrist and Zakrajšek (2013) argue in the same manner but do not explicitly refer to the default risk channel. Furthermore, Eser and Schwaab (2016) agree that asset purchases can affect the default risk perceptions of market participants. However, they claim that this is to be attributed to the signaling channel.[12]

Overall, lack of consistency among researchers with respect to the definition and the interpretation of channels makes it difficult to pinpoint the CSPP impact and link it to a single transmission channel. In my analysis I will follow recent remarks by the ECB policymaker Coeure (2017) who argues in favour of the standard portfolio rebalancing channel as the main transmission mechanism for the APP as a whole. Moreover, I will focus on the default risk channel which is by its nature particularly relevant for this study. The assessment of the remaining channels will not be the object of this study due to the limited scope of this paper.

While the exact transmission process is debated heavily in the literature, there is broad consensus about the effectiveness of unconventional monetary policy.[13] Within this context, studying the impact of asset purchases on market prices provides the starting point for assessing a policy's effectiveness, as any QE intervention is very likely to have an impact directly on markets where purchases have been conducted, and indirectly on neighbouring markets. Hereafter, I aim to summarize the most relevant contributions with a special focus on the literature that deals particularly with the CSPP.

Looking at the US evidence, there is a large and growing body of literature that analyses QE policy effects on asset prices. Pioneering evidence is presented by Gagnon et al. (2011) in an event study on the Federal Reserve's purchases between December 2008 and March 2010, hereafter re-

[12] While Krishnamurthy and Vissing-Jorgensen (2011) differentiate between the signaling channel and the default risk channel, Eser and Schwaab (2016) relate default risk to the signaling channel.

[13] Note, however, that the estimated size of effects varies considerably across studies. Heterogeneity in results derives from different measuring methods.

ferred to as QE1. QE1 included a variety of assets such as mortgage-backed securities, treasury securities and agency securities; and proved to have economically meaningful and long-lasting effects on longer-term interest rates. Based on key QE1 announcements dates and time series regressions, Gagnon et al. (2011) notice large changes in the 10-year Treasury yield relative to the 2-year Treasury yield. To put this result into perspective, the QE1 policy has worked predominantly by mitigating the term premium. Indeed, the 10-year term premium was estimated to have been reduced between 30 and 100 basis points overall.

In consonance with the former study, Krishnamurthy and Vissing-Jorgensen (2011) target the effect of the Federal Reserve's QE1 programme through an event study methodology but dig deeper into the QE mechanisms. They find that this policy had a significant effect on yields, inter alia, through the default risk channel. In fact, they observe a substantial drop in nominal interest rates on lower-rated corporate bonds. Most strikingly, however, the authors report declining CDS rates linked to a clear pattern across credit ratings, ranging from Aaa to B. On the event dates related to QE1, there is a large decrease in CDS premia especially for lower grade firms. In particular, 5-year CDS rates of Aaa firms do not change appreciably with QE1 (6 basis points), whereas 5-year CDS rates written on B rated firms experience the largest fall (991 basis points). In terms of statistical significance, two-day changes in CDS spreads are significantly more negative for QE1 announcement days than on other days for 4 of 6 rating categories. Altogether their study suggests that - consistent with the default risk channel - QE has reduced the default risk premium.

Similarly, Gilchrist and Zakrajšek (2013) focus on the market's default risk perception and research the sensitivity of credit risk - measured by means of CDS indices - to changes in the benchmark market interest rates prompted by the US QE announcements. The authors apply a heteroscedasticity-based approach and find that the policy announcements have substantially lowered the overall level of credit risk in the economy. More specifically, for both the investment- and speculative-grade U.S. corporate sector there are economically large and statistically significant reductions in CDS index spreads. In line with the former study, the decline in the lower-rated CDS index is larger than in the higher-rated segment. In the financial sector, however, the response on credit risk is much more muted. A range of subsequent studies provide supportive findings in that the Federal Reserve's QE asset purchases were successfully diminishing medium and long-term interest rates, including those by Hancock and Passmore (2011), Swanson (2011), Hamilton and Wu (2012), Neely (2012), Wright (2012) and D'Amico and King (2013).

In order to avoid cultural bias and gain a sense of the universal challenges, it is crucial to investigate whether these trends appear in other countries as well. Undeniably, for the United Kingdom, Meier (2009) and Joyce et al. (2011a,b) find that the Bank of England's asset purchases between March 2009 and January 2010 had economically significant effects on government bond yields. Based on an event study approach, Meier (2009) determines that the initial QE announcements have reduced government bond yields between 35 to 60 basis points. Joyce et al. (2011a) estimate that medium- to long-term government bond yields haven fallen cumulatively by around 100 basis points. In addition, they report a downward trend for corporate bond yields with smaller effects on investment grade bonds and larger effects on non-investment grade bonds. Further insights into the significant impact of the first phase of Bank of England's QE policies have been provided by Joyce and Tong (2012) and McLaren et al. (2014). For Japan there is also compelling evidence that outright asset purchases have led to a drop in long-term yields and a boost in asset prices (Lam, 2011, Ueda, 2012, Fukunaga et al., 2015).

For the euro area, there is a set of studies that qualitatively supports the results ascertained in the US, the United Kingdom and Japan. For instance, Andrade et al. (2016) scrutinize the impact of ECB's APP announcement across 24 studies to find a persistent decrease in 10-year sovereign yields with effects being the largest when new interventions are announced. Additionally, the researchers make efforts to take into account the banking sector. Particularly, the APP induces an increase in share prices of banks subject to a higher proportion of sovereign bonds in their portfolios. Apart from that the authors employ a general equilibrium model to compare the APP to conventional monetary policy measures. Hereof they argue that the APP has had an impact similar to a 100 basis point interest rate cut. Altavilla et al. (2015) obtain a similar set of findings confirming the economically meaningful impact of the APP on asset prices. They detect that the reduction in yields is more pronounced for longer dated sovereign bonds in high-yield countries. Interestingly Altavilla et al. (2015) document spillover effects. In particular, a decrease in euro area sovereign bond spreads by 100 basis points leads to a statistically significant decrease in corporate spreads by 63 basis points and 50 basis points for financial and non-financial institutions, respectively. The authors argue that this is to be attributed to the interplay between the transmission channel and the degree of financial distress. Similar patterns also show up in a succeeding study by De Santis (2016b) who accounts for the fact that the APP was implicitly communicated to the market before actual purchases had started. His econometric analysis suggests that the ECB policy has reduced GDP-weighted 10-year euro area sovereign yields by 63 basis points over the period from September 2014 to October 2015, with vulnerable countries benefiting the most.

Although the SMP is in general not considered a QE policy, in the literature there is some evidence that the programme works, inter alia, through the default risk channel and accounts for spillover effects. Hence, in the following I will briefly outline relevant contributions. Within the SMP framework, the ECB has engaged in purchases in five distinct sovereign markets beginning with Greece, Ireland, and Portugal and then expanding the programme to Spain and Italy. Based upon a panel regression model Eser and Schwaab (2016) evaluate the yield impact of the SMP in the euro area sovereign bond market from 2010 to 2011. The authors estimate that government bond purchases have been successfully declining yields for Greece, Ireland, Italy, Portugal and Spain. For instance, in Greece € 1 billion of bond purchases have lowered yields by more than 20 basis points. Further, in their study Eser and Schwaab (2016) show that SMP purchases have also affected CDS spreads, yet to a lesser extent as compared to corresponding sovereign bond yields. While CDS spreads for Greece have reduced by 10 basis points, interestingly, for Italy the SMP impact on CDS has been positive. The authors conclude that a positive impact of purchases on CDS but not on the bond yield could be an indication of market participants worrying about moral hazard but welcoming the reduced liquidity risk premia on bonds. A related study by Koijen et al. (2016) estimates that the ECB is exposed to 3 percent of all sovereign risk as a consequence of the SMP intervention.

The latest literature urges to widen the research examining a set of ECB's asset purchase programmes conjointly. In a comprehensive study, Szczerbowicz et al. (2015) finds that SMP, OMT and CBPP have been effectively lowering refinancing costs of banks and governments, especially for periphery countries in the euro area. Further, she reports spillover effects to non-targeted asset classes, particularly, a 19 basis points tightening of covered bond spreads upon the SMP announcement and a 5 basis points tightening of sovereign bond spreads upon the CBPP announcement. In her study, she employs an event study approach based on daily data throughout the time period from 2007 to 2012. Transferred to a broader sample, Fratzscher et al. (2016) document reduced risk aversion, higher equity prices and lower credit risk for sovereigns and global banks upon the ECB intervention. Most noteworthy, as a consequence of the announcement of the OMT and SMP, equity prices have increased globally, while contraction in bond yields have been concentrated in periphery countries within the Eurozone. For Italy and Spain, for example, the 10-year government bond yield has declined cumulatively by 74 and 121 basis points, due to OMT and SMP related announcements, respectively. Consecutive work by Krishnamurthy et al. (2017) examines the relationship more closely proposing that both SMP and OMT have been much more effective at reducing sovereign bond yields than the LTRO measures across Italy, Spain and Portugal. Based on the Kalman-filter augmented event study, their analysis reveals that default risk accounts for 37 percentage of the reduction in yields. At this early stage, available empirical evidence on the CSPP is limited but points towards a similar direction as earlier QE studies. According to the ECB the announcement of the CSPP as such in March 2016 had a significant impact on the secondary market pricing of corporate bonds. Specifically, the 5-year yield (spread) on euro area CSPP-eligible bonds has decreased steadily in the period following the announcement. This downward movement is consistent across all credit rating classes although more pronounced for lower-rated bonds (European Central Bank, 2017a). Further empirical research supports the former findings. For example, Abidi et al. (2017) demonstrate that the CSPP leads to a significant decrease in euro area corporate bond yield spreads by around 40 basis points. Contrary to expectations, they find that the decline is more noticeable in the sample of non-eligible bonds close to the investment grade threshold. In addition, the authors document an increase in bond issuance volume, in particular for non-eligible bonds. This is an important insight implying that - in line with the notion of spillover effects - the CSPP impact is not limited to eligible bonds but extends beyond the eligibility criteria.

Given favourable credit conditions induced by ECB's expansionary monetary policy, large corporations are increasingly able to finance themselves through bond issuances rather than bank loans. At the same time, the inception of the CSPP has deepened the corporate bond market with an expanded primary market activity. Arguing in this line the consequence would then be the contraction in the demand of bank loans as a funding source creating capacity in the balance sheet of banks. Consistent with the objectives set for the CSPP programme, banks should therefore be willing to divert the flow of credit towards companies that do not rely on capital markets for their financing, particularly small and medium-sized enterprises. Indeed, Arce et al. (2017) observe for Spanish companies that the CSPP has not only achieved its direct goal of reducing financing costs and stimulating new debt issuances but also has benefited non-eligible firms by means of a subsequent reallocation in the loan base of banks, especially in conjunction with the TLTRO. In relative terms, one euro less in the credit balance of eligible issuers leads to an increase of around 78 cents of euro in the credit balance of non-eligible firms following the CSPP. On a broader level, Grosse-Rueschkamp et al. (2017) take up this notion and validate that the intervention in the bond market indeed has reduced corporates' reliance on the banking system across the euro area, especially of investment grade corporates with lower credit quality. For their analysis, the authors use a more representative sample of publicly listed firms in S&P's Capital IQ. The DID framework in their study then reveals that within the set of CSPP-eligible firms, BBB rated firms increase their bond leverage relative to higher rated firms (1.6 percentage points versus 1.2 percentage points). Akin to the former study, Grosse-Rueschkamp et al. (2017) confirm that banks subject to a high proportion of CSPP-eligible firms in their portfolios prior to the CSPP announcement subsequently shift lending to private ineligible firms.

In conclusion, the impact of the CSPP programme spans two main dimensions: a relaxation of corporate lending costs and the spillover to non-targeted assets. Hereof empirical research considers predominantly the corporate bond market, while evidence on the derivative market is rather scarce.

3. Credit Default Swaps

CDS are classified as credit derivatives. These bilateral contracts present a relatively recent financial innovation. The first contract was traded by J.P. Morgan in 1994 to meet the increasing demand for transferring counterparty credit risk. Since then the market has grown remarkably (Augustin et al., 2014). Nowadays the CDS is the most popular and widely used instrument amid the broad class of credit derivatives, inter alia, due to its high degree of convenience with which market participants can express a view on the credit market (Blanco et al., 2005, Longstaff et al., 2005).

3.1. Overview of Corporate Credit Default Swaps

Single-name CDS are useful instruments to offset exposure to counterparty credit risk, namely the default risk of a certain issuer of debt capital. More precisely, two parties enter into an agreement, whereby the CDS buyer acquires protection from the CDS seller against the default of a third party, called the reference entity or the name. The reference entity, a particular company, can be either the issuer or the guarantor of the debt obligation. In essence, a CDS contract can be interpreted as an insurance, since one party intends to insure against the possibility of default while the other party is willing to bear this risk. Technically speaking, the protection seller 'longs' a third-party credit risk, whereas the protection buyer 'shorts' the credit risk (Blanco et al., 2005, Fontana and Scheicher, 2016). In contrast to a classical insurance contract, however, an engagement in a CDS does not require ownership of the reference asset. In effect, speculators are able to take long (short) positions in credit risk by selling (buying) protection without the need to trade the underlying bond (Blanco et al., 2005, Stulz, 2010, Breitenfellner and Wagner, 2012).[14] Hence, investors who provide the capital are not necessarily those who bear the credit risk. This is an important insight as according to Stulz (2010) the separation of funding and risk bearing introduces greater transparency in the pricing of credit.

Back to a standard CDS contract, protection is sold in exchange for the payment of a regular fee at fixed payment dates (Fontana and Scheicher, 2016, Breitenfellner and Wagner, 2012). As in an interest rate swap (IRS) agreement, the fee is set such that the initial value of the CDS is zero which means there is no cash exchange at the time of trade.[15] This fee is an annual premium paid over the lifetime of the contract, generally referred to as the CDS spread or CDS premium. It is denominated in percentage of the notional amount insured or in basis points, and to be paid in quarterly or semi-annual instalments (Augustin et al., 2014) until the maturity of the contract or the occurrence of issuer default (whichever comes first) (Fontana and Scheicher, 2016). Most importantly, a CDS contract is written on a single company rather than on specific bond issues (Chen et al., 2010). Hence a CDS usually comprises a category of the capital structure, such as the senior, unsecured, or junior debt obligations of the underlying entity, and references a particular amount of the insured debt, defined as the notional amount (Augustin et al., 2014).

If a default does not occur over the lifetime of the contract, then the contract will expire at its maturity date and the protection seller will not pay any compensation. Conversely, in the case of a default, the contract is terminated prematurely and the protection component is triggered, which in fact is a cash payout reflecting the loss experienced by holders of defaulted debt obligations (Fontana and Scheicher, 2016, Breitenfellner and Wagner, 2012). The protection component is linked to a specific credit event. This contingent credit event refers to the case when the underlying entity fails to meet its obligations for any of a predetermined set of its debt claims, designated as the reference obligation. Formally, the occurrence of a credit event must be documented by public notice and notified to the investor by the protection buyer (Augustin et al., 2014). Amid the class of qualifying and valid credit events are bankruptcy, failure to pay, obligation default or acceleration, repudiation or moratorium (for sovereign entities) and restructuring, whereas the International Swaps and Derivatives Association (ISDA)[16] eventually decides on whether a credit event has occurred. Put differently, credit events adhere to the strict standardised definitions laid down by the ISDA. For example, according to the ISDA documentation the restructuring event refers to the case when either the interest rate or the principal paid at maturity is reduced or postponed, a priority ranking of payments is altered, or when there is a change in the currency or composition of payments (O'Kane et al., 2003, Blanco et al., 2005, Beber et al., 2009).

Following a credit event, the final settlement can be cash or physical delivery, depending on the terms of the contract. Either the protection seller compensates the protection buyer for the incurred loss by paying the face value of the bond upon delivery of the defaulted bond (physical settlement), or by paying the difference between the postdefault market value of the bond and the notional value (cash settlement). In particular, with cash settlement the post-default value of the bond is determined through an auction mechanism. The monetary exchange involves then only the actual incurred losses while the protection buyer continues to hold on to the debt claim on the underlying reference entity's balance sheet, given she owns the claim (Fontana and Scheicher, 2016, Augustin et al., 2014).

While in the early days of CDS market participants had the choice of settling physically or in cash upon the occurrence of a valid credit event, for practical reasons, a marketwide cash settlement mechanism has been implemented in recent years. The main concern is that, with CDS outstanding greater by multiples than the volume of bonds issued, the bond market is subject to occasional market squeezes. Ef-

[14] Note that, as from November 2012, the European Union has enacted a regulation that bans short sales of uncovered sovereign debt CDS; corporate CDS are not subject to this regulation (Regulation, 2012).

[15] Both legs of a CDS need to have the same value at the inception of the swap. This is known as the zero net-present-value condition for swaps and implies that engagement in a CDS does not require a principal payment (Longstaff et al., 2005, Fontana and Scheicher, 2016).

[16] ISDA provides guidance on legal and institutional details of CDS contracts. The association has played a significant role in the growth of the CDS market by providing standardized contracts in 1992, the ISDA Master Agreement, which has been updated continually since then.

fectively, only few deliverable cash bonds are available in the market to settle all CDS trades (Blanco et al., 2005). Investors recognizing this are incentivized to source bonds, thereby raising artificially the bond price beyond the expected recovery value, and also increasing the volatility of the post-default bond. As a consequence, with the introduction of the Big Bang and Small Bang[17] protocols, cash settlements have become gradually convention (Augustin et al., 2014).

As depicted in Figure 4, under standard physical settlement the protection buyer has to deliver a bond of seniority at least equal to the obligation referenced in the contractual agreement in the case of a default. In return, the buyer will receive the full notional amount of the underlying contract. The protection seller can then try to maximize the resale value of the debt claim received or continue to hold on to it. Most noteworthy, if the credit event occurs in between the regular premium payment dates, then at the final settlement the protection buyer will also have to pay that part of the premium to the protection seller that has accrued since the most recent payment (Longstaff et al., 2005).

Against this backdrop the restructuring event is an interesting feature of CDS contracts. It is considered a 'soft' event because, in stark contrast to other credit events, it allows for debt restructuring prior to any violation of the contract. More specifically, provided a firm is in financial distress but still economically viable, it may be optimal for the firm to restructure its debt within a private or debt workout while continuing operations. Within the context of a physical settlement, naturally, some deliverable reference bonds will be cheaper than others, such as debt with long maturities and low coupon rates. If there are multiple bonds available for delivery, the protection buyer will most likely choose to transfer the 'cheapest' bond to the protection seller.[18] Hereof restructuring clauses constrain the set of bonds that are available for delivery upon the occurrence of a restructuring event, and specifically prevent the delivery of very long-dated bonds. In general, there are four different types of restructuring events: the old restructuring clause, the deletion of restructuring as a credit event, the (American) modified restructuring and the (European) modified-modified restructuring.[19] Intuitively, these restrictions reduce the value of the cheapest-to-deliver option, and in turn are an important determinant for the pricing of CDS. The higher the value of the inherent option to the protection buyer is, the higher the restructuring premium and correspondingly the CDS premium will be (Blanco et al., 2005, Longstaff et al., 2005, Berndt et al., 2007, Augustin et al., 2014). Contractual clauses attached to the different restructuring credit events have been adjusted and updated several times by the ISDA. The recent 2014 definitions introduce a number of simplifications to the Big Bang and Small Bang protocols (Augustin et al., 2014). Overall, while the restructuring event is particularly relevant for the cheapest-to-deliver option, it represents at the same time the most critical aspect in the pricing of CDS contracts.

CDS are the most popular and widely used instrument amid the broad class of credit derivatives. On the one hand, CDS allow the mitigation of counterparty risk exposure, especially for capital or credit exposure constrained businesses such as banks, pension funds or insurance companies (Longstaff et al., 2005, Abad et al., 2016). For instance, CDS are often used by banks for risk management purposes and are recognized by regulators as a regulatory capital relief (Augustin et al., 2014). On the other hand, speculation is a significant driver for engagement in the CDS market. Besides hedging investors are able to gain speculative benefits, specifically from negative credit events. For example, investors buy CDS not necessarily because they expect a default but because they anticipate that CDS spreads will increase further. To cash in the profits, investors will not be obliged to wait for a default but can rather sell another CDS.[20] To sum up, CDS allow pessimistic investors to bet against prices (Delatte et al., 2012). Similar to other derivatives, CDS can be viewed as 'side bets' on the underlying assets without any effect on the fundamentals of these assets (Liu et al., 2017).

Generally speaking, CDS are over-the-counter transactions, not traded on an organized exchange, whereby trades usually take place between institutional investors and dealers (Longstaff et al., 2005, Augustin et al., 2014). While dealers assume the intermediary role, financial institutions, including hedge funds and mutual funds, non-financial corporations, as well as insurances and pension funds are net buyers of protection. The market is highly concentrated among a few dominant dealers with the majority of trades relating to a few reference entities (Augustin et al., 2014, Abad et al., 2016). In principal, CDS can be negotiated at any time and in unlimited amounts (Delatte et al., 2012). However, as a necessary condition, institutional investors and dealers have to enter into an ISDA Master Agreement, setting up the legal framework for trading. The ISDA Master Agreement specifies the contractual terms and provides investors with a fully documented yet flexible contract (Augustin et al., 2014).

3.2. Credit Default Swaps as a Measure of Credit Risk

Credit or default risk associated with a particular company can be quantified by a number of metrics. Tradition-

[17] The landscape for CDS altered significantly with the implementation of the CDS Big Bang and CDS Small Bang protocols on April 8, and June 20, 2009 for the American and European CDS markets, respectively. The primary goal of these market changes - mainly affecting the contract and trading conventions - was to improve the efficiency and transparency within the CDS market.

[18] Conceptually, this cheapest-to-deliver option is equivalent to a short position in a put option. If not otherwise specified in the contract, upon exercise the protection buyer will have the right to deliver the least valuable asset among the defined set of eligible reference obligations as long as they rank pari passu with the reference asset (Blanco et al., 2005). For empirical evidence on the cheapest-to-deliver option inherent in corporate CDS see Jankowitsch et al. (2008).

[19] For an in-depth discussion of the restructuring feature, see O'Kane et al. (2003) or Berndt et al. (2007).

[20] Given an investor wants to liquidate her CDS position, it is more convenient to simply enter into a new swap in the opposite direction than trying to sell the current position (Longstaff et al., 2005).

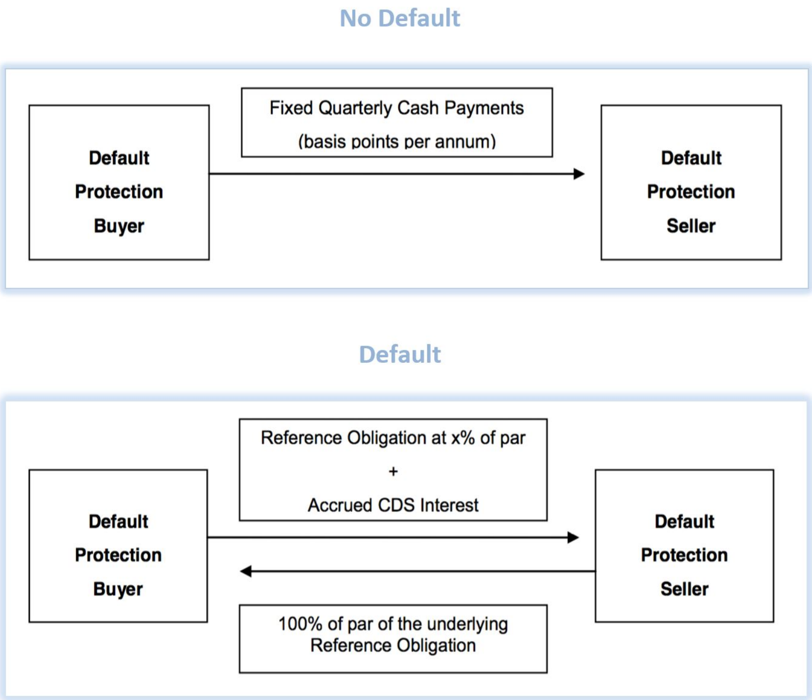

Figure 4: CDS Transactions under Physical Settlement; Source: Markit Group (2008).

The figure describes CDS transactions under physical settlement. Hereby the protection buyer makes fixed periodic payments to the protection seller, for instance on a quarterly basis. Given a default event occurs, a payout is triggered. The protection buyer transfers the obligation referenced in the contractual agreement - not necessarily the defaulted bond - and in return receives the full notional amount of the underlying. In other words, the protection seller is obliged to buy back the defaulted bond at par value.

ally, the financial health of companies has been assessed by predicting default probabilities. These probabilities have often been derived by modelling historical default events in a logistic-regression framework or by applications of Merton's firm value model.[21] However, in real life very few companies do default. As such, these frameworks are hard to calibrate empirically and subject to the rare-event bias (Opsahl and Newton, 2015). To overcome potential biases, I will follow Krishnamurthy and Vissing-Jorgensen (2011) and choose an outcome variable that is quantified for a relatively large number of companies as well as closely related to the risk profile of a company, namely CDS contracts written on a particular company.[22] Given the underlying company becomes more risky, respective CDS rates will increase and vice versa. Accordingly, CDS are considered reliable measures of a firm's credit quality, widely used by practitioners and academics to gauge the market's perceptions of a firm's credit risk. In the broader sense, CDS spreads may also serve as a proxy for the firm's cost of wholesale funding (Beau et al., 2014).[23]

It may well be argued that within financial markets there are several alternative parameters that can be used to measure credit risk. Scanning the market for instruments with near-identical risk and return characteristics as a CDS, while abstracting from arbitrage, enables the identification of these parameters. Conceptually, in an arbitrage-free market a CDS could be replicated by an asset swap, which is a combination of an IRS and a defaultable coupon bond. The IRS swaps the coupon of the bond into a reference rate plus spread. The asset swap is chosen such that the value of the whole package is par value of the defaultable bond. However, the arbitrage is not perfect. Unlike CDS, IRS are not affected by credit events and thus not automatically cancelled at default (Duffie, 1999). Therefore, spreads of both, the asset swap and the CDS, can trade at different levels in the market for the same issuer and maturity. This differential in spreads is called basis. Skinner and Townend (2002) claim that CDS contracts resemble American put options on the underlying bonds. This is most evident under physical set-

[21] Such structural default models model explicitly the link between equity and default (Merton, 1974).

[22] In particular, Krishnamurthy and Vissing-Jorgensen (2011) use CDS to isolate default risk premium effects for their estimation purposes.

[23] There exists a link between the quality of borrowers' balance sheets and their access to external finance. Given profits decline and balance sheets deteriorate, bond investors will anticipate that the expected future cashflows will not meet the current debt obligations. In turn, as they will have to assume the additional credit risk, investors will demand a higher credit risk premium which subsequently increases the external cost of funding, and vice versa (De Santis, 2016a).

tlement when the underlying asset is delivered upon exercise. Duffie (1999) provides a more precise theoretical relation and argues that in absence of arbitrage opportunities the CDS is identical to a swap of a default-free floating rate note for a defaultable floating rate note. Hull and White (2000) build on this pricing model as a key element for the valuation of CDS.

Despite each of these instruments representing a theoretically legitimate measure of credit risk, in reality corresponding spreads across these instruments are not at parity in the short-run for reasons related to liquidity, margin requirements or simply market frictions (Fontana and Scheicher, 2016, Augustin et al., 2014). In this regard, Blanco et al. (2005) conclude that the CDS rate provides rather an upper limit on the price of credit risk. Overall, the choice of CDS as the variable of interest - in comparison to similar financial instruments - still is preferable due to simplicity and data availability.[24]

Nonetheless, except for a few papers, my focus on CDS presents a clear deviation from standard literature that assesses the CSPP impact preliminarily with respect to bonds. At first glance, as the bond market is the predominant area targeted, the current approach seems reasonable, especially given the fact that in theory CDS and bond spreads are closely interlinked and should therefore provide equivalent results. However, it has been detected empirically that CDS spreads portray corporate credit risk better than corporate bond spreads. In other words, the CDS market clearly dominates the bond market in terms of modelling credit risk. This line of argumentation rests on two main pillars. First, in CDS markets pure issuer credit risk is priced.[25] After all, in absence of market frictions, the price of a CDS is solely about the expected default loss and not affected by contractual provisions such callability, maturity or coupon. In the bond market, in contrast, issue-specific credit risk and market risk are priced in a bundle (Norden and Weber, 2009, Fontana and Scheicher, 2016, Stulz, 2010). Second, price discovery takes place predominantly in the CDS market, that is default-risk related information is reflected earlier in the CDS market. While the first argument is debated heavily in the literature, the observed empirical difference between CDS and bond spreads is indeed proven to be due to informational problems and market frictions. To shed light on this matter, in the following I will briefly review the literature on the different dynamics of cash and derivative markets.

Pioneering work by Longstaff et al. (2005) is fielded using CDS data of 68 US firms from March 2001 to October 2002 to examine weekly lead-lag relationships between CDS spread changes, corporate bond spreads and stock returns. In their analysis the authors utilize CDS as a tool to disentangle default from liquidity risk in corporate bond spreads, as they assume that illiquidity is the non-default component affecting bonds but not CDS. Indeed, they find that information flows first into stock and credit derivative markets and then into corporate bond markets. Yet, their study shows no clear lead of the stock market over the CDS market, and vice versa.[26]

Blanco et al. (2005) explore the same relationship but suggest in contrast to the former study that credit risk in CDS and bond markets is priced relatively equally. In cases where there is a deviation between corporate bond spreads and CDS premia, they attribute the difference to the tendency of CDS premia to lead corporate bond spreads in price discovery. Besides the authors argue that only well informed investors trade in CDS markets. Their dataset includes a daily time series for 33 U.S. and European investment grade companies during the period from January 2001 to June 2002.

In similar fashion, but based on a longer sample period, Zhu (2006) attests for a set of 24 investment grade firms from 1999 to 2002 that the CDS market leads the bond market in terms of price discovery. According to this study, CDS and corporate bonds spreads from the same firm with the same maturity horizon are cointegrated that is they may considerably deviate from each other in the short-run but are strongly linked in the long run. The author concludes that this deviation stems from the higher responsiveness of CDS premia to changes in credit conditions. In a sample of 58 firms across US, Europe and Asia covering the period 2000 to 2002, Norden and Weber (2009) examine monthly, weekly and daily lead-lag relationships in a vector autoregressive model and further highlight the existence of a cointegration relationship.

Finally, Delatte et al. (2012) abstract from the linear price discovery model often used in the standard literature and propose a non-linear method. However, their database relies not on corporate but on sovereign CDS premia from developed member states of the European Union. Their results suggest that price discovery varies with the degree of market distress. In particular, only during periods of relatively high distress does the CDS market dominate the information transmission between CDS and bond markets. Liu et al. (2017) further confirm that the information revelation role of CDS is especially apparent when there is a negative information shock. Additional empirical evidence on the concept of price discovery with respect to CDS is documented by Acharya and Johnson (2007), Berndt and Ostrovnaya (2014) and Batta et al. (2016).

Altogether, the CDS market is informationally more efficient absorbing information at a faster pace. This superiority of CDS over bonds encompasses many aspects but most importantly has it roots in the synthetical nature of CDS which facilitates a continuous flow of transactions. For example,

[24] In practice, for instance, spreads on corporate par yield floaters are difficult to observe (Hull and White, 2000).

[25] Yet other studies dispute the validity of the underlying notion, arguing that CDS rates are not a pure measure of default risk after all, since they also incorporate a liquidity component (Fulop and Lescourret, 2007, Tang and Yan, 2007). Moreover, Jarrow (2012) discusses problems with using CDS to infer implied default probabilities on firms or sovereigns.

[26] More recent studies actually provide evidence that the equity market leads both the CDS and bond market, see for instance Forte and Pena (2009) or Hilscher et al. (2015).

CDS offer a convenient way to short bonds, whereas establishing a short position in the bond market is rather problematic (Norden and Weber, 2009). Especially in times of financial turmoil, when short sales are particularly valuable agents tend to retract from the underlying bond market (Delatte et al., 2012). In this regard, many economists argue that the existence of short sales, as such, makes a market more responsive to new information (Stulz, 2010).[27] At the same time, CDS are more flexible and less capital-intense because they require no principal payments. In contrast, within the underlying bond market the purchase of a bond generates a large cash outflow at the initiation of the trade (Norden and Weber, 2009).

Moreover, bond spreads in the secondary market depend on the availability and specificity of the total amount of bonds outstanding, which in turn is related to the issuance activity of the single firm. Given investors buy bonds with the motive to hold them until maturity, this curbs market liquidity. Poor liquidity in the secondary bond market will then make the purchase of large amounts of credit risk difficult and costly (Blanco et al., 2005, Longstaff et al., 2005). In stark contrast, the CDS market is more standardised and less dependent on primary market issuances (Blanco et al., 2005, Norden and Weber, 2009). In fact, CDS can be negotiated at any time and in arbitrarily large amounts. And indeed, the CDS market has experienced extraordinary growth over the past years with CDS outstanding greater by multiples than the volume of bonds issued.[28] To conclude, sensitivity to liquidity effects reduces the ability of the bond market to reflect information as timely as the CDS market, especially in the short run. Further differences between CDS and bonds can emerge due to accrued interest, the cheapest-to-deliver option and/or counterparty risk (Delatte et al., 2012).

Although the derivative and the cash market can differ on the same maturity-same reference entity in the short-run, CDS and bonds still provide roughly contemporaneous information. This is most evident when taking a step back and recognizing that an investor can conduct a risk-free strategy by combining the purchase of a bond with the corresponding CDS (Chen et al., 2010, Fontana and Scheicher, 2016). This insight is particularly relevant for the remainder of the present paper. More specifically, the negative effect of the CSPP on bond spreads - thoroughly discussed in the literature - can be transferred to the CDS market and serve as an anchor to determine the direction of the CSPP effect on CDS spreads. In fact, the next section takes up this line of reasoning to form two hypotheses.

Taken together, the standardized documentation, the liquidity, the ability to customize terms, and the 'pure' credit focus makes CDS contracts convenient to express a view on the credit market, particularly in regard to the deterioration or improvement of a firm's credit quality. Hereby the CDS spread represents the price, market participants are willing to pay, in order to offset exposure to the reference entity's default risk. Therefore, these market-based indicators can be viewed as an appropriate metric to isolate and quantify credit risk.

4. Data and Empirical Strategy

Now that I have highlighted the institutional features of the CSPP initiative and granted a brief overview of corporate CDS, I proceed by elaborating on the underlying assumptions, the estimation method and the sample data used for the estimation. The aim of this section is to provide a strategy that isolates the direct and indirect effects of the CSPP programme on those firms whose bonds have been eligible by the programme.

4.1. Hypotheses

According to recent literature, the announcement of the CSPP was successfully followed by a significant decline in the spreads of bonds issued by non-financial corporations (European Central Bank, 2016). This contraction in credit default risk - proxied by the bond yield spread or asset swap spread - establishes the main rationale for my first hypothesis, whereas I resort to CDS spreads as an alternative metric to quantify credit risk. If the transmission mechanism of the CSPP is the default risk channel, I will expect the following:

> H0: CDS spreads for CSPP companies and non-CSPP companies decline around the CSPP purchase shock.

My first hypothesis claims that CSPP purchases have evoked a specific market reaction, particularly a contraction in CDS rates. Given the CSPP succeeds in stimulating the economy, one should observe a reduction in expected defaults and, as a result, a decline in corporate default risk. The implicit assumption is that the policy lowers bond yields in order to increase the expected repayments of bondholders. Standard asset pricing models predict that investors' risk aversion will also fall as the economy recovers. More specifically, diminishing CDS premia would then be related to an increase in investors' risk appetite, underlining the lower default risk perception, and ultimately the lower default risk premium (Fontana and Scheicher, 2016, Krishnamurthy and Vissing-Jorgensen, 2011, Gilchrist and Zakrajšek, 2013).[29] Thus, evidence in favour of H0 would be consistent with the programme's objective of lowering risk premia across the European non-financial corporate sector.

[27] For a formal model, see Diamond and Verrecchia (1987).

[28] As already mentioned, CDS are also affected by illiquidity, yet to a lesser degree than bonds. In particular, lack of liquidity is more pronounced for larger companies as compared to smaller companies (Stulz, 2010).

[29] Default risk premium may also diminish due to the possibility of risk mitigation by means of CDS. Put differently, the CSPP effect will be corroborated, given the reduction of CDS spreads allows a firm's creditors to hedge their credit risk at a relatively lower cost. In turn, creditors' willingness to supply credit to the same CDS-referenced firm will increase. This is, however, not the object of this paper and leaves space for future research.

Figure 5 plots the evolution of CDS prices from 2015 to 2017 for both entities that have issued CSPP bonds and entities that have not issued CSPP bonds, hence CSPP companies and non-CSPP companies.[30] Clearly, asset purchase programmes have been launched in response to widening credit spreads reflecting the overall adverse economic developments in the Eurozone. At the aggregate level, this graphical evidence underlines my hypothesis that the CSPP has moved the credit market. In fact, following the announcement in March 2016, denoted by the left vertical line in the graph, decreasing CDS spreads are visible over the long run. Nonetheless, this can only be taken as tentative evidence supporting H0 as the announcement date and the subsequent decrease in CDS spreads may be driven by some latent omitted variables. In order to formally test whether the reduction in CDS rates is certainly caused by the new policy, I propose the DID estimation as elaborated in the next subsection.

On the contrary, the impact of the official implementation date of the CSPP, denoted by the right vertical line in the graph, is rather ambiguous with a slight pick-up shortly after June 8, 2016. In line with the efficient market hypothesis it may be argued that the announcement per se absorbs available price information immediately for all bonds at the aggregate level such that the implementation date on its own becomes trivial (Fama, 1970). In this respect, Arce et al. (2017) disclose in their study that the CSPP effect on bond yields is more attenuated for the implementation date as compared to the announcement date (7.6 basis points versus 46 basis points). Further, they report that during the first month of purchases the effects are slightly higher with a value of around 8 basis points. Taking this into consideration, it is reasonable to focus on the announcement effect of the newly implemented policy as a basis to derive the hypotheses. This is also the current practice in the literature (see for example Gagnon et al., 2011, Krishnamurthy and Vissing-Jorgensen, 2011, Arce et al., 2017). However, if anything, I expect a lower bound estimate on the CSPP effect.

In the context of the second conjecture, my paper is closely related to the work by Abidi et al. (2017). They document that the CSPP impact on bond yield reduction is most noticeable in the sample of bonds that have not been subject to CSPP purchases. Though at first glance this may appear counter-intuitive, a closer look suggests that higher credit risk firms - typically a subset of non-CSPP companies – are supposed to benefit from the new policy on a larger scale. Indeed, Krishnamurthy and Vissing-Jorgensen (2011) and Gilchrist and Zakrajšek (2013) detect the pattern that the decline in CDS rates, following a QE policy, is more profound for firms with lower credit quality. This line of argument rests on the fact that benefits associated with the CSPP do not accrue selectively but extend to non-targeted assets.

Figure 5 allows a comparison of CDS premia between CSPP and non-CSPP companies. Not surprisingly, there is a high degree of comovement in the CDS spreads of these two groups, reflecting the exposure to common macroeconomic factors. Over the whole sample period, though, spreads for the CSPP group are on average lower than that of the benchmark. Given the strict eligibility criterion for CSPP purchases, such as preliminarily targeting investment grade bonds, it is not surprising that the ECB is more inclined to buy bonds associated with lower credit risk. Throughout the year 2015, the spread for both groups widens substantially, reaching its peak in early March 2016. Shortly before the announcement of the programme on March 10, 2016, spreads exhibit a considerable decrease. This fall in spreads continues around the date of the announcement and thereafter, interrupted only by temporary phases of uncertainty in May and June. The United Kingdom's referendum on the European Union membership may be related to widening spreads, but the effect seems short-lived (European Central Bank, 2016). Over the course of the second half of the year 2016, spreads decline more gradually. Overall, by November 2017, the CSPP group reaches a new all-time low of about 60 basis points, which marks a reduction of 80 basis points relative to the peak in early March 2016. The downward trend is, however, more pronounced for the non-CSPP group with a tightening in spreads by about 170 basis points, from roughly 270 basis points in March 2016 to around 100 basis points at the end of year 2017. Interestingly, from mid-2017 onwards, spreads of the CSPP and the non-CSPP group slightly converge. As of this date, spreads are also more stable. At the aggregate level, this may suggest that while credit risk has reduced overall, the impact on the non-CSPP group will be more striking. The existence of potential spillover effects dictates my second hypothesis which reads:

> H1: CDS spreads for non-CSPP companies will decline relatively more than for CSPP companies around the CSPP purchase shock.

H1 supports the view that the transmission mechanism of the CSPP operates as desired beyond the eligibility criteria. In fact, the reduction in funding costs induced by the CSPP should be reflected in substantially lower costs of default insurance, especially for riskier credits. When CDS rates decline relatively more for non-CSPP firms as expected, the CSPP policy contributes endogenously through spillover effects, in line with the theory of the portfolio rebalancing channel (Altavilla et al., 2015).

4.2. Empirical Strategy

This subsection elaborates on the underlying estimation method to test the hypotheses formed in the previous subsection. A simplistic approach to estimate the impact of CSPP may be to compare CDS rates across entities issuing purchased bonds and non-purchased bonds while exclusively

[30] The data is extracted from Markit and comprises all non-financial CDS outstanding, irrespective of the fact whether firms have issued bonds purchased by the ECB under the CSPP policy. Bonds and companies that are subject to the CSPP policy are labelled as CSPP bonds and CSPP companies, respectively. This applies analogously for non-CSPP bonds and non-CSPP companies. Note, however, that the definition of 'non-CSPP' here deviates from the definition provided in the Section 4.2 and the definition used in the empirical estimation.

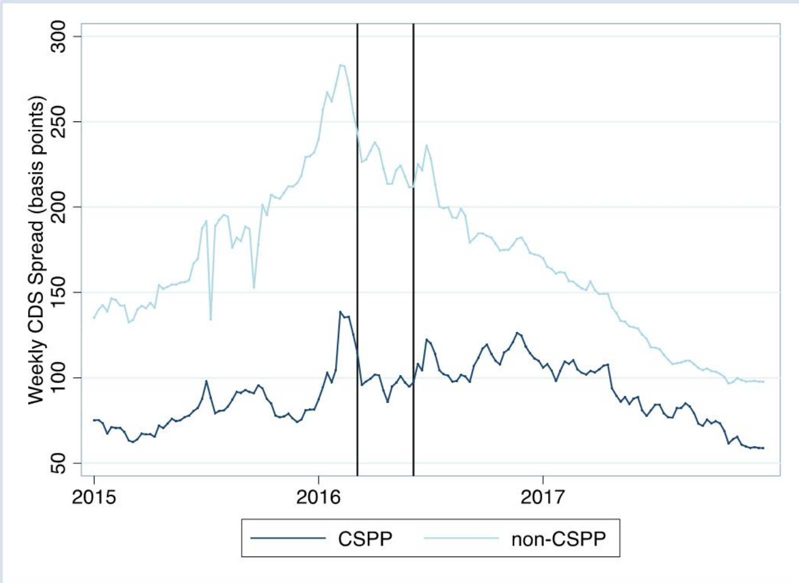

Figure 5: CDS Spread Evolution by CSPP Purchases; Source: Markit (author's own computations).

The figure presents the evolution of weekly CDS prices. The CDS set is split among those firms issuing bonds that are effectively purchased under the CSPP (CSPP) and those firms issuing bonds not subject to the new policy (non-CSPP). The observation window ranges from January 2015 to November 2017. The CSPP announcement in March 2016 is denoted by the left vertical line, while the right vertical line labels the official start of the CSPP in June 2016.

focusing on the post-intervention time, that is the period succeeding the purchase date. However, biased estimates may result when prior to that period differences in prices between the two groups exist. In order to establish causality I adopt a DID analysis which explicitly considers differences in prices prior to the policy implementation. In particular, the DID method identifies causal effects by contrasting the change in outcomes pre- and post-intervention, for the treatment and control group.[31] DID assumes that, in the absence of treatment, prices remain unchanged and then trends within treatment and control groups are equivalent. This assumption of parallel trends allows the averages of the time-invariant unobserved variables to differ between treated and control groups, provided their effects do not change over time (Bertrand et al., 2004, Lechner, 2011, Morris et al., 2013).[32]

The basic DID regression is given by the following equation:

$$Y_{it} = \alpha + \beta \text{Treat}_{it}\text{Pot}_t + \gamma \text{Treat}_{it} + \delta \text{Post}_t + \epsilon_{it} \quad (1)$$

where i and t index firm and time observations. Y_{it} is the outcome of interest, Treat_{it} (=1 if bond of firm i is purchased at day t) is a dummy for CSPP entities and Post_t (=1 beginning from the initial purchase date and thereafter) is an indicator for the post-CSPP period. Furthermore, the equation includes a constant α and a random error term ϵ_{it}. The coefficient β is the DID estimator and identifies the treatment effect of the CSPP, as the treatment is $\text{Treat}_{it}\text{Post}_t$. The evaluation period is seven trading days before and after the purchase date of the respective bond.

Controlling for fixed effects rules out the concern that findings are explained by heterogeneous effects of the CSPP policy on CDS rates. By this means I am able to capture firm specific differences such as unobserved differences in local economic environments, management quality, or the cost of capital (Gormley and Matsa, 2013). Thus, in my estimations the basic DID regression is complemented by the inclusion of fixed effects to control for unobservable time-invariant factors at the firm level as well as time-varying fixed effects. The baseline regression reads:

$$\text{CDS Spread}_{it} = \alpha + \beta \text{Treat}_{it}\text{Pot}_t + \theta_i + \vartheta_t + \epsilon_{it} \quad (2)$$

where θ_i are firm fixed effects and ϑ_t are day fixed effects. Moreover, CDS Spread_{it} is the outcome of interest. Note that Pot_t will be absorbed by the time fixed effects. But what if the relationship between CDS premia and the regressor is non-linear? As Figure 6 shows, the distribution of CDS spreads

[31] For an early study in this vein, see Ashenfelter (1978).

[32] It is worth emphasizing that, in contrast to the current practice in the literature, I refrain from employing an event study methodology. The underlying rationale is that there are serious identification issues with this econometric approach, such as neglecting key announcement dates or ignoring the simultaneous implementation of policies (see for example Gilchrist and Zakrajšek, 2013 or Fratzscher et al., 2016).

is skewed to the left[33] whereas its logged value appears normally distributed.

When assuming a linear model, I may obtain biased estimates of the effects of the CSPP on spreads. That is why I adjust the benchmark regressions to a semi log estimation by changing the dependent variable to log CDS Spread_{it}.

$$log\text{CDS Spread}_{it} = \alpha + \beta \text{Treat}_{it}\text{Post}_t + \theta_i + \vartheta_t + \epsilon_{it} \quad (3)$$

All coefficients in the non-linear regression are unchanged except for the outcome of interest, that is $log\text{CDS Spread}_{it}$. In all specifications, I cluster standard errors at the firm level. Apart from that, the regressions specified previously are estimated on daily CDS spreads using the DID approach in combination with robust standard errors to account for heteroscedasticity. Overall, my research hypotheses suggest decreasing CDS spreads for entities in both the control and treatment sample, and increasing spreads for entities in the treatment group as compared to the control group. Thus, support for the hypotheses requires $\beta > 0$ and $\delta < 0$.[34]

Studying the CSPP impact empirically requires solving an identification problem which relates to the endogeneity of CSPP-eligible bonds. Indeed, given the nature by how the CSPP policy is implemented, bonds that are accepted in the CSPP portfolio differ systematically from bonds which are not. In fact, the assignment of bonds to the CSPP portfolio is discrete and follows strictly the specific eligibility criteria developed by the ECB (see Section 2.2). Therefore, the comparison between eligible and non-eligible bonds or firms is likely to capture the effect of these (observable and unobservable) differences rather than capturing the causal effect of the CSPP. For example, low credit risk issuers - most likely to be part of the CSPP due to fulfilling the admission criteria - might have been less credit constrained before the start of the CSPP, relative to high risk underperforming issuers (Grosse-Rueschkamp et al., 2017). Ignoring this issue would then lead to the underestimation of CDS rates, and in turn, to biased estimates based on the standard regression analysis.

I overcome this obstacle by restricting the sample to CSPP firms, thus a subset of firms that issues at least one bond that is eventually to be purchased by the ECB. At the same time by exploiting the gradual implementation of the CSPP policy, namely the time dimension with which bond purchases have been executed, a potentially exogenous source of variation is generated that I can use to estimate the effect of the CSPP reform. In other words, the distinct purchase dates allow me to compare a subsample of firms transferred primarily to the CSPP portfolio (treatment group) with firms transferred later (control group).[35] This suggests that in the control sample there will be companies having issued at least one bond purchased under CSPP over the course of time since the basis for the selection of these companies is the bond purchase list published by the ECB (see next subsection). However, as the relevant purchase date is succeeding the post-CSPP period of seven trading days[36] for my estimation purposes these firms are not viewed as treated firms. In this light in the following, firms in the treatment and control sample will be referred to as CSPP and non-CSPP firms, respectively. Figure 7 schematically summarizes the empirical strategy.

The following example illustrates the empirical strategy: data is retrieved on a daily basis with the sample period beginning in $t = 0$. Firm A has issued a bond that is effectively purchased under the CSPP on day $t = 1$. Firm A will be assigned to the treatment group for the purchase day $t = 1$. Firm B from the same industry has issued a bond that is purchased on day $t = 8$, that is one week later. As this date is beyond the evaluation period, firm B serves as a control variable. In aggregate, the within CSPP-sample analysis mitigates concerns related to omitted variables.

Another challenging task is related to the fact that the ECB decides to purchase bonds on distinct days. While on the one hand this is convenient for the purpose of demonstrating a direct effect between the CSPP and the change in CDS spreads, on the other hand running a single regression on the full sample to pinpoint the aggregate effect of the policy on a single day will not be possible. Moreover, as elaborated earlier, the main assumption upon which the DID approach rests is that of parallel trends. However, clustering all firms together can violate the former assumption as firms across different industries may not be comparable. For example, the insurance sector is likely to be negatively affected by accommodative monetary policies, because the ability to generate adequate interest income is severely impaired when credit risk is low at the aggregate level (Mertens, 2017). From a statistical perspective, an industry specific analysis addresses the heterogeneity concern that may remain in each sub-panel. Hence I run the DID regression at the industry level for each of the industries identified. Observations within an industry context also allow adherence to the underlying assumption of the DID approach.

4.3. Sample Data

The construction of the sample data is constrained by the availability of CDS. Indeed, reliable CDS data is available for a very low number of companies. Against this backdrop, the data collection is separated into two parts. First I seek to collect CSPP sample data at the aggregate level from the ECB

[33] Provided that the trade takes place between institutional investors and dealers, a left-skewed distribution indicates that most dealers exhibit low counterparty risk while a few dealers have higher counterparty risk (Giglio, 2014).

[34] This in in line with the work by Abidi et al. (2017). Note that a negative estimate for β would be at odds with the second hypothesis but by no means rule out the existence of spillover effects. Rather this scenario would indicate that the CSPP impact on non-targeted firms is not as strong as expected.

[35] Abidi et al. (2017) rule out the issue of selection bias by only considering bonds close to the eligibility threshold. They assume that in this case the admission to the CSPP portfolio will be random. Grosse-Rueschkamp et al. (2017), in contrast, define non-rated European firms with public debt as the benchmark.

[36] Purchases are published on a weekly basis, hence there is at least one week between each purchase date.

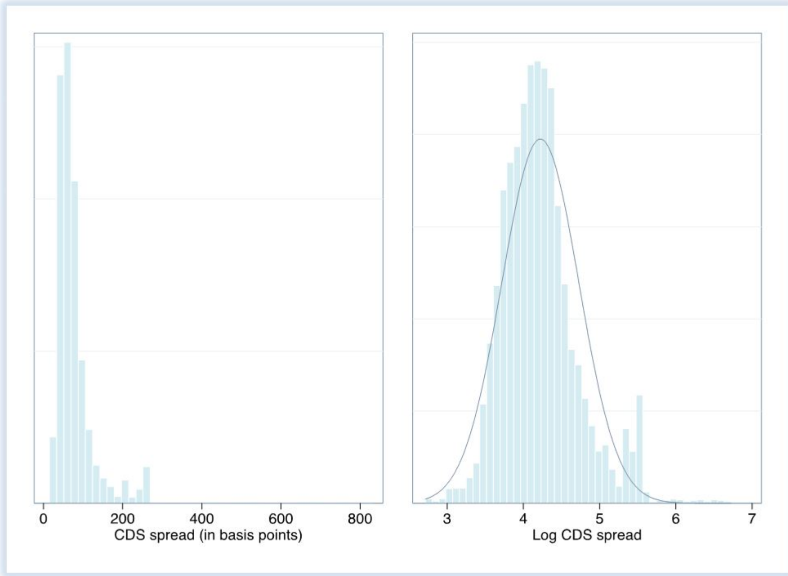

Figure 6: Distribution of CDS Spreads; Source: Markit (author's own computations).

The figure shows the distribution of CDS spreads for the entire sample. The mean spread level throughout the entire sample equals 79.368 basis points and the median value is 64.706 basis points. The standard deviation of spread levels is fairly high at 58.57 basis points. Overall, the distribution is highly left-skewed but conforms closer to the pattern of the Gaussian normal distribution after transforming it with the natural logarithm.

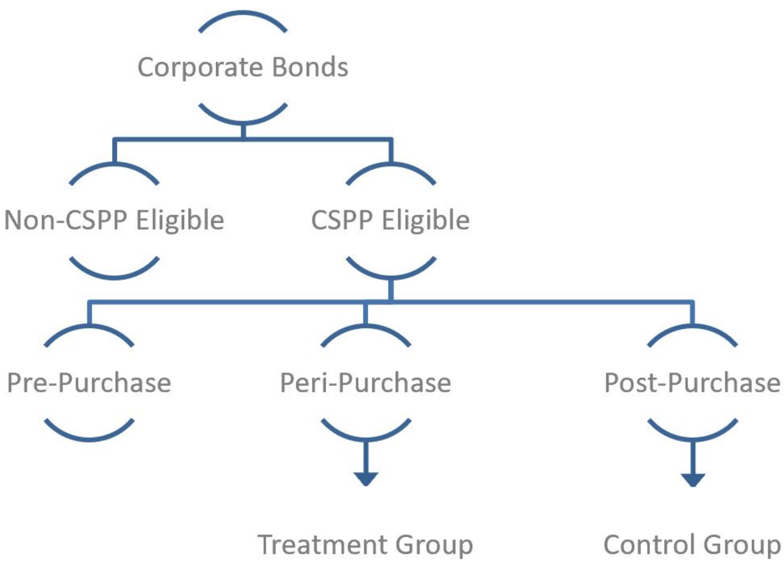

Figure 7: Empirical Strategy; Source: author's own contribution.

The figure shows that in both the treatment and the control sample there will be CSPP companies in the course of time. The assignment to treatment remains reasonable as it is based on bonds purchased the first time through the CSPP. At the same time, companies in the control sample will have issued CSPP bonds eventually. However, the respective purchase date is succeeding the post-evaluation period of seven trading days.

website; subsequently I will combine the dataset with CDS pricing data extracted from Markit. The peculiar admission to the treatment and control sample as proposed in the previous subsection will be then discussed below in more detail. The ECB publishes a list of bonds purchased and held under the CSPP with the respective purchase dates. This list includes each bond's International Securities Identification Number (ISIN) and is updated on a weekly basis. Similar to other asset purchase programmes, CSPP purchases are announced ex post which allows the exploitation of the official intervention as an exogenous, unexpected reduction in the supply of corporate bonds traded amongst investors.

As CDS premia are written on a single company, comprising a set of multiple bonds, I will have to consider the reference or parent company of each purchased bond in order to construct a reasonable benchmark for the DID estimation. Thus, the underlying data is retrieved from Bloomberg by matching each bond with its ultimate parent company using the ISINs. From Bloomberg I also collect information that includes bond level characteristics such as amount outstanding, coupons, country, currency, payment rank and maturity to redemption. Additionally, I obtain the rating at launch of the corporate bond issuances from four rating agencies S&P, Moody's, Fitch Ratings and Dominion Bond Rating Services. I follow Grosse-Rueschkamp et al. (2017) and use the credit rating at bond level as a proxy for the rating of the ultimate parent issuer. The implicit assumption is that the parent issuer rating is positively correlated with issue ratings, and further, that credit ratings are positively correlated across rating agencies. In total, there are 72 firms in my sample.

I use Markit as the central source for the CDS data. Markit offers comprehensive pricing data, collected directly from market markers, and subject to a rigorous data cleaning process.[37] However, matching the ECB's list of purchased bonds with the CDS data is not straightforward. The main concern is that in Markit CDS prices are not mapped to single ISINs but identified through a unique 6-digit REDCode number assigned by Markit for each reference company. As mentioned previously, CDS contracts are written on issuers and not appreciated at the issue level. Accordingly, prices are only available at the company level. Therefore, to avoid collecting data by hand, an intermediate step is required. I need to match the multiple bonds to the 6-digit REDCode with the aid of the ISINs. Only then am I able to match reference entities between the two data sources, whereby the matching procedure here will be based on the 6-digit REDCode.

After merging datasets and removing missing observations, I am able to identify 52 firms with available CDS data for the sample period between January 2015 and November 2017. The series covers the quoted spread, the reference company, the seniority tier,[38] the currency, the country, the industry, the recovery rate[39] and the restructuring clause levels of the respective CDS on a daily basis. In addition, 16 firms are dismissed because in the corresponding industries no bonds have been purchased by the ECB, or because the spread data does not cover the period from January 2015 until November 2017. In total, 36 firms remain in the sample.

Most noteworthy, there is no one-to-one correspondence between a CDS spread and its underlying entity, as the 6-digit REDCode identifies CDS contracts for all available restructuring and seniority characteristics. I follow Berndt and Obreja (2010) and Mertens (2017) who select 5-year contracts with modified-modified restructuring clause for senior unsecured Euro denominated debt. These are considered to be the most liquid CDS contracts in the European market.[40] As discussed earlier, restructuring events are less straightforward as compared to other credit events. Nevertheless, for my estimation I will focus on the modified-modified restructuring clause, which is most popular in Europe. It imposes a maturity limit of 60 months for restructured obligations and 30 months for all other obligations (Berndt et al., 2007, Augustin et al., 2014). My approach is motivated by recent evidence. In the absence of restructuring as a credit event, lenders to a reference company who also trade CDS linked to that same reference company - known as empty creditors - are likely to be tougher during debt renegotiations, refusing private workouts and making distressed borrowers more vulnerable to bankruptcy. For example, buyers of 'no restructuring' CDS contracts with bankruptcy as a credit event will only be paid if the reference firm files for bankruptcy (Pollack, 2003, Subrahmanyam et al., 2014). For a formal model see Bolton & Oehmke (2011). One implication of the model is that the empty creditor problem is, in fact, priced in CDS premia. Hence, to avoid any distortion of results I will opt for restructuring as a credit event, particularly for the modified-modified restructuring clause. It should be noted that the overall tightening of the data comes at the expense of severely reducing the number of observations. As an example, consider the data for the company Aegon N.V. In the full dataset, there are 4009 observations for the 5-year maturity CDS, but after filtering for the seniority tier and the restructuring clause, only 743 remain.

After applying this filter, I am able to construct a representative sample of the treatment and control group. Hereby, within each industry, entities issuing peri-CSPP bonds serve as the treatment variable while the rest are assigned to the control group (see Figure 7). The key point, though, is to avoid the assignment to the control group occurring arbitrarily. Hence, for each treated firm I select only comparable firms from the same industry. More specifically, comparable firms are defined as those firms that - with respect to the CDS spread series - exhibit a similar pre-treatment trend as the treated group (see Appendix). The parallel trend assumption is, as already stated, an important prerequisite underlying the DID estimation. Overall, of the 36 firms, 9 can be assigned to the treatment group and 23 firms can be assigned to the con-

[37] Note that I do not observe bid and ask quotes for CDS spreads, but only mid quotes. In particular, Markit reports spreads that are obtained by averaging the quotes reported by various financial institutions, inter-dealer brokers, and electronic trading platforms (Giglio, 2014). Moreover, reported CDS quotes reflect the sell-side offering price and not the finally agreed price between counterparties (Liu et al., 2017).

[38] The credit risk a CDS references is not limited to a particular bond or loan, but comprises a predetermined set of debt obligations. Markit defines by means of the seniority tier the level of risk of these debt claims.

[39] The recovery rate corresponds to the industry standard value of 40 percent for all CDS contracts in the sample (Chen et al., 2010).

[40] Blanco et al. (2005), Longstaff et al. (2005) and Norden and Weber (2009) also choose the benchmark maturity of five years.

trol group. Table 2 presents characteristics of the 32 firms included in the final sample. The table lists the reference entities, together with basic descriptive information, such as the S&P credit rating, the country and the currency, as well as the daily spread average at the firm and industry level, and finally the number of observations in the CDS series. Each industry group is well diversified across ratings and country of risk, whereby the country selection is due to data availability. Control firms, on average, have slightly higher spreads as compared to treated firms (74.538 basis points versus 72.300 basis points).

It may be argued that the sample size of 32 firms in this context is not realistic. But according to a report by the International Capital Market Association the non-sovereign, non-financial CDS sector is in general modestly represented, while sovereign and financial CDS dominate the European CDS market. In fact, government and financial CDS contribute to 58 percent of the total notional outstanding as of 29 September 2017 (Callsen and Hill, 2018). Hence the data I use is not ideal but the best currently available for my purpose.

5. Empirical Results

This section reports the empirical findings regarding the CSPP impact on CDS prices. To recap, this paper seeks to examine two main questions.

- Do CDS rates increase relative to the time before the CSPP announcement?
- Do CDS rates increase less for CSPP-eligible firms relative to the control group (eligible firms not yet subject to the CSPP) and relative to the time before the CSPP announcement?

The regression specified in the previous section is estimated on daily CDS spreads using the DID approach in combination with robust standard errors to account for heteroscedasticity. The main regressor is the interaction term of the bond CSPP purchase dummy Treat_{it} (=1 if bond of entity i is purchased at day t) and the time dummy variable Post_t (=1 from the initial purchase date and thereafter), that indicates the post-purchase period. The evaluation period is seven trading days before and after the purchase date of the respective bond. Empirical results are listed in Table 3 to 7, for each industry separately. Columns (1) to (3) show the results with CDS Spread_{it} as the main dependent variable. Columns (4) to (6) show the results with logCDS Spread_{it} as the main dependent variable. This pattern is analogous for Table 3 to 7.

Column (1) starts with the specification that only includes the post-programme dummy term, Post_t , while controlling for unobserved time-invariant firm characteristics. The empirical result for the Basic Materials sector suggests that - in line with the first hypothesis - after the bond purchase (Post_t), all entities in this industry experience an average decrease of 9 basis points in their CDS spreads. In column (2) the model is then further saturated with the interaction term Treat_{it} Post_t . Here the results are strengthened with a value of around 11 basis points for Post_t (see Table 3). Similarly, for the Industrials sector CDS rates drop by up to more than 5 basis points (see Table 7). For the remaining three sectors CDS rates do not change as appreciably with the CSPP implementation. Corresponding figures are between 0 and 3 basis points (see Table 4 to 6). Hence, firms in the Basic Materials sector experience the largest fall in CDS rates, followed by the Industrial sector. In all instances, the estimates of the coefficient Post_t are negative. In terms of statistical significance, daily CDS rates across industries are significantly more negative, after the CSPP purchase day than previously, in 7 out of 9 instances. These results hint towards a systematic decline in spreads following CSPP purchases.

In order to be able to infer causality I take a closer look at the interaction term Treat_{it} Post_t in column (2). In agreement with the second conjecture, only a positive sign of the term Treat_{it} Post_t implies that after the purchase date, and conditional on being purchased, spreads of treated entities drop less than spreads of their non-CSPP counterparts. For the Basic Materials sector this difference in drop is indeed positive and robust to the inclusion of entity fixed effects. Particularly, CDS rates have decreased post-CSPP purchase by almost 9 basis points less for the treated firm relative to control group firms and relative to the pre-CSPP event. Hence, this finding indicates the existence of spillover effects of the CSPP programme.

However, it is possible that time-specific shocks are driving the results. Column (3) controls for time-specific shocks (time fixed effects) as defined in Equation (2). Naturally, the post-programme dummy term Post_t is dropped when adding day fixed effects, as the programme affects all entities at a specific point in time. The magnitude of the coefficient still remains fairly constant across the specification and the standard error does not vary significantly. Thus, for the Basic Material sector, spillover effects are indeed evident (see Table 3). However, across industries there is no clear pattern with respect to the sign of the coefficient of the interaction term, as detected for Post_t . A similar effect can only be observed for one subset of the Industrial sector. In fact, the bond purchase on April 30, 2017 prompts CDS rates of the treatment group (Atlantia S.p.A.) to decline by 4 basis points less as compared to the control group (see Table 7). For the remaining three industries corresponding coefficients are either statistically insignificant or the magnitude is negligible in economic terms (below 1 basis point). Note that in 6 out of 9 cases where the interaction term is statistically significant, 3 carry a positive sign and 3 a negative sign. Two important implications can be drawn from these findings. First, the for the most part low but highly significant estimates implicate that there is actually an association between the CSPP and CDS rates. Second, irregularities with respect to the sign of the coefficients do not allow for interpretations on spillover effects as postulated in the second hypothesis.

However, it might be the case that the prior relationship is non-linear. To account for that I run the same regression but

Table 2: Sample Description

The table summarizes the final database after filtering, comprising 5-year CDS denominated in EUR for France, Germany, Greece, Italy, Netherlands, Portugal, Spain and the United Kingdom in a period ranging from January 2015 to November 2017. Mean spreads are calculated in basis points; (1) purchased on August 8th, 2016 (2) purchased on August 15th, 2016 (3) purchased on October 3rd, 2016 (4) purchased on January 23rd, 2017 (5) purchased on May 1st, 2017.

Entity	Currency	Country	Rating S&P	Observations	Mean
Panel A: Basic Materials					
Koninklijke DSM N.V.	EUR	Netherlands	A-	743	40.142
LINDE Aktiengesellschaft	EUR	Germany	BBB	743	30.103
LANXESS Aktiengesellschaft (1)	EUR	Germany	BBB	743	71.885
XSTRATA LIMITED	EUR	United Kingdom	BBB+	743	244.212
Panel B: Financials					
Aegon N. V. (1)	EUR	Netherlands	A-	743	87.929
Allianz SE	EUR	Germany	AA-	743	38.185
ASSICURAZIONI GENERALI	EUR	Italy	A+	743	110.186
AXA	EUR	France	A-	743	58.702
NN Group N. V.	EUR	Netherlands	BBB	743	70.018
UNIBAIL-RODAMCO SE	EUR	France	A	743	60.592
Panel C: Industrials					
Airbus Group SE	EUR	Netherlands	BBB+	479	65.538
Airbus Group N.V.	EUR	Netherlands	BBB+	110	51.858
ATLANTIA S. P. A. (1),(5)	EUR	Italy	A	743	66.599
BRISA - AUTO-ESTRADAS DE PORTUGAL, S. A.	EUR	Portugal	A	742	126.100
BRISA - CONCESSAO RODOVIARIA, S. A.	EUR	Portugal	A	743	125.810
HeidelbergCement AG (4)	EUR	Germany	BBB-	743	113.051
THALES	EUR	France	BBB+	743	51.187
Lafarge	EUR	France	BB+	743	54.775
PostNL N. V. (2)	EUR	Netherlands	BBB+	743	54.281
Siemens Aktiengesellschaft	EUR	Germany	AA-	743	36.376
COMPAGNIE DE SAINT-GOBAIN	EUR	France	BBB+	743	63.776
VINCI	EUR	France	BBB+	743	52.595
Panel D: Telecommunications Services					
Deutsche Telekom AG	EUR	Germany	BBB+	743	45.348
Orange (1)	EUR	France	A-	743	58.990
Vivendi	EUR	France	BBB	743	62.271
Panel E: Utilities					
EnBW Energie Baden-Wuerttemberg AG	EUR	Germany	A-	743	53.941
ENEL S. P. A.	EUR	Italy	A-	743	86.083
ENGIE (1)	EUR	France	A-	589	55.754
E.ON SE (1)	EUR	Germany	AA-	743	73.969
EDISON S. P. A. (3)	EUR	Italy	BBB	743	64.815
Iberdrola S.A.	EUR	Spain	BBB+	743	72.735
RWE Aktiengesellschaft	EUR	Germany	A+	708	92.226
					71.360

Table 3: CSPP Effects on CDS Spreads in Basic Materials Sector (7 Trading Days)

Table 3 presents the DID regression for the subsample of entities within the Basic Materials sector. This table checks whether entities within the treated sample are affected differently in terms of CDS spreads relative to the control group. The dependent variable is the corporate CDS spread. The main regressor is an interaction term of a bond CSPP purchase dummy $Treat_{it}$ (=1 if bond of entity i is purchased at day t) and a time dummy variable $Post_t$, that indicates the purchase of the respective bond under the CSPP (=1 from August 8, 2016 and after). Columns (1) to (3) correspond to the linear regression of Eq. 2. Columns (3) to (6) use the semi log regression of Eq. 3. Observations are between 7 trading days before and after August 8, 2016 and the bond purchased has been issued by Lanxess AG; Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

	$CDS\ Spread_{it}$			$log(CDS\ Spread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	-8.934***	-11.09***		-0.0680***	-0.0772***	
	(2.019)	(2.625)		(0.00782)	(0.00995)	
$Treat_{it}Post_t$		8.615***	8.615***		0.0370***	0.0370***
		(2.643)	(3.074)		(0.0111)	(0.0106)
Observations	56	56	56	56	56	56
Entities	4	4	4	4	4	4
R-squared	0.994	0.994	0.995	0.999	0.999	0.999
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

Table 4: CSPP Effects on CDS Spreads in Telecommunications Services Sector (7 Trading Days)

Table 4 presents the DID regression for the subsample of entities within the Telecommunications Services sector. This table checks whether entities within the treated sample are affected differently in terms of CDS spreads relative to the control group. The dependent variable is the corporate CDS spread. The main regressor is an interaction term of a bond CSPP purchase dummy $Treat_{it}$ (=1 if bond of entity i is purchased at day t) and a time dummy variable $Post_t$, that indicates the purchase of the respective bond under the CSPP (=1 from August 8, 2016 and after). Columns (1) to (3) correspond to the linear regression of Eq. 2. Columns (3) to (6) use the semi log regression of Eq. 3. Observations are between 7 trading days before and after August 8, 2016 and the bond purchased has been issued by Orange S.A.; Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

	$CDS\ Spread_{it}$			$log(CDS\ Spread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	-1.471***	-1.350***		-0.0276***	-0.0257***	
	(0.205)	(0.243)		(0.00389)	(0.00473)	
$Treat_{it}Post_t$		-0.364	-0.364**		-0.00551	-0.00551**
		(0.453)	(0.140)		(0.00843)	(0.00221)
Observations	42	42	42	42	42	42
Entities	3	3	3	3	3	3
R-squared	0.995	0.995	1.000	0.995	0.995	1.000
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

on the logarithm of the dependent variable (logCDS Spread$_{it}$) as defined in Equation (3). The initial results are broadly unchanged. For the most part, the Post$_t$ coefficients in column (4) and (5) keep their signs and remain highly significant across industries, when previously designated as statistically significant. Again, the effects are most striking for the Basic Materials sector as presented in Table 3. Following the bond purchase by the ECB, within this industry, CDS spreads exhibit on average a decrease between 7 and 8 percent. Most noteworthy, the CDS spread for the treatment entity decreases by 3.77 percentage points less relative to the control group after the announcement of the CSPP. Likewise, within the Industrials sector (for the issuer Atlantia S.p.A.) CDS spreads drop on average by 6 percent post-CSPP. This finding is highly significant and holds for both, the purchase date in 2016 and 2017. Interestingly, only for the latter purchase date the coefficient on the interaction term is positive and sizeable with a figure of roughly 6 percentage points (see Table 7).

For the CDS rates of issuers Engie S.A. and E.ON International Finance B.V. from the Utilities sector there is a significant decline of the order of around 4 percent after the ECB conducts the bond purchases, whereas post-CSPP and relative to the control group the effect between the treated and control group becomes statistically indistinguishable from zero (see Table 6). The Financials sector experiences a drop in spreads of similar magnitude, but again the interaction is not statistically different from zero (see Table 5). Moreover,

Table 5: CSPP Effects on CDS Spreads in Financials Sector (7 Trading Days)

Table 5 presents the DID regression for the subsample of entities within the Financials sector. This table checks whether entities within the treated sample are affected differently in terms of CDS spreads relative to the control group. The dependent variable is the corporate CDS spread. The main regressor is an interaction term of a bond CSPP purchase dummy $Treat_{it}$ (=1 if bond of entity i is purchased at day t) and a time dummy variable $Post_t$, that indicates the purchase of the respective bond under the CSPP (=1 from August 8, 2016 and after). Columns (1) to (3) correspond to the linear regression of Eq. 2. Columns (3) to (6) use the semi log regression of Eq. 3. Observations are between 7 trading days before and after August 8, 2016 and the bond purchased has been issued by Aegon N.V.; Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

	$CDS\ Spread_{it}$			$log(CDS\ Spread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	-3.147***	-3.118***		-0.0430***	-0.0447***	
	(0.364)	(0.416)		(0.00455)	(0.00528)	
$Treat_{it}Post_t$		-0.172	-0.172		0.0104	0.0104
		(0.818)	(0.584)		(0.00902)	(0.00677)
Observations	84	84	84	84	84	84
Entities	6	6	6	6	6	6
R-squared	0.997	0.997	0.998	0.997	0.997	0.998
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

Table 6: CSPP Effects on CDS Spreads in Utilities Sector (7 Trading Days)

Table 6 presents the DID regression for the subsample of entities within the Utilities sector. This table checks whether entities within the treated sample are affected differently in terms of CDS spreads relative to the control group. The dependent variable is the corporate CDS spread. The main regressor is an interaction term of a bond CSPP purchase dummy $Treat_{it}$ (=1 if bond of entity i is purchased at day t) and a time dummy variable $Post_t$ that indicates the purchase of the respective bond under the CSPP. Columns (1) to (3) correspond to the linear regression of Eq. 2. Columns (3) to (6) use the semi log regression of Eq. 3. Observations are between 7 trading days before and after August 8, 2016 and October 3, 2016, for Panel A and B respectively. Purchased bonds are issued by Engie S.A. and E.ON International Finance B.V. as shown in Panel A; and by Edison S.p.A. shown in Panel B; Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Panel A: 8 August 2016	$CDSSpread_{it}$			$log(CDSSpread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	-2.603***	-2.740***		-0.0396***	-0.0390***	
	(0.188)	(0.232)		(0.00261)	(0.00311)	
$Treat_{it}Post_t$		0.480	0.480**		-0.00222	-0.00222
		(0.385)	(0.224)		(0.00576)	(0.00215)
Observations	98	98	98	98	98	98
Entities	7	7	7	7	7	7
R-squared	0.996	0.996	0.999	0.997	0.997	1.000
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

Panel B: 3 October 2016	$CDSSpread_{it}$			$log(CDSSpread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	0.447**	0.622**		0.00673**	0.00918**	
	(0.221)	(0.272)		(0.00290)	(0.00356)	
$Treat_{it}Post_t$		-0.877***	-0.877**		-0.0123***	-0.0123**
		(0.292)	(0.354)		(0.00378)	(0.00481)
Observations	70	70	70	70	70	70
Entities	5	5	5	5	5	5
R-squared	0.996	0.996	0.998	0.997	0.997	0.999
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

Table 7: CSPP Effects on CDS Spreads in Industrials Sector (7 Trading Days)

Table 7 presents the DID regression for the subsample of entities within the Industrials sector. This table checks whether entities within the treated sample are affected differently in terms of CDS spreads relative to the control group. The dependent variable is the corporate CDS spread. The main regressor is an interaction term of a bond CSPP purchase dummy $Treat_{it}$ (=1 if bond of entity i is purchased at day t) and a time dummy variable $Post_t$, that indicates the purchase of the respective bond under the CSPP. Columns (1) to (3) correspond to the linear regression of Eq. 2. Columns (3) to (6) use the semi log regression of Eq. 3. Observations are between 7 trading days before and after the specific purchase date as shown in Panel A to D respectively. Purchased bonds are issued by Atlantia S.p.A. as shown in Panel A and B; and by PostNL N.V. and HeidelbergCement Finance B.V. shown in Panel C and D respectively; Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Panel A: 8 August 2016	$CDSSpread_{it}$			$log(CDSSpread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	-5.272***	-5.343***		-0.0575***	-0.0558***	
	(0.468)	(0.525)		(0.00344)	(0.00375)	
$Treat_{it}Post_t$		0.639	0.639		-0.0151*	-0.0151***
		(0.707)	(0.586)		(0.00802)	(0.00435)
Observations	126	126	126	126	126	126
Entities	9	9	9	9	9	9
R-squared	0.997	0.997	0.997	0.999	0.999	0.999
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

Panel B: 1 May 2017	$CDSSpread_{it}$			$log(CDSSpread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	-3.889***	-4.292***		-0.0577***	-0.0638***	
	(0.467)	(0.499)		(0.00625)	(0.00667)	
$Treat_{it}Post_t$		4.030***	4.030***		0.0611***	0.0611***
		(0.929)	(0.699)		(0.0109)	(0.0105)
Observations	140	140	140	140	140	140
Entities	10	10	10	10	10	10
R-squared	0.994	0.994	0.997	0.994	0.995	0.998
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

Panel C: 15 August 2016	$CDSSpread_{it}$			$log(CDSSpread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	-1.591***	-1.624***		-0.0202***	-0.0190***	
	(0.399)	(0.457)		(0.00348)	(0.00391)	
$Treat_{it}Post_t$		0.268	0.268		-0.00984	-0.00984**
		(0.515)	(0.626)		(0.00632)	(0.00459)
Observations	112	112	112	112	112	112
Entities	8	8	8	8	8	8
R-squared	0.998	0.998	0.998	0.999	0.999	0.999
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

Panel D: 23 Januar 2017	$CDSSpread_{it}$			$log(CDSSpread_{it})$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Post_t$	0.0719	0.176		0.00459	0.00628	
	(0.323)	(0.356)		(0.00427)	(0.00471)	
$Treat_{it}Post_t$		-0.939	-0.939**		-0.0151*	-0.0151**
		(0.722)	(0.452)		(0.00869)	(0.00611)
Observations	126	126	126	126	126	126
Entities	9	9	9	9	9	9
R-squared	0.998	0.998	0.999	0.997	0.998	0.998
Entity FE	YES	YES	YES	YES	YES	YES
Time FE			YES			YES

following the CSPP policy, for Telecommunication companies the sign on the interaction estimate is reversed and negative, which seems to negate the existence of spillover effects in connection with the second assumption. However, the figure is relatively small in economic terms (see Table 4). Overall, the most pronounced impact in lowering credit risk can be observed for the sector of Basic Materials with a decrease of 8 percent. Noticeable evidence on spillover effects can be inferred from the Industrial sector with a value equal to 6 percentage points. In 7 out of 9 instances where the interaction term is statistically significant, 2 carry a positive sign and 5 carry a negative sign. Despite assuming non-linearity, the results of this exercise do not contribute to further insights. These findings rather suggest that spillover effects are limited to specific bonds (which is most evident for the issuer Atlantia S.p.A.). Note that the large R-squared values throughout all specifications are based on the fact that fixed effects often capture a lot of the variation in the data.

6. Discussion

The CSPP was designed to complement the main thrust of ECB'S QE policy. The overall goal has been to ease financial conditions for corporates, and ultimately to support a sustained economic recovery in the euro area. This paper adds to the strand of literature to study the CSPP impact, and especially the spillover effects of monetary policy decisions on related financial markets. While it is difficult to be certain about the effects of the CSPP policy without a greater body of experience than is so far available, some provisional conclusions may be possible.

To summarize, I find that, consistent with the initial assumption, the CSPP programme has contained credit risk across European non-financial corporates. The results indicate that credit market reactions to the CSPP event - measured by means of CDS prices - imply negative CDS rates throughout. In contrast, spillover effects to non-CSPP firms have been heterogeneous within and across industries. The empirical support for the second conjecture is limited, and if anything, rather bond specific. Hence, the ECB's commitment to continue the CSPP is indeed helping to lift credit constraints overall, but according to my estimation the programme seems to not have stronger effects on firms not subject to the CSPP, as suggested by previous work.

A potential critique of the above analysis is related to the identification strategy. While the second hypothesis is motivated by the fact that the reduction in CDS rates - prompted by the CSPP - spills over to riskier CDS instruments, in the estimation the full sample is restricted to the CSPP portfolio. In other words, the implicit assumption underlying the empirical strategy is that control group firms transferred later to the CSPP portfolio are higher credit risk firms and thus non-CSPP-eligible which is, however, not necessarily true. As elaborated earlier, the empirical strategy is convenient as it dismisses any endogeneity concerns. Nonetheless, defining a too narrow control group may lead to inconsistent results. In this respect, the sample could be extended to select Eurozone investment grade-rated companies issuing USD denominated bonds into the control group. An alternative control group may comprise European investment grade-rated firms that are incorporated in countries outside of the Eurozone. These approaches would still alleviate any endogeneity concerns, as treated companies would most likely not differ systematically from the control group except by the currency or country. Next to that, as in my estimation there are only 32 firms with available CDS spreads, an adjustment of the sample as proposed would indeed allow access to a larger database which may in turn complement the prior results. However, such analyses are beyond the scope of this paper, leaving space for future research.

At the aggregate level, it may well be argued that CDS contracts as such are restrictive for the evaluation of the CSPP impact. In fact, CDS do not refer to a single bond but to a firm, which issues various bonds. And indeed, the prevailing examination hints towards the fact that CSPP purchases are having a systematic effect at the individual bond-level, whereas the effect on the entity as a whole is rather ambiguous. Beyond that there are some other shortcomings associated with this financial instrument. As discussed earlier, CDS rates present rather an upper limit on the price of credit risk. In fact, Subrahmanyam et al. (2014) find that the inception of CDS increases the credit risk of underlying reference entities due to the higher likelihood of credit rating downgrades and bankruptcy. The increase in credit risk is also associated with the absence of borrower monitoring and tougher debt renegotiations. Similarly, Arce et al. (2017) report that the cost of debt of risky firms actually increases after CDS trading is initiated. Hence, the choice of CDS as the variable of interest may lead to distorted results because estimation results, if anything, will be biased upwards.

However, this line of reasoning omits a certain important aspect, that is that the CSPP announcement date absorbs pricing-relevant information for the most part, generating lower bound estimates for the individual purchase date (Arce et al., 2017). In aggregate, there exists the issue of an overestimation on the one hand, and an underestimation on the other hand. Prospective research will be required to disentangle these two effects, and disclose whether they offset each other.

Within this context, it is also crucial to understand that the predominant focus on CDS quotes may be too simplistic. Instead, a shift towards a composite dataset of both CDS transaction data and CDS quotes may provide a more comprehensive picture of CDS activities, revealing supplementary information on referenced firms. Further, as a robustness check future research may consider multi-name CDS instruments which typically represent the more liquid part of the relevant single-name CDS market (Fontana and Scheicher, 2016). Corresponding CDS spreads would then serve as a more powerful indicator of credit risk.

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