ECB Corporate QE and the Loan Supply to Bank-Dependent Firms*

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Using a representative sample of euro-area businesses, we show that Eurosystem purchases of corporate bonds under the Corporate Sector Purchase Programme (CSPP) triggered a shift in bank loan supply in favor of firms that do not have access to bond-based financing. Identification comes from matching bank-dependent firms to their lenders and accounting for the effect of CSPP on banks' activity in the syndicated loan market. Credit access improved relatively more for firms borrowing from banks relatively more exposed to CSPP-eligible firms. This result applies regardless of bank balance sheet quality as measured by tier 1, NPL, and liquidity ratios.

JEL Codes: E52, E58, G01, G21, G28.

1. Introduction

Compared with traditional interest rate policy, the impact of unconventional monetary policy is less well understood. This applies in particular to the following addition to the unconventional toolkit by the European Central Bank (ECB): the Corporate Sector Purchase Programme (CSPP), launched in March 2016. Under the CSPP, the

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Eurosystem purchases outright, in both primary and secondary markets, investment-grade euro-denominated bonds issued by non-bank corporations (i.e., non-financial corporations (NFCs) and insurance corporations) established in the euro area.[1] The goal of the CSPP is to ease financing conditions in the real economy and stimulate the provision of new credit through the issuance of corporate bonds.

In this paper, we tackle the key question of whether the CSPP also benefited firms that themselves do not issue corporate bonds. The idea is that CSPP creates spare capacity in banks' balance sheets that they can use to lend to bank-dependent firms, mainly small and medium-sized enterprises (SMEs), the latter accounting for 70 percent of employment and 60 percent of value-added in the euro area. This policy question is particularly pertinent, given that in the context of the coronavirus pandemic (COVID-19), the U.S. Federal Reserve announced in June 2020 the purchases of individual corporate bonds and the ECB, Bank of England, and Bank of Japan have expanded their corporate bond purchase schemes.

We show that the CSPP triggered a shift in bank loan supply in favor of firms that do not have access to bond-based financing. In particular, we find that credit access improved relatively more for firms borrowing from banks relatively more exposed to CSPP-eligible firms. This result applies regardless of bank balance sheet quality as measured by tier 1, non-performing loans (NPLs), and liquidity ratios. In our view, these findings are best interpreted as the result of a shift in relative risk-adjusted returns and decreasing returns to scale. In particular, the CSPP has driven down the cost of funding for CSPP-eligible issuers. This, in turn, lowers the risk-adjusted returns for banks attempting to lend to these companies. As loans to SMEs and loans to corporates are substitutes in credit production, more SME loans will be produced if lending rates decline. The transmission of the unconventional monetary policy is working through a simple substitution effect, and the quality of the balance sheet of the banks is irrelevant for the mechanism. Decreasing returns to scale explain why banks have not been able to extend loans to these firms before the introduction of the CSPP.

[1]The CSPP was announced on March 10, 2016 and purchases started on June 8.

Regarding the quality of bank balance sheets, it is important to bear in mind that by 2016, banks were already well capitalized and liquid.[2] This is reflected in the euro-area Bank Lending Survey, according to which banks' liquidity and capital positions eased the credit standards applied to NFC loans during the period under consideration.[3] We also find that the CSPP has not induced a loan supply shift towards more riskier borrowers. Instead, we argue that a simple rebalancing in banks' loan portfolios has occurred, with funds channeled from large firms with direct access to the corporate bond market to firms relying solely on bank credit.

The CSPP was part of a comprehensive policy package in March 2016 that included the following complementary measures: (i) a further reduction in key ECB interest rates; (ii) a new series of four targeted longer-term refinancing operations (TLTROs); (iii) an increase in the monthly net purchases under the Asset Purchase Programme (APP) from EUR 60 billion to EUR 80 billion; and (iv) the CSPP, which forms part of the APP.[4] The remainder of the paper refers to these measures as the March 2016 package. The challenge for the identification strategy is to disentangle the effect of the CSPP from those of the complementary policy measures.

To carry out the analysis, first we make use of an ECB database providing the bond ISINs actually purchased by the Eurosystem during the sample period.[5] This allows us to identify precisely the companies that could have substituted bank loans with debt securities due to the CSPP, because this substitution is originated directly from firms whose bonds were purchased by the ECB. We then link these firms to their lenders in the syndicated loan market, which in turn have incentives to rebalance their loan portfolio vis-à-vis CSPP-ineligible firms. Specifically, we combine Dealogic data on loan syndications with data on all ECB purchases at the ISIN level,

[2]According to the European Banking Association (EBA), the common equity tier 1 capital ratio amounted to 13.15 percent. Moreover, banks had benefited from the four-year targeted liquidity operations conducted by the ECB.

[3]Liquidity positions (BLS.Q.U2.ALL.LP.E.Z.B3.ST.S.WFNET) and capital positions (BLS.Q.U2.ALL.CP.E.Z.B3.ST.S.WFNET) are available on https://sdw.ecb.europa.eu/ using the search function.

[4]In an environment characterized by slightly negative consumer price inflation and weak real GDP growth, with risks to the outlook tilted to the downside, the ECB adopted these policies to stimulate aggregate demand and credit supply.

[5]ISIN stands for International Securities Identification Number.

including NFCs and insurance companies, in order to identify which banks could have experienced a negative demand shock in the loan market.

Second, our analysis makes use of a credit supply concept based on the Survey on the Access to Finance of Enterprises (SAFE), which provides a representative sample of non-financial firms in the euro area. For our purposes, the survey has three advantages. (i) Most bank-dependent firms are SMEs. (ii) We can avoid working with lending volumes, which are equilibrium outcomes reflecting both supply and demand. As our main measure of credit supply, we consider the extent to which firms have their loan applications rejected or are discouraged from applying in the first place. A second complementary measure, which relies on the individual firms' perceptions of banks' credit standards, is used as a robustness check. (iii) The survey is fielded twice a year, usually in April and October. This enables us to carry out the analysis within a time window comprising the year before and the year after the announcement of the CSPP, mitigating the impact of confounding factors.

Third, we manually match this information with a restricted-access data set provided by Bureau van Dijk that links SAFE respondents to their banks. This yields a difference-in-differences setting where firms that borrow from a bank that experienced a CSPP-induced negative demand shock in the syndicated loan market should be more likely to report an improvement in credit supply post-CSPP.

The empirical strategy is based on the fixed-effects methods recommended by Dygryse et al. (2019) for settings where firms borrow from a single bank. We report results for two different explanatory variables that measure whether the bank experiences a negative demand shock in the syndicated loan market. The first measure is an indicator equal to 1 if banks' activity with firms whose bonds were purchased under the CSPP declined following the CSPP. The second measure is an indicator equal to 1 if prior to the CSPP the bank had relatively greater exposure to CSPP-eligible than to CSPP-ineligible syndicated loan counterparts. In a difference-in-differences setting, we show that credit access improved relatively more for firms borrowing from banks relatively more exposed to CSPP-eligible firms.

To attribute the spillover effects to the CSPP, we employ a complementary empirical strategy, by making use of a restricted-access

database on all unconventional monetary policy activities that were part of the March 2016 package. This set of exercises correlates the purchase flows associated with the policies of the March 2016 package with credit supply. In addition to the CSPP flows scaled by GDP measured at the country-survey wave level, we also carry out similar exercises using the outright purchases of government bonds under the PSPP, the TLTRO flows net of all other longer-term refinancing operations, and the additional liquidity provided under the conventional main refinancing operation (MRO).

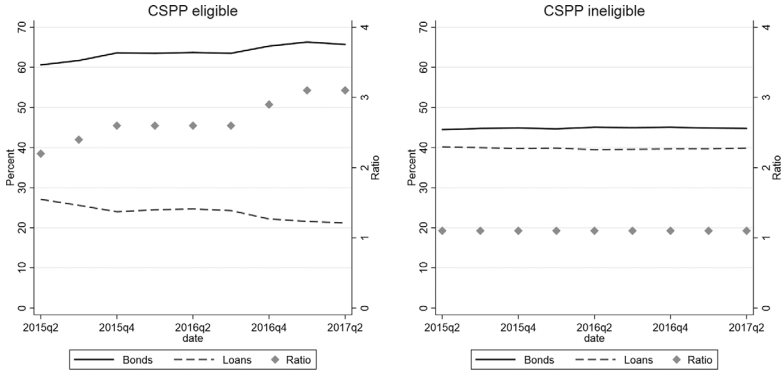
We test two mechanisms as to how this may occur. First, large corporations can issue bonds more easily with a new important actor in both the primary and the secondary markets and, as a result, substitute bank loans with relatively cheaper corporate bonds. Second, ECB activity in secondary markets may prompt banks to sell some of the corporate bonds they hold on their balance sheets, thereby also generating balance sheet capacity.

The empirical evidence supports the conclusion that the program made a positive contribution to the provision of financing to bank-dependent firms, including SMEs. We find the magnitude of CSPP flows to be significantly associated with our measures of credit supply. This does not apply to other measures of the March 2016 package. The data are consistent with the notion that the CSPP stimulated net corporate bond issuance, and that the funds generated by the reduced loan demand from corporates active in the bond markets were shifted towards bank-dependent firms. It could be argued that the funds could result from banks selling some of their holdings of corporate bonds, though the evidence does not support the empirical salience of this channel.

Literature on the CSPP has so far focused on its effects on the bond market. Following the announcement of the CSPP, De Santis and Zaghini (2021) document an increase in net issuance of debt securities, and several papers show a decrease in corporate bond yield or spreads.[6] Grosse-Rueschkamp, Steffen, and Streitz (2019)

[6]See, e.g., ECB (2016); Cecchetti (2017); Zaghini (2019); Abidi and Miquel Flores (2018); De Santis et al. (2018); Rischen and Theissen (2018); Gross-Rueschkamp, Steffen, and Streitz (2019); Li et al. (2019); Todorov (2020); Arce, Mayordomo, and Gimeno (2021).

Figure 1. Debt Structure of Non-financial Corporations Eligible (LHS) and Ineligible (RHS) for CSPP



Source: De Santis et al. (2018).

Note: The figure shows the share of bank loans and bonds in the debt structure of NFCs. Ratio is defined as bond/loan volumes. The computation is based upon 534 euro-area NFCs, of which 113 issue CSPP-eligible bonds.

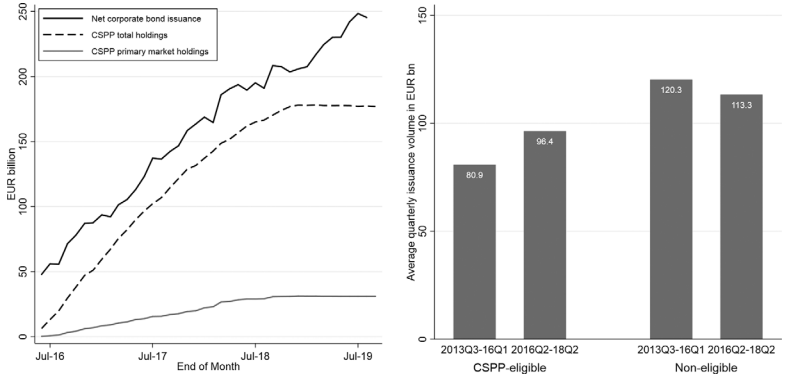
show that CSPP-eligible borrowers switched away from bank financing towards bond issuance, as described in Figure 1.

Only a few papers discuss CSPP spillovers to bank-dependent firms and SMEs. Arce, Mayordomo, and Gimeno (2021) offer cross-sectional evidence of an increase in loan growth to bank-dependent firms in Spain one quarter after the CSPP announcement, while we cover a large number of euro-area countries and employ a credit supply measure.

Ertan, Kleymenova, and Tuijn (2020) document that CSPP purchases improve credit access for small businesses.[7] This exercise is carried out by linking firms to their banks at the country-industry (four sectors) level. Thanks to access to a proprietary database, we are able to link banks and firms at the individual level; hence, our analysis is less vulnerable to omitted variables. In addition, Ertan, Kleymenova, and Tuijn (2020) conduct their analysis using ECB

[7]Ertan, Kleymenova, and Tuijn (2020) classify as credit-constrained firms those which applied and did not receive the full amount of the loan, thereby excluding a substantial share of discouraged borrowers that did not apply because of a possible rejection (see also Ferrando, Popov, and Udell (2017, 2019).

Figure 2. Cumulated Net Issuance and CSPP Purchases of Euro-Denominated Long-Term Debt Securities (LHS) and Average Quarterly Issuance Volume of Non-financial Corporate Bonds in EUR Billion (RHS)



Source: ECB and Dealogic.
Note: Monthly flows.

purchases in the primary market, which overall represents only about 20 percent of the CSPP and only 14 percent when the analysis was conducted (i.e., EUR 10.5 billion up to June 2017); our work instead uses all corporate bonds purchases under the CSPP (i.e., EUR 75.5 billion up to the first half of 2017). As reported in panel A of Figure 2, long-term net bond issuance by NFCs, insurance companies, and pension funds cumulated from March 2016 co-moves in size with the total CSPP holdings in the primary and secondary market. It is important to include the CSPP purchases in the secondary market, because bond scarcity at the firm level generates favorable financing conditions, which leads to additional bond issuance purchased by other investors.[8]

Panel B of Figure 2 shows the ratio of the bond issuance of eligible versus non-eligible firms before and after the CSPP. The ratio has increased substantially, suggesting that corporate borrowers have issued relatively more bonds after the CSPP introduction.

[8]Grosse-Rueschkamp, Steffen, and Streitz (2019) focus their analysis of the syndicated loan market on large corporations.

De Santis and Zaghini (2021), who have investigated in detail the impact of the CSPP on corporate bond issuance exploiting the euro denomination eligibility criterion, proved this result.

Other studies that use the SAFE investigate the impact on credit constraints of the euro-area sovereign debt crisis (Ferrando, Popov, and Udell 2017) and of the ECB's Outright Monetary Transactions (OMT) program (Ferrando, Popov, and Udell 2019). Studies that use firm-level survey data to identify the role of credit supply during the financial crisis include Popov and Udell (2012), Beck et al. (2014), Presbitero, Udell, and Zazzaro (2014), and Pigini, Presbitero, and Zazzaro (2016). More generally, our paper contributes to research on the impact of unconventional monetary policy (Krishnamurthy and Vissing-Jorgensen 2011; Giannone et al. 2012; Gilchrist and Zakrajšek 2013; Acharya et al. 2015; Darracq-Paries and De Santis 2015; Gilchrist, López-Salido, and Zakrajšek 2015; Foley-Fisher, Ramcharan, and Yu 2016; Altavilla, Canova, and Ciccarelli 2020).

The remainder of this paper is structured as follows. Section 2 describes the data. Section 3 presents the methodology. Section 4 provides evidence on the CSPP purchase flows and the CSPP-induced loan supply effect. Section 5 provides evidence about the spillover effect in favor of bank-dependent firms using the bank-firm relation. Section 6 concludes.

2. Data

2.1 Survey on the Access to Finance of Enterprises

Our main data source is the SAFE, an enterprise survey administered by the ECB and the European Commission. In 12 larger euro-area countries, the ECB runs the survey twice per year, usually in April and October.[9]

[9]In each of the ECB rounds, the smallest countries in the euro area (currently Estonia, Cyprus, Latvia, Lithuania, Luxembourg, Malta, and Slovenia) are excluded from the sample. As they represent less than 3 percent of the total number of employees in the euro area, this has only a marginal impact on the results for the euro area as a whole. The more comprehensive survey, run in cooperation with the European Commission, covers all countries of the European Union and some neighboring economies.

The SAFE documents the availability of and needs for external finance in the six months preceding the interview. In addition, the survey collects information on firm characteristics, such as sector, size, and age. The interviews are conducted over a four-week period mainly by telephone, but respondents can also complete an online questionnaire. The interviewee in each company usually is a senior executive (general manager, finance director, or chief accountant). The sample is stratified by country, enterprise size class, and economic activity. The SAFE has a panel component such that a subset of firms participates in multiple survey waves.

The SAFE covers firms of all size categories. The sample is constructed to offer comparable precision for micro (1–9 employees), small (10–49 employees), and medium-sized (50–249 employees) enterprises, taking into account total employment in these size classes. In addition, a sample of large enterprises (250 or more employees) is included in order to make it possible to compare developments for SMEs with those for large enterprises. The enterprises are split into four major economic activities: industry, construction, trade, and other services. The sample excludes firms in agriculture, public administration, and financial services.

To account for credit supply, we primarily use a factual measure and, as a robustness check, a perceptions-based measure. The factual measure of credit supply is based on questions 7a and 7b of the SAFE (Q7), where type of financing refers to (a) credit line, bank overdraft, or credit cards overdraft; (b) bank loans (excluding overdraft and credit lines); (c) trade credit; (d) other external financing.[10]

Q7a: Have you applied for the following types of financing in the past six months?

a) Applied
b) Did not apply because of possible rejection
c) Did not apply because of sufficient internal funds
d) Did not apply for other reasons

[10]The questionnaire and results of all SAFE waves are available at https://www.ecb.europa.eu/stats/ecb_surveys/safe/html/index.en.html.

Q7b: If you applied and tried to negotiate for this type of financing over the past six months, what was the outcome?

a) Received everything
b) Received 75% and above
c) Received below 75%
d) Refused because the cost was too high
e) Was rejected
f) Application is still pending

As in Ferrando, Popov, and Udell (2017), we consider a firm to be credit constrained if the firm requested the financing (Q7a) and one of the following conditions from Q7b applies: (i) the firm received less than 75 percent of the desired bank loan amount; (ii) the firm refused the bank loan offer because the cost was too high; (iii) the firm's application for a bank loan or credit line was denied. Firms that (iv) did not apply because of a possible rejection (Q7a) are also classified as credit constrained.

We refer to the perceptions-based measure as the change in willingness to lend. The change in willingness to lend is based on question 11 (Q11) of the SAFE:

Q11: For each of the following factors, would you say that they have improved, remained unchanged, or deteriorated over the past six months?

a) General economic outlook
b) Access to public financial support
c) Your enterprise-specific outlook with respect to your sales and profitability or business plan
d) Your enterprise's own capital
e) Your enterprise's credit history
f) Willingness of banks to provide credit to your enterprise

All responses are coded as follows: improvement 1, unchanged 0, and deterioration −1. It is important to stress that the question asks for a qualitative assessment of *changes* in the environment rather than levels. The answers to Q11f serve as our second measure of credit supply.

Question 11 can also be exploited to obtain firm-specific control variables. In particular, we use Q11c to control for the enterprise-specific outlook, Q11d to account for the firm's capital position, and Q11e to control for the firm's credit history. The macroeconomic outlook is controlled for by using time fixed effects or business cycle variables (see next section). Additional controls include (the log of) employment and indicators for firm age. Table 1 provides an overview of the variables that we use.

Our analysis draws on SAFE waves 13–16. Waves 13 and 14 cover the period from April 2015 until March 2016, while rounds 15 and 16 cover April 2016 until March 2017. The window length reflects various considerations. First, from an identification viewpoint, a shorter window is preferable. The longer the window, the more likely it is that the results are contaminated by confounding factors. On the other hand, it takes time for the effects of the program to materialize, as firms and banks adjust to the presence of ECB in the corporate bond market. Firms have to decide on the issuance volumes after the monetary policy surprise. They have to organize roadshows in order to advertise the arrival of the new supply. The time length is even longer for firms deciding to enter the market for the first time. In this case, two agreements—one with the stakeholders and one with investment banks—are needed. Second, it takes several quarters for the impact of monetary policy measures to peak. Third, dropping two waves would halve the sample size. In our view, a window width of announcement date plus or minus one year balances these considerations. A robustness check with a shorter window is also provided.

The starting date excludes the period characterized by a sharp improvement in financing conditions in 2014 resulting from negative policy rates and the expected announcement of the ECB's sovereign quantitative easing (QE) program (PSPP) in January 2015. The end date captures the period under which purchases were intended to run according to the ECB decision in June 2016.[11]

[11]In June 2016, the ECB announced that the outright purchases under the APP were intended to run until the end of March 2017, or beyond, if necessary, and in any case until the ECB sees a sustained adjustment in the path of inflation consistent with a return to price stability.

Table 1. Variable Definitions

Variable Name	Definition	Source
Credit Constrained	Indicator equal to 1 if (i) the firm received less than 75 percent of the desired bank loan amount; (ii) the firm refused the bank loan offer because the cost was too high; (iii) the firm's application for a bank loan or credit line was denied. Firms that (iv) did not apply because of a possible rejection are also classified as credit constrained	SAFE
Willingness to Lend	Equal to 1 if the firm reports an improvement in banks' willingness to lend; equal to –1 if the firm reports a deterioration of banks' willingness to lend; and 0 otherwise	SAFE
Outlook Improved	Indicator equal to 1 if the firm reports an improvement in the enterprise-specific outlook and 0 otherwise	SAFE
Outlook Deteriorated	Indicator equal to 1 if the firm reports a deterioration in the enterprise-specific outlook and 0 otherwise	SAFE
Capital Improved	Indicator equal to 1 if the firm reports an improvement in its capital and 0 otherwise	SAFE
Capital Deteriorated	Indicator equal to 1 if the firm reports a deterioration in its capital and 0 otherwise	SAFE
Credit History Improved	Indicator equal to 1 if the firm reports an improvement in its credit history and 0 otherwise	SAFE
Credit History Deteriorated	Indicator equal to 1 if the firm reports a deterioration in its credit history and 0 otherwise	SAFE
Log Employment	Log of total full- and part-time employment	SAFE
Small Firm	Indicator equal to 1 if firm has between 10 and 49 employees	SAFE
Medium Firm	Indicator equal to 1 if firm has between 50 and 249 employees	SAFE
Large Firm	Indicator equal to 1 if firm has more than 250 employees	SAFE
Firm Age 5y–10y	Indicator equal to 1 if the firm is between 5 and 10 years old	SAFE
Firm Age $<$ 5y	Indicator equal to 1 if the firm is less than five years old	SAFE

(*continued*)

Table 1. (Continued)

Variable Name	Definition	Source
Net Bond Issuance/GDP	Monthly NFC net issuance of corporate bonds, aggregated to match the reference period of the SAFE, scaled by GDP	ECB
Bank Bond Purchase/GDP	Monthly transaction of debt securities held by MFIs, aggregated to match the reference period of the SAFE, scaled by GDP	ECB
CSPP/GDP	Monthly country-level CSPP flows aggregated to match the reference period of the SAFE, scaled by GDP	ECB
PSPP/GDP	Monthly country-level PSPP flows aggregated to match the reference period of the SAFE, scaled by GDP	ECB
MRO/GDP	Monthly country-level MRO flows aggregated to match the reference period of the SAFE, scaled by GDP	ECB
TLTRO/GDP	Monthly country-level TLTRO flows aggregated to match the reference period of the SAFE, scaled by GDP	ECB
Expected GDP Growth	One-year-ahead GDP forecast	Consensus
Expected Inflation	One-year-ahead inflation forecast	Consensus
Δ Eligible Deals	Indicator equal to 1 if banks' activity with CSPP-eligible syndicated loan counterparts declines following CSPP	Dealogic
Relative Exposure	Indicator equal to 1 if prior to CSPP bank's percentile rank in the distribution of loans to CSPP-eligible borrowers exceeds that of CSPP-ineligible borrowers	Dealogic
G-SIB	Firm has relationship with a G-SIB	Amadeus
Savings Bank	Firm has relationship with a savings bank	Amadeus
Cooperative	Firm has relationship with a cooperative bank	Amadeus
Foreign Subsidiary	Bank is headquartered in a different country than the firm	Amadeus
Capital	Capital is an indicator equal to 1 if the firm borrows from a bank with a tier 1 ratio above the country median	EBA
NPL	NPL is an indicator equal to 1 if the firm borrows from a bank with an NPL ratio above the country median	EBA
Liquidity	Liquidity is an indicator equal to 1 if the firm borrows from a bank with the loan-to-deposit ratio above the country median	EBA

Table 2. Summary Statistics

A. SAFE			
	Pre-CSPP Waves 13 & 14	**Post-CSPP Waves 15 & 16**	**Difference**
Credit Constrained	0.112	0.099	−0.013**
Willingness to Lend	0.212	0.219	0.007
Outlook Improved	0.343	0.352	0.009
Outlook Deteriorated	0.174	0.151	−0.023***
Capital Improved	0.314	0.323	0.009
Capital Deteriorated	0.099	0.079	−0.020***
Credit History Improved	0.296	0.311	0.015**
Credit History Deteriorated	0.081	0.066	−0.015***
Log Employment	3.682	3.678	−0.004
Firm Age 5y–10y	0.106	0.097	−0.009**
Firm Age < 5y	0.047	0.041	−0.006**
B. Macro Data			
	Pre-CSPP	**Post-CSPP**	**Difference**
Net Bond Issuance/GDP	0.27	0.51	0.24
Bank Bond Purchase/ GDP	−0.02	−0.01	0.01
CSPP/GDP	0.00	0.66	0.66***
PSPP/GDP	6.33	7.52	1.19**
MRO/GDP	−0.80	−0.37	0.43
TLTRO/GDP	0.28	2.63	2.35**
Expected GDP Growth	1.91	1.77	−0.140
Expected Inflation	0.84	1.25	0.410***

Note: Panel A shows survey-weighted averages. CSPP purchase flows, net corporate bond issuance, PSPP, MROs, and LTROs net flows are all expressed in percent of GDP. Waves 13 and 14 cover the one-year period before the CSPP announcement, April 15–March 16. Waves 15 and 16 cover the one-year period after the CSPP announcement, April 16–March 17. *p < 10%, **p < 5%, ***p < 1%.

2.2 Data for Purchase-Flow-Based Method

Panel A in Table 2 reports descriptive statistics on the sample that we work with to implement the purchase-flow-based methodology. A survey wave covering the 12 larger euro-area economies has information on about 11,000 firms. We require firms to participate in at least

one survey wave before and one after the announcement of CSPP, which allows us to control for firm fixed effects. Given the research question, we drop those large firms that consider debt securities a relevant financial instrument. This leaves us with a sample of 13,945 firm-wave observations covering 6,150 firms.[12]

In addition to the firm-level data from the SAFE, we also assemble country-level data on monetary policy action, bond markets, and the cyclical position of euro-area economies. The restricted-access data set on countries' CSPP flows, PSPP flows net of reinvestments, TLTROs net of all other long-term refinancing operations, and the flows of main refinancing operations are all provided by the ECB. Data on bonds flows, defined as corporate bond issuance net of redeemed bond volume at maturity, are also provided by the ECB. Data on banks' balance sheets come from the European Banking Authority. Finally, one-year-ahead professional forecasts of GDP growth and inflation are provided by Consensus Economics.[13]

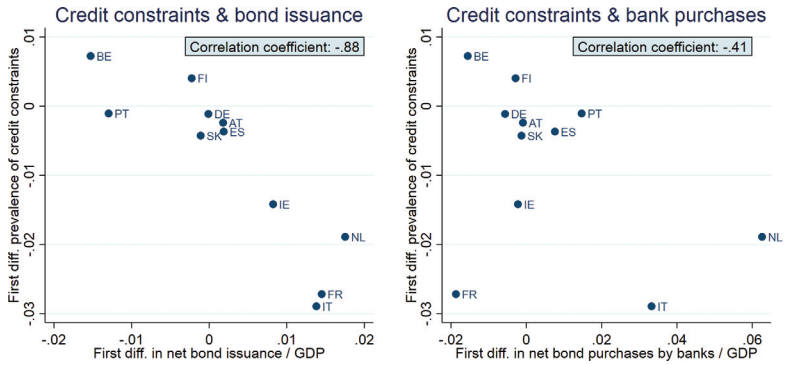
The country disaggregation of CSPP flows is compiled on the basis of the country of risk, where the main activity is conducted, and not on the basis of the ultimate parent. The ultimate parent might be domiciled in financial centers, while subsidiaries conduct their main economic activity in other countries. Panel B of Table 2 provides the summary statistics of the macro variables used in the econometric analysis.

Ceteris paribus, we might expect a greater share of firms reporting an improvement in credit access in countries where corporate bond issuance has increased strongly following the announcement of the CSPP. Firms domiciled in the Netherlands, France, Italy,

[12]The analysis does not include firms from Greece, as at the time the situation in Greece was in many ways not representative of the European experience.

[13]It is important to stress that Consensus Economics asks the professional forecasters their year-on-year forecast at the end of the current year and at the end of the following year. Following Dovern, Fritsche, and Slacalek (2012), by simple interpolation we construct the Consensus Economics forecast one year ahead using the following formula to construct the weight: $[(1 + 1/12) - w/12]$, where w is the number of months required to reach the end of the year. For example, if the Consensus forecast is collected in January, then $w = 12$ and the weight is 0.083333. In other words, the estimated Consensus forecast one year ahead is equal to the year-on-year December forecast for the current year multiplied by 0.916667 plus the year-on-year December forecast for the subsequent year multiplied by 0.083333.

Figure 3. Change in Credit Supply and Net Bond Issuance by Non-financial Corporations, and Net Purchases of Corporate Bonds by Banks



Note: The first difference is computed as one-year after minus one-year before the CSPP announcement.

Ireland, and to a smaller extent Spain, Austria, and Germany have issued more bonds than those redeemed over the one-year period after the CSPP announcement relative to the previous year. This is what is observed on the left-hand-side plot of Figure 3, which shows a tight negative correlation between the first difference in net bond issuance over GDP and the first difference in the change of credit constraints.[14]

Likewise, we might expect the prevalence of credit constraints to decline to a greater extent in countries where banks reduce their holdings of non-financial corporate bonds following the announcement of CSPP. This does not seem the case given that the cross-country correlation is even negative, driven by banks in Italy and the Netherlands, which increased the holding of non-financial corporate bonds, as Figure 3 (right-hand-side plot) shows.[15]

[14]CSPP purchases and net bond issuance (gross bond issuance minus the redeemed bonds) are flow measures. Therefore, we scale both variables by GDP. We use the contemporaneous relationship vis-à-vis GDP, because the impact of the CSPP on economic performance is not contemporaneous. We also scale by GDP available in the previous period and the results remain invariant.

[15]Through other instruments, such as the LTROs, banks might have had sufficient liquidity to carry out both activities, purchasing corporate bonds and increasing lending to bank-dependent borrowers.

2.3 Data for Firm-Bank Linkage-Based Method

To construct the firm-bank linkages, we proceed in three stages. First, we identify the source of the loan demand shock; that is, we identify the corporations eligible for CSPP, whose bonds were purchased by the ECB. Second, we account for banks' activity in the syndicated loan market. Third, we link the SAFE respondents to their lenders. Information on CSPP-eligible bonds comes from a restricted-access ECB database.[16] This yields 922 bond ISINs that were CSPP eligible at end-March 2017. We obtain the identifiers and names of the underlying firms through Bloomberg and Dealogic DCM, generating 260 CSPP-eligible firms. In particular, 76 firms are matched with Loan Analytics databases through the Bloomberg-specific or Dealogic DCM-specific firm identifier; 92 firms are matched with Loan Analytics databases manually through the name of the firms; and 43 firms are matched with Loan Analytics databases manually adding company parents of those special-purpose financing vehicles, which do not have a match in the Loan Analytics database (e.g., for Bayer Finance SA, we take Bayer AG). Thus, 211 out of 260 CSPP-eligible firms, corresponding to 81 percent of the universe, could be identified.

In the second step, we identify the activity of CSPP-eligible firms in the syndicated loan market. In total, we obtain data on 2,948 syndicated loans on Dealogic DCM between April 2015 and March 2017. Among these, the borrowers were CSPP eligible in 137 cases. This appears small at first glance, but loans of CSPP-eligible borrowers are on average larger than those of CSPP-ineligible firms. The total loan volume of CSPP-eligible firms accounted for USD 195 billion in the year preceding the announcement of the CSPP, compared with USD 459 billion for CSPP-ineligible firms. Importantly, total syndicated loan activity of CSPP-eligible firms declined following the introduction of the CSPP to USD 128 billion. In contrast, the volume of loans associated with CSPP-ineligible firms increased slightly

[16]The ECB published the first list of bonds held in its portfolio only on June 23, 2017, after the end of our sample period. The public available information is not informative about when the bond purchase was carried in the sample we used.

to USD 483 billion.[17] For each syndicated loan, we know the overall volume and the identity of the banks participating. This information allows constructing measures of bank activity in the syndicated loan market as well as matching this information to the banks of SAFE respondents.

To link the SAFE respondents to their lenders, we exploit the results of a matching exercise between the SAFE and Bureau van Dijk's Amadeus data set. The matching exercise was performed by Bureau van Dijk. The bank information recorded in Amadeus is time invariant and reflects the information available at the time of the match. Unfortunately, bank data are available only for a subset of the firms in the SAFE. This reflects mainly two reasons. First, Bureau van Dijk could not match all SAFE respondents to Amadeus. This applies to about 40 percent of observations. Second, even if a match is found, information on the bank may not be available in Amadeus. As a result, the number of available firm-wave observations drops from 40,646 to 13,311. In particular, we do not have bank information for firms located in Belgium, Finland, Italy, and Slovakia.[18] The exercise is concluded by matching the bank names recorded in Amadeus to the bank names in the syndicated loan data set.

Table 3 provides summary statistics for the matched bank-firm sample in comparison to the full sample. As expected, the firms in the matched subsample are on average larger, older, and therefore less likely to be credit constrained. Despite their statistical significance, most differences are at the second digit; hence, the matched bank-firm sample appears to preserve the representativeness of the SAFE.

Based on the data set, we construct two additional variables of interest. The first measures whether the bank experiences a negative demand shock in the syndicated loan market. It is an indicator equal to 1 if banks' activity with CSPP-eligible syndicated

[17]The volume of syndicated loans (654 billion) the year preceding the CSPP, which we use to construct the firm-bank linkages, represents 21.4 percent of the stock of bank loans and 16 times the flow of bank loans to NFCs in the euro area over the same period.

[18]At the end of 2015, the countries for which we have data cover 71.6 percent of the bank loans vis-à-vis euro-area NFCs on aggregate.

Table 3. Summary Statistics

A. Firm Data			
	SAFE	**Bank-Firm Sample**	**Difference**
Credit Constrained	0.106	0.084	-0.022^{***}
Willingness to Lend	0.216	0.283	0.067^{***}
Outlook Improved	0.348	0.374	0.026^{***}
Outlook Deteriorated	0.163	0.161	-0.002
Capital Improved	0.318	0.347	0.029^{***}
Capital Deteriorated	0.089	0.074	-0.015^{***}
Credit History Improved	0.303	0.331	0.028^{***}
Credit History Deteriorated	0.074	0.066	-0.008^{***}
Small Firm	0.215	0.228	0.013^{***}
Medium Firm	0.172	0.214	0.042^{***}
Large Firm	0.293	0.375	0.082^{***}
Firm Age 5y–10y	0.101	0.070	-0.031^{***}
Firm Age < 5y	0.044	0.020	-0.024^{***}
No. Observations (N)	40,646	13,311	
B. Bank Data			
Δ Eligible Deals	0.718		
Relative Exposure	0.03		
G-SIB	0.309		
Savings Bank	0.203		
Cooperative	0.217		
Foreign Subsidiary	0.085		

Note: Panel A shows survey-weighted averages (see notes in Table 2). The bank-firm sample refers to the subset of the SAFE with information on a firm's bank available in Amadeus. *p < 10%, **p < 5%, ***p < 1%.

loan counterparts declines following CSPP. For instance, the number of syndicated loans with CSPP-eligible borrowers that Spanish bank Santander engaged in declined from 35 in the year prior to the announcement of the CSPP to 24 after. The 35 syndicated loans prior to the CSPP had a total volume of USD 141 billion, compared with USD 90 billion following the introduction of CSPP. The idea is that the decline in activity can be attributed to the CSPP.

The second approach measures a bank's susceptibility to a demand shock. It is an indicator equal to 1 if prior to the CSPP the bank had relatively greater exposure to CSPP-eligible than to

CSPP-ineligible syndicated loan counterparts. We only know the overall volume of a syndicated loan and the identity of the banks participating in the syndicate, not the individual bank's share. Therefore, we proxy a bank's activity by comparing its percentile rank in the distribution of loans to CSPP-eligible borrowers to that of CSPP-ineligible borrowers. Working with the percentile rank accounts for two issues: one resulting from the different number of syndicated deals vis-à-vis CSPP-eligible and non-eligible borrowers, and the other related to bank size and, correspondingly, the total number of syndicated loans they participate in.

Finally, several variables control for features of the bank or the firm-bank relationship. In particular, we construct indicators equal to 1 if the bank is classified as a global systemically important bank (G-SIB), a savings bank, or a cooperative. We also account for cross-border firm-bank relationships by constructing an indicator equal to 1 if the firm is located in a country that differs from the headquarter of the bank.

3. Empirical Strategy

This section introduces the methodologies that we use. The first methodology, based on purchase flows, has broader country coverage and exploits the full sample of the SAFE, but is more vulnerable to confounding factors. The second methodology, using firm-bank linkages, provides cleaner identification but for a smaller sample of firms.

3.1 Purchase Flows

Identifying the effect of the CSPP requires tackling two challenges. First, it is necessary to separate loan supply from demand (Khwaja and Mian 2008; Jakovljevic, Hans, and Ongena 2020). Second, the methodology needs to isolate the effects of the CSPP from potential confounding factors. Fortunately, the SAFE puts us in a good position to deal with the first issue. To measure loan supply, we use the change in the credit-constrained indicator. Additionally, we use firm and time fixed effects as well as other regressors to control for other determinants of loan supply.

To organize the discussion on potential confounding factors, it is convenient to first introduce the regression equation, which considers the link between credit supply to bank-dependent firms and CSPP purchases:

$$y_{f,L,t} = \beta_1 QE_{L,t} + \beta_2 X_{L,t} + \beta_3 Z_{f,L,t} + \eta_t + \delta_f + u_{f,L,t}, \quad (1)$$

where $y_{f,L,t}$ is the change in banks' loan supply reported by firm f domiciled in country L at time t; $QE_{L,t}$ is the variable of interest associated with the CSPP program for each country L; $X_{L,t}$ is a vector of time-varying macro factors at the country level; $Z_{f,L,t}$ is a vector of time-varying firm-level control variables; η_t is a time fixed effect which corresponds to each survey wave; δ_f is a firm fixed effect; and $u_{f,L,t}$ is an error term that allows for clustering at the country level.

In order to capture the effects of CSPP, we estimate two specifications. In the reduced-form regression, $QE_{L,t}$ is given by the CSPP flows scaled by GDP at the country level. In the instrumental-variables (IV) regression, $QE_{L,t}$ represents either NFCs' net issuance of corporate bonds (gross issuance minus redeemed bonds) or banks' net corporate bond purchases both scaled by GDP at the country level and instrumented by the CSPP flows/GDP ratio. The coefficient of interest is therefore β_1. In the reduced form, it captures how the change in loan supply to bank-dependent businesses varies in response to ECB corporate bond purchases. In the IV regression, it identifies the CSPP-induced mechanism by measuring how the change in lending activity varies in response to an increase either in net corporate bond issuance by NFCs or in net sales of non-financial corporate bonds by banks.

Reverse causality from loan supply to ECB's corporate bond purchases is not a question because of the intrinsic nature of the commitment in the conduct of the ECB monetary policy decisions. First, ECB purchases of corporate bonds contribute to the APP's total monthly purchase volume, and this is predetermined on a monthly basis. Second, the time variation recorded in CSPP purchase flows aims uniquely at minimizing any impact that could be detrimental to the functioning of the corporate bond market. The monthly flow is fluctuating in line with the monthly liquidity of the corporate bond market to avoid market malfunctioning (i.e., liquidity-driven

mispricing). Particularly, during July and August, CSPP activity is smaller, because the number of trades in both the primary and secondary markets is heavily reduced (De Santis et al. 2018). All in all, the scheduled monthly purchases under the CSPP do not depend on banks' lending activity to businesses.

While the firm-specific fixed effects absorb the time-invariant heterogeneity in firms' loan demand, the estimates may potentially be contaminated by time-varying omitted variables, both at the country level and at the level of the firm. We address both issues in turn. We cannot rule out that cyclical developments drive credit constraints and firms' perceptions of banks' willingness to lend. To alleviate these concerns, all specifications include (i) one-year-ahead forecasts of both countries' GDP growth and inflation used to capture the cyclical position of euro-area economies, $X_{L,t}$, and (ii) time fixed effects to control for global shocks that are common to all firms, η_t.

At the firm level, credit supply depends on the firm's creditworthiness. Therefore, the vector of firm-specific variables $Z_{f,L,t}$ includes measures of the firm-specific outlook, capital position, and credit history. These three variables enter the regressions as binary variables that indicate an improvement or a deterioration, as the loan supply may respond differently to an improvement or a deterioration of the respective variable. To further account for firm heterogeneity, all specifications include time-varying measures of firm size (log of employment) and age.

3.2 Firm-Bank Linkages

The second approach employs a difference-in-differences setting to test for CSPP spillovers to bank-dependent firms. The idea is that firms that borrow from a bank that experiences lower demand for syndicated loans following the introduction of the CSPP should be more likely to report an improvement in credit supply. In contrast to the first methodology, this approach exploits within-country variation. Given that SMEs typically have a relationship with one bank, we adopt the ILST (industry-location-size-time) fixed-effects strategy suggested by Degryse et al. (2019). Specifically, firm size is divided into four different bins: micro (less than 9 employees), small (between 10 and 49 employees), medium (between 50 and 249 employees), and large (more than 50 employees). Therefore, firms are

clustered into industry-location-size bins, reflecting the assumption that firms in the same bin exhibit the same loan demand.

In particular, we estimate a second equation of the following form:

$$y_{f,b,t} = \beta_1 I_t + \beta_2 D_b + \beta_3 I_t * D_b + \beta_4 Z_{f,b,t} + \beta_4 B_B + \delta_{I,L,S,t} + u_{f,b,t}, \quad (2)$$

where $y_{f,b,t}$ is the change in loan supply reported by firm f borrowing from bank b at time t; I_t is an indicator equal to 1 if the CSPP is implemented, i.e., for SAFE waves 15 and 16; D_b measures banks' activity with CSPP-eligible firms in the syndicated loan market; $\delta_{I,L,S,t}$ are the ILST fixed effects; and B_B are dummies controlling for the type of bank, $b \in B$. At the level of the firm, $Z_{f,b,t}$ is a vector of regressors controlling for age, changes in the firms' capital position, credit history and outlook, and a dummy capturing the cross-border firm-bank relationships.[19]

We use two different measures of activity in the syndicated loan market. In the first specification, it is given by an indicator equal to 1 if banks' activity with CSPP-eligible syndicated loan counterparts declines following the CSPP. We argue that this decline in activity reflects lower demand for loans induced by the implementation of the CSPP. The second specification makes a weaker assumption. It identifies banks with the potential of a negative demand shock, and exploits only information available prior to the CSPP. To implement it, we use the relative exposure indicator. This indicator equals 1 if the bank exhibits a higher percentile rank in the distribution of CSPP-eligible borrowers than in the distribution of CSPP-ineligible borrowers.

The coefficient of interest is given by β_3, the coefficient on the interaction term between the CSPP indicator and syndicated loan market activity. If the CSPP increases the loan supply to bank-dependent firms, the interaction term should be negative, as fewer firms would be credit constrained.

[19]Matching SAFE respondents to their banks leads to a significant loss in the number of observations. As the SAFE is a rotating panel, only a subset of the respondents to a given wave will be interviewed also in the following wave. Imposing firm fixed effects would lead to additional, significant attrition of the sample.

It could be argued that the CSPP indicator might pick up the effects of the other unconventional policies of the March 2016 package. Specifically, it may well be that PSPP also stimulates bond issuance by lowering the cost of long-term finance. However, it is unlikely that PSPP weakens the demand for syndicated loans, because the flattening of the yield curve through the PSPP should have stimulated the demand for syndicated loans. Though using Model (2), we cannot econometrically control for the PSPP expansion, we test this argument in the context of the original announcement of PSPP in January 2015. A similar argument applies to the TLTROs. The attractive conditions attached to TLTRO funding should have stimulated the extension of credit. It is difficult to see how the TLTROs can account for weaker demand for syndicated loans from large corporations. We test this line of reasoning in the context of the TLTRO-I announced in June 2014 and implemented in September.

4. Purchase Flows and Loan Supply

Section 4.1 provides evidence on the CSPP purchase flows and the CSPP-induced loan supply effect. Section 4.2 discusses the potential mechanism, and 4.3 examines the robustness of the cross-country approach.

4.1 CSPP-Induced Loan Supply Effect

Econometric evidence of the shift in loan supply owing to the CSPP using Model (1) is presented in column 1 of Table 4, where the dependent variable is given by an indicator equal to 1 if the firm reports to be credit constrained. The explanatory variable of interest is the Eurosystem's corporate bond purchases, scaled by GDP. The sample consists of SMEs and large firms that do not consider debt securities a relevant source of finance.

The testable hypothesis is the following: everything else equal, the larger the Eurosystem's corporate bond purchase volumes in a country relative to its size, the stronger the decrease in the prevalence of credit constraints among firms of that country that do not have access to the corporate bond market. As the credit-constrained

Table 4. ECB March 2016 Package and Credit Constraints: OLS Regression

	CSPP (1)	MRO (2)	TLTRO (3)	PSPP (4)
CSPP/GDP(c,t)	−0.016***			
	(−3.51)			
MRO/GDP(c,t)		0.003		
		(1.20)		
TLTRO/GDP(c,t)			−0.002*	
			(−2.01)	
PSPP/GDP(c,t)				−0.004
				(−1.33)
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes
N	9,711	9,711	9,711	9,711

Note: This table shows the key estimated coefficients using Equation (1), $y_{f,L,t} = \beta_1 QE_{L,t} + \beta_2 X_{L,t} + \beta_3 Z_{f,l,t} + \eta_t + \delta_f + u_{f,L,t}$, where $y_{f,L,t}$ is the change in banks' credit constraints reported by SMEs and large firms f that do not consider debt securities relevant, domiciled in country L at time t; $QE_{L,t}$ is the variable of interest associated with the CSPP for each country L; $X_{L,t}$ is a vector of time-varying macro factors at the country level; $Z_{f,l,t}$ is a vector of time-varying firm-level control variables; η_t is a time fixed effect which corresponds to each survey wave; δ_f is a firm fixed effect; and $u_{f,L,t}$ is an error term. T-statistics are in parentheses. *p < 10%, **p < 5%, ***p < 1%. Sample period: April 2015–March 2017.

indicator is equal to 1 if the firm is credit constrained, a negative coefficient indicates an improvement in loan supply.

The coefficient is negative and highly significant at conventional levels with a t-statistic equal to –3.51. Therefore, the evidence is consistent with the notion that the Eurosystem's bond purchases have benefited bank-dependent firms. An increase in CSPP flows by 1 percent of GDP is associated with a decrease in the share of credit-constrained firms of 1.6 percentage points, which is equal to about 15 percent of the sample mean.

The shift in loan supply appears to be induced mainly by CSPP. In a similar exercise, we replace the CSPP purchase flows with MRO, TLTRO, and PSPP purchase flows. The remaining columns of Table 4 present the results. The estimated coefficients are not statistically significant, except for the TLTRO coefficient at 10 percent.

The relationship between these instruments and corporate bond issuance is further investigated in the next subsection.

4.2 Mechanisms

In principle, two different mechanisms can account for the increase in credit supply to bank-dependent firms. On the one hand, large corporations can issue bonds more easily with a new important actor in both the primary and the secondary markets. The Eurosystem's aggregate demand for euro-denominated corporate bonds allows corporations to finance their business by substituting bank loans with issuance of relatively cheaper corporate bonds. In turn, banks can use the funds previously assigned to large corporations to supply loans and finance the activity of firms that do not have access to the corporate bond market (i.e., substitution effect). On the other hand, ECB activity in secondary markets may prompt banks to sell some of the non-financial corporate bonds they hold on their balance sheets, thereby generating balance sheet capacity.

The evidence suggests that reduced loan demand from companies active in the bond markets accounts for the spillovers to bank-dependent firms. Empirically, in column 1 of Table 5, we instrument net issuance of corporate bonds issued by NFCs with the country breakdown of the CSPP flows. In column 2, CSPP flows are used to instrument banks' net purchases of non-financial corporate bonds. Table 5 presents second-stage IV estimates followed by the coefficient of interest from the first stage. The results are clear: net issuance activity by NFCs is negatively associated with the credit-constrained indicator. The first-stage regression coefficient is equal to 0.696 with a t-statistic of 3.28. The Kleibergen-Paap rk Wald statistic (Kleibergen and Paap 2006) is above 10, ranging between the 10 percent and the 15 percent maximal Wald-test size distortion provided by Stock and Yogo (2005). On the other hand, the evidence does not support the conclusion that the CSPP induced banks to sell their corporate bonds to the ECB. The coefficient from the second stage has the incorrect sign, and the specification in column 2 is underidentified.

The other policy measures of the March 2016 package do not convincingly account for the observed increase in net corporate bond issuance. Table 5 presents IV estimates, where NFC's net corporate bond issuance is instrumented with MRO, TLTRO, and PSPP flows.

Table 5. Channels of the ECB March 2016 Package Spillover Effect: IV Regression

	CSPP (1)	CSPP (2)	MRO (3)	TLTRO (4)	PSPP (5)
	Second-Stage Regression				
Issuance/GDP(c,t)	−0.024**		−0.014	−0.038	−0.013
	(−2.00)		(−0.91)	(−0.70)	(−1.33)
Bank Purchase/ GDP(c,t)		−1.268*			
		(−1.93)			
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes	Yes
N	7,747	7,747	7,747	7,747	7,747
	First-Stage Regression				
CSPP/GDP(c,t)	0.696***	0.013			
	(3.28)	(1.25)			
MRO/GDP(c,t)			−0.235		
			(−1.39)		
TLTRO/GDP(c,t)				0.058	
				(0.61)	
PSPP/GDP(c,t)					0.288***
					(2.82)
K-P Stat	10.739	1.569	1.945	0.369	7.928
S-Y 10% Critical Values	16.38	16.38	16.38	16.38	16.38
S-Y 15% Critical Values	8.96	8.96	8.96	8.96	8.96

Note: This table shows the key estimated coefficients using Equation (1). The dependent variable is the change in banks' credit constraints reported by SMEs and large firms f that do not consider debt securities relevant (see notes of Table 4). Coefficients of interest from second- and first-stage IV regressions. All country- and firm-specific control variables are included. All specifications include firm-specific and time fixed effects. The first-stage regression shows only the coefficients of the excluded instruments. "K-P Stat" denotes the Kleibergen-Paap rk Wald statistic. "S-Y 10% and 15% Critical Values" correspond to Stock-Yogo critical values for 10 percent and 15 percent maximal Wald-test size distortion. T-statistics are in parentheses. *p < 10%, **p < 5%, ***p < 1%. Sample period: April 2015–March 2017.

Coefficients in the second stage are all statistically insignificant, and neither MRO nor TLTRO flows are partially correlated with NFCs' net corporate bond issuance. The case of PSPP is slightly different. In the IV regression, the PSPP flows become statistically significant,

but the Kleibergen-Paap rk Wald statistic is around 7–8, suggesting that PSPP flows are a comparatively weaker instrument for net corporate bond issuance.

All in all, the complementary unconventional monetary policies and liquidity operations by the ECB cannot account for the observed changes in the cross-country distribution of credit constraints in the time window examined. Let us emphasize that this first approach based on flows might not be relevant for TLTROs, because banks could obtain long-term liquidity from operations preceding the estimation window.

4.3 Robustness of the Cross-Country Approach

Table 6 provides a set of robustness checks. Columns 1 and 2 replicate the specifications in column 1 of Tables 4 and 5, respectively, including the firms that are interviewed only once. We can no longer use firm fixed effects to control for unobserved time-invariant heterogeneity across firms. Instead, we are using industry-location-size (ILS) fixed effects. The coefficients are statistically significant but weaker. Columns 3 and 4 use the change in willingness to lend as the endogenous variable proxying for loan supply, and the coefficients are positive and strongly statistically significant, corroborating the CSPP-induced credit supply shift in favor of bank-dependent firms. The coefficient of the OLS regressions is 0.024, which is equal to about 10 percent of the sample mean. The first-stage regression coefficient is equal to 0.658 with a t-statistic of 3.42. The Kleibergen-Paap rk Wald statistic is above 10, ranging between the 10 percent and the 15 percent maximal Wald-test size distortion.

5. CSPP-Induced Substitution Effect in Bank Loans

Section 5.1 provides direct evidence on the loan supply to bank-dependent firms resulting from the CSPP exploiting the firm-bank linkages. Section 5.2 presents placebo tests and additional robustness checks.

Table 6. Robustness

	Credit Constraints		Willingness-to-Lend	
	OLS (1)	**IV (2)**	**OLS (3)**	**IV (4)**
CSPP/GDP(c,t)	−0.007*		0.024***	
	(−3.14)		(5.41)	
Issuance/GDP(c,t)		−0.011*		0.037***
		(−2.17)		(3.79)
ILS FE	Yes	Yes	—	—
Firm FE	—	—	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes
N	18,950	18,950	13,945	12,656
	First-Stage Regression			
CSPP/GDP(c,t)		0.627***		0.658***
		(3.30)		(3.42)
K-Y Stat		10.950		10.739
S-Y 10% Critical Values	16.38	16.38	16.38	16.38
S-Y 15% Critical Values	8.96	8.96	8.96	8.96

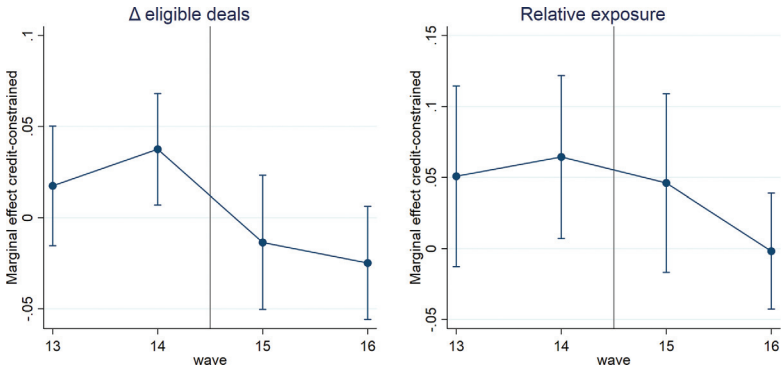
Note: This table shows the key estimated coefficients using Equation (1). The dependent variable is the change in banks' credit constraints reported by SMEs and large firms f that do not consider debt securities relevant (see notes of Table 4). Specifications in columns 1 and 2 include ILS (industry-location-size) fixed effects and time fixed effects. Columns 3 and 4 have firm-specific and time fixed effects. The first-stage regression shows only the coefficients of the excluded instruments. "K-P Stat" denotes the Kleibergen-Paap rk Wald statistic. "S-Y 10% and 15% Critical Values" correspond to Stock-Yogo critical values for 10 percent and 15 percent maximal Wald-test size distortion. T-statistics are in parentheses. *p < 10%, **p < 5%, ***p < 1%. Sample period: April 2015–March 2017.

5.1 Firm–Bank Linkages and Spillover Effects

The evidence in Tables 4–6 suggests that reduced loan demand from corporates accounts for the loan supply shift towards bank-dependent firms. In this section, we go one step further and explicitly test this causal chain in a difference-in-differences setting. Identification comes from within-country variation in banks' exposure to CSPP-eligible corporates.

Figure 4 provides visual evidence on the parallel trend assumption. The plots show marginal effects from a variant of Equation (2),

Figure 4. Visual Evidence on the Parallel Trend Assumption



Note: The figure shows the marginal effects (β_{3a}, β_{3b}, β_{3c}, and β_{3d}) and the 90 percent confidence intervals from a variant of Equation (2) where the treatment is interacted with the indicator for each survey wave: $y_{f,b,t} = \beta_{1a}W13 + \beta_{1b}W14 + \beta_{1c}W15 + \beta_{1d}W16 + \beta_2 D_b + \beta_{3a}W13 * D_b + \beta_{3b}W14 * D_b + \beta_{3c}W15 * D_b + \beta_{3d}W16 * D_b + \beta_4 Z_{f,b,t} + \beta_4 B_B + \delta_{I,L,S} + u_{f,b,t}$, where $y_{f,b,t}$ is the change in banks' credit constraints reported by SMEs and large firms f that do not consider debt securities relevant, borrowing from bank b at time t; $W13$, $W14$, $W15$, and $W16$ are the four SAFE waves; D_b measures banks' activity with CSPP-eligible firms in the syndicated loan market; $\delta_{I,L,S}$ are the ILS fixed effects; B_B are dummies controlling for the type of bank, $b \in B$; and $u_{f,b,t}$ is an error term. Δ *eligible deals* is an indicator equal to 1 if the number of syndicated loan deals with CSPP-eligible borrowers declines with the implementation of CSPP. *Relative exposure* is an indicator equal to 1 if a bank ranks higher in the distribution of loans to CSPP-eligible than to CSPP-ineligible borrowers in the syndicated loan market.

where the treatment is interacted with indicators for each wave. Therefore, the estimated marginal effects are allowed to differ for each survey wave. The chart on the left-hand side shows results for our first explanatory variable, Δ *eligible deals*. Δ *eligible deals* is an indicator equal to 1 if banks' activity with CSPP-eligible syndicated loan counterparts declines following the CSPP. The plot on the right-hand side deals with *relative exposure*, our second explanatory variable. This is an indicator equal to 1 if prior to the CSPP the bank has relatively greater exposure to CSPP-eligible than to CSPP-ineligible syndicated loan counterparts.

The parallel trend assumption appears to be met. The chart in the first column indicates that prior to CSPP, firms that borrowed

from banks that eventually decrease their activity in the syndicated loan market report on average marginally worse access to credit. Crucially though, there is no evidence for a shock in credit supply in either wave 13 or wave 14 of the survey. The improvement in access to credit coincides with the announcement of CSPP. The same applies to the relative exposure indicator, though access to credit improves with wave 16.

Columns 1 and 2 of Table 7 present the key results. The dependent variables are paired with our two measures of banks' activity with CSPP-eligible borrowers in the syndicated loan market. Intuitively, the higher the exposure of banks to CSPP-eligible firms, the higher the substitution effect after the launch of CSPP and the higher the loan supply to bank-dependent firms. Of interest are therefore the interactions with a CSPP indicator that is equal to 1 during SAFE waves 15 and 16. The coefficient on the interaction term has the expected negative sign for both indicators. The results are therefore in line with the findings shown in Tables 4 and 5, despite the differences in methodology. The results are also corroborated if firms are clustered into sector-location-credit history bins, rather than sector-location-size bins (see columns 3 and 4 of Table 7).

The shift in loan supply to bank-dependent firms appears largely unrelated to bank balance sheet strength. Grosse-Rueschkamp, Steffen, and Streitz (2019) find that firms in the syndicated loan market are more likely to obtain a loan from weakly capitalized banks and banks with a high share of NPLs. We run an analogous regression that includes a triple interaction between the CSPP indicator, bank activity with CSPP-eligible borrowers in the syndicated loan market, and bank capital. Bank capital is measured by an indicator equal to 1 if the bank's tier 1 ratio exceeds the country-specific median in December 2015. As columns 1 and 2 in panel A of Table 8 show, the interaction is not significant in any of the specifications. Adding the additional variables slightly reduces the precision of the other estimates but does not change the overall pattern. Columns 3 and 4 in panel A of Table 8 present the corresponding results for asset quality. Here the explanatory variable of interest is an indicator equal to 1 if the bank's NPL ratio exceeds the country median. Again, we obtain insignificant coefficients on the triple interaction. Bank liquidity likewise does not appear to modulate the shift in loan supply. In panel

Table 7. CSPP and Firm-Bank Linkages: Baseline Results

	Δ Eligible Deals (1)	Relative Exposure (2)	Δ Eligible Deals (3)	Relative Exposure (4)
CSPP Indicator	−0.015	−0.044	0.018	0.018
	(−0.44)	(−1.18)	(0.43)	(0.40)
Δ Eligible Deals	0.025		0.028*	
	(1.41)		(1.66)	
CSPP Ind. × Δ Eligible Deals	−0.046**		−0.045**	
	(−2.35)		(−2.34)	
Relative Exposure		0.070**		0.068**
		(2.14)		(2.08)
CSPP Ind. × Relative Exposure		−0.063*		−0.062*
		(−1.91)		(−1.80)
G-SIB	0.031**	0.031**	0.032**	0.031**
	(2.10)	(2.06)	(2.10)	(2.05)
Savings Bank	0.019	0.020	0.022	0.023
	(1.18)	(1.37)	(1.44)	(1.59)
Cooperative	0.019	0.014	0.016	0.011
	(1.32)	(0.97)	(1.15)	(0.78)
Foreign Subsidiary	−0.011	−0.016	−0.018	−0.020
	(−0.56)	(−0.84)	(−0.89)	(−1.06)
ILST FE	Yes	Yes	—	—
ILCT FE	—	—	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes
N	6,094	6,094	6,015	6,015

Note: This table shows the key estimated coefficients using Equation (2), $y_{f,b,t} = \beta_1 I_t + \beta_2 D_b + \beta_3 I_t * D_b + \beta_4 Z_{f,b,t} + \beta_4 B_B + \delta_{I,L,S,t} + u_{f,b,t}$, where $y_{f,b,t}$ is the change in banks' credit constraints reported by SMEs and large firms f that do not consider debt securities relevant, borrowing from bank b at time t; I_t is an indicator equal to 1 if the CSPP is implemented, i.e., for SAFE waves 15 and 16; D_b measures banks' activity with CSPP-eligible firms in the syndicated loan market; $\delta_{I,L,S,t}$ are the ILST fixed effects; B_B are dummies controlling for the type of bank, $b \in B$; and $u_{f,b,t}$ is an error term. "Δ Eligible Deals" is an indicator equal to 1 if the number of syndicated loan deals with CSPP-eligible borrowers declines with the implementation of the CSPP. "Relative Exposure" is an indicator equal to 1 if a bank ranks higher in the distribution of loans to CSPP-eligible borrowers than to CSPP-ineligible borrowers. The specifications in columns 1 and 2 include ILST (industry-location-size-time) fixed effects. The specifications in columns 3 and 4 include ILCT (industry-location-credit history-time) fixed effects. T-statistics are in parentheses. *p < 10%, **p < 5%, ***p < 1%. Sample period: April 2015–March 2017.

B, liquidity is an indicator equal to 1 if the bank's loan-to-deposit ratio exceeds the country median. The triple interaction terms are again not significant. This goes contrary to the findings of Ertan,

Table 8. CSPP and Firm-Bank Linkages: Bank Balance Sheet Quality and Risk-Taking

	Capital		Asset Quality	
Panel A	**(1)**	**(2)**	**(3)**	**(4)**
CSPP Ind. × Δ Eligible Deals	−0.047**		−0.041*	
	(−2.28)		(−1.83)	
CSPP Ind. × Δ Eligible Deals × Z	0.007		−0.008	
	(0.38)		(−0.39)	
CSPP Ind. × Relative Exposure		−0.055		−0.044
		(−1.62)		(−1.26)
CSPP Ind. × Relative Exposure × Z		−0.023		−0.060
		(−0.32)		(−1.10)
	Liquidity		**Borrower Risk**	
Panel B	**(1)**	**(2)**	**(3)**	**(4)**
CSPP Ind. × Δ Eligible Deals	−0.050**		−0.079***	
	(−2.27)		(−2.76)	
CSPP Ind. × Δ Eligible Deals × Z	0.013		0.008	
	(0.80)		(1.60)	
CSPP Ind. × Relative Exposure		−0.057		−0.064
		(−1.57)		(−1.12)
CSPP Ind. × Relative Exposure × Z		0.015		0.001
		(0.21)		(0.11)
ILST FE	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes

Note: This table shows the key estimated coefficients using Equation (2) (see notes of Table 7), plus a triple interaction term between the CSPP indicator, the banks' activity with CSPP-eligible firms in the syndicated loan market, and the following characteristics Z in panel B. "Capital" is an indicator equal to 1 if the firm borrows from a bank with a tier 1 ratio above the country median. "Asset Quality" is an indicator equal to 1 if the firm borrows from a bank with an NPL ratio above the country median. "Liquidity" is an indicator equal to 1 if the firm borrows from a bank with the loan-to-deposit ratio above the country median. "Borrower Risk" is given by log employment. T-statistics are in parentheses *p < 10%, **p < 5%, ***p < 1%. Sample period: April 2015–March 2017.

Kleymenova, and Tuijn (2020), who argue that the CSPP benefited mainly less liquid banks.[20] Despite an overall shift in credit supply to bank-dependent firms that are in all likelihood more risky

[20]In unreported specifications we split the sample at the unconditional median of the tier 1 ratio, the NPL, and the liquidity ratio. In all cases, the results remain insignificant.

borrowers, the CSPP has not induced a heterogeneous credit supply shift within the latter group depending upon firm size, a proxy for borrower risk (see columns 3 and 4 in panel B of Table 8). It is worthwhile pointing out that our exercise is not directly comparable to that of Grosse-Rueschkamp, Steffen, and Streitz (2019). In addition to the differences in the sample, our work relies on bank-firm relationships that were in place before the CSPP, whereas their approach allows new bank-firm linkages to emerge.

In our view, these results are best interpreted as the result of a shift in relative risk-adjusted returns and decreasing returns to scale. In particular, the CSPP has driven down the cost of funding for CSPP-eligible issuers. This in turn lowers the risk-adjusted returns for banks attempting to lend to these companies. As loans to SMEs and loans to corporates are substitutes in credit production, more SME loans will be produced if the lending rates to SMEs decline. Decreasing returns to scale explain why banks have not been able to extend loans to these firms before the introduction of the CSPP.

5.2 Placebo Tests and Robustness Checks

Table 9 presents results for a placebo experiment corresponding to the implementation of the TLTRO-I in September 2014 and the announcement of PSPP on January 22, 2015, which was well anticipated by the markets since October 2014. The experiment consists of assessing whether the same negative loan demand shock triggered by CSPP-eligible corporations produces a shift in loan supply vis-à-vis bank-dependent firms in a different period—for example, after the launch of the TLTROs and PSPP. If this would be the case, it would be spurious and, as a consequence, it would challenge the main baseline results. Specifically, we apply Model (2), but we change the reference period for $y_{f,b,t}$ to October 2014–September 2015 (SAFE waves 12–13) versus October 2013–September 2014 (SAFE waves 10–11). The placebo treatment variable is equal to 1 in SAFE waves 12 and 13. The coefficients on the interaction terms are not statistically significant. This is consistent with the view that TLTROs and PSPP are operating through different channels.

Table 9. CSPP and Firm-Bank Linkages: Robustness

	Placebo Treatment		Short Sample Period	
	Δ Eligible Deals (1)	**Relative Exposure (2)**	**Δ Eligible Deals (3)**	**Relative Exposure (4)**
Treatment	0.008	−0.009	0.051***	0.011
	(0.28)	(−0.24)	(2.60)	(0.98)
Δ Eligible Deals	−0.003		0.034	
	(−0.16)		(1.57)	
Treatment × Δ Eligible Deals	0.008		−0.056**	
	(0.32)		(−2.44)	
Relative Exposure		−0.022		0.068*
		(−0.65)		(1.77)
Treatment × Relative Exposure		0.040		−0.029
		(1.01)		(−0.65)
G-SIB	0.008	0.008	0.041**	0.040*
	(0.61)	(0.61)	(1.97)	(1.93)
Savings Bank	0.009	0.009	0.040*	0.040**
	(0.65)	(0.67)	(1.77)	(1.97)
Cooperative	0.008	0.007	0.039*	0.033
	(0.61)	(0.57)	(1.90)	(1.64)
Foreign Subsidiary	−0.003	−0.003	−0.003	−0.006
	(−0.18)	(−0.16)	(−0.12)	(−0.22)
ILST FE	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes
N	6,237	6,237	2,739	2,739

Note: This table shows the key estimated coefficients using Equation (2) (see notes of Table 7). The estimation window in columns 1 and 2 starts in October 2013 and ends in September 2015, corresponding to SAFE waves 10–13. Placebo treatment equals 1 in SAFE waves 12 and 13 (October 2014–September 2015) and covers the implementation of the first TLTRO and the announcement of the PSPP. The estimation window in columns 3 and 4 starts in October 2015 and ends in September 2016, corresponding to SAFE waves 14 and 15. "Δ Eligible Deals" is an indicator equal to 1 if the number of syndicated loan deals with CSPP-eligible borrowers declines with the implementation of CSPP. "Relative Exposure" is an indicator equal to 1 if a bank ranks higher in the distribution of loans to CSPP-eligible borrowers than to CSPP-ineligible borrowers. The firm-specific control variables from Table 4 are included in the regressions. All specifications include survey wave-country-sector-firm size category fixed effects. T-statistics are in parentheses. *p < 10%, **p < 5%, ***p < 1%.

However, we also have to be cautious with these conclusions because, compared with TLTRO-I, TLTRO-II provides rewards, in the form of lower interest rates, for banks that outperform their

benchmarks. The interest rate to be applied is linked to the participating banks' lending patterns. The more loans that participating banks issue to non-financial corporations and households (except loans to households for house purchases), the more attractive the interest rate on their TLTRO-II borrowing becomes. In this context, however, it is important to note that banks that suffered an adverse loan demand shock due to the CSPP face reduced incentives to bid highly in the TLTROs.

An additional robustness check is carried out reducing the number of SAFE waves used for the analysis. Limiting the period of analysis to six months before and six months after the announcement of CSPP reduces the likelihood that the results are driven by confounding factors. At the same time, there is a risk that we underestimate the impact of the monetary policy instrument to the extent that it takes more than six months to materialize. Columns 3 and 4 of Table 9 restrict the analysis to the two closest survey waves, one before and one after the CSPP announcement. The results using Δ *eligible deals* are strongly corroborated, while the coefficient on relative exposure remains negative but is insignificant.

The final set of robustness checks are carried out using the change in willingness to lend as a measure of credit supply. The results summarized in Table 10 confirm the shift in loan supply to bank-dependent firms, which appears largely unrelated to bank balance sheet strength. The coefficient on the interaction terms reported in panel A has the expected positive sign, but just fails to meet conventional standards of significance in column 3. The interaction between CSPP and relative exposure shown in columns 2 and 4, on the other hand, is significant at the 5 percent level. With the exception of the specification with liquidity (column 1 in panel C), the triple interaction terms are again not significant. In column 1, firms borrowing from less liquid banks are less likely to report an improvement in willingness to lend.

All in all, we can safely say that the CSPP increased the net issuance of debt securities by NFCs, triggering a shift in bank loan supply in favor of firms that do not have access to bond-based financing, which is larger for banks relatively more exposed to CSPP-eligible firms.

Table 10. CSPP and Firm-Bank Linkages: Willingness to Lend

	ILST FE		ILCT FE	
Panel A	**(1)**	**(2)**	**(3)**	**(4)**
CSPP Indicator	0.112	0.074	0.195	0.129
	(0.27)	(0.17)	(1.48)	(0.93)
Δ Eligible Deals	−0.043		−0.049*	
	(−1.53)		(−1.78)	
CSPP Ind. × Δ Eligible Deals	0.055*		0.045	
	(1.70)		(1.41)	
Relative Exposure		−0.060		−0.071
		(−1.28)		(−1.55)
CSPP Ind. × Relative Exposure		0.144**		0.152***
		(2.53)		(2.77)
	Capital		**Asset Quality**	
Panel B	**(1)**	**(2)**	**(3)**	**(4)**
CSPP Ind. × Δ Eligible Deals	0.054		0.053	
	(1.60)		(1.45)	
CSPP Ind. × Δ Eligible Deals × Z	−0.002		0.000	
	(−0.07)		(0.01)	
CSPP Ind. × Relative Exposure		0.109*		0.128**
		(1.89)		(2.20)
CSPP Ind. × Relative Exposure × Z		0.129		−0.013
		(1.36)		(−0.15)
	Liquidity		**Borrower Risk**	
Panel C	**(1)**	**(2)**	**(3)**	**(4)**
CSPP Ind. × Δ Eligible Deals	0.077**		0.079*	
	(2.10)		(1.82)	
CSPP Ind. × Δ Eligible Deals × Z	−0.046*		−0.008	
	(−1.70)		(−1.02)	
CSPP Ind. × Relative Exposure		0.146**		0.148
		(2.34)		(1.63)
CSPP Ind. × Relative Exposure × Z		−0.104		−0.009
		(−0.98)		(−0.45)
Other Controls	Yes	Yes	Yes	Yes

Note: The endogenous variable is willingness to lend. This table shows the key estimated coefficients using Equation (2) in panel A (see notes of Table 7) and Equation (2) plus a triple interaction term between the CSPP indicator, the banks' activity with CSPP-eligible firms in the syndicated loan market, and the following characteristics Z in panels B and C. "Capital" is an indicator equal to 1 if the firm borrows from a bank with a tier 1 ratio above the country median. "Asset Quality" is an indicator equal to 1 if the firm borrows from a bank with an NPL ratio above the country median. "Liquidity" is an indicator equal to 1 if the firm borrows from a bank with the loan-to-deposit ratio above the country median. "Borrower Risk" is given by log employment. ILST denotes industry-location-size-time fixed effects. ILCT denotes industry-location-credit history-time fixed effects. T-statistics are in parentheses. *p < 10%, **p < 5%, ***p < 1%. Sample period: April 2015–March 2017.

6. Conclusions

Since the announcement of the CSPP in March 2016, financing conditions for euro-area firms have improved considerably. Corporate bond spreads have tightened and corporate bond issuance has increased, with large corporations certainly benefiting from the policy. The open question is whether financing conditions outside of corporate bond markets have also improved.

We find clear evidence that companies with no access to the corporate bond market have also benefited from the CSPP, because the monetary policy measure has induced a negative loan demand shift, by reducing the corporate bond yields, and has prompted banks to allocate funds to bank-dependent firms. Banks lost market share due to the CSPP. Part of the market share was regained, increasing the volume of loans to SMEs and, as a result, the riskiness of their underlying portfolio.

It could be argued that the effect of the monetary policy is stronger for banks with low tier 1 and high NPL ratios. We do not find a role for bank balance sheet quality. Bank liquidity likewise does not appear to modulate the shift in loan supply due to the CSPP. We also find that the CSPP has not induced a loan supply shift towards more riskier borrowers. The CSPP is not transmitted through the bank lending channel but through a simple substitution effect. This result has important policy implications, because the spillover effect is independent of the quality of banks' balance sheets.

Literature studied extensively the economic impact of unconventional monetary policies through the purchase of government bonds in many economic areas. Understanding central bank purchases of corporate bonds is particularly important now that major central banks have launched new initiatives or stepped up existing commitments to cushion the economic impact of COVID-19. Between March and December 2020, the Eurosystem conducted EUR 53 billion net purchases of corporate-sector bonds under the CSPP and EUR 21 billion under the Pandemic Emergency Purchase Programme (PEPP). The overall additional EUR 74 billion net purchases of corporate-sector bonds is similar to the amounts that were purchased between June 2016 and March 2017 under the CSPP.

Though extrapolating the results to the COVID-19 pandemic is subject to many caveats, applying the elasticities from Table 4 suggests that 2020 purchases of corporate bonds could have led to a decline in the prevalence of credit constraints of 1.6 percentage points.

Little work has so far been carried out to investigate the effectiveness of the CSPP. This paper fills the analytical gap, but additional work on the macroeconomic implications is required. We leave this for future research.

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