

DNB Working Paper

No. 667 / January 2020

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EUROSYSTEEM

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Working Paper No. 667

January 2020

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Corporates' dependence on banks: The impact of ECB corporate sector purchases*

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Abstract

This paper investigates whether ECB corporate sector purchases impact the funding structure of non-financial corporates. Regression models are estimated using a unique microdata panel, combining data on all Eurosystem corporate sector purchases and individual balance sheets of 672 non-financial corporations headquartered in the euro area with access to capital markets. The findings indicate that ECB purchases of corporate bonds reduce the dependence on bank financing of corporates whose debt is purchased. The effects vary according to corporates' interest paid, financial expenses and price-to-book ratio. In addition, this paper shows that the relationship between central bank purchases and corporates' dependence on bank financing is non-linear. The downward effect on bank dependence is largest for those corporates of which most debt is purchased under the CSPP, relative to their total stock of debt.

JEL codes: E44, E58, G10, G21

Key Words: Non-financial corporates, bank dependence, ECB corporate sector purchases, monetary policy

*The views expressed are those of the author and do not necessarily reflect the position of De Nederlandsche Bank or the Eurosystem. I thank Maurice Bun, Massimo Giuliodori, Jakob de Haan, Aerd Houben, Jan Kakes, Michael Kurz, René Rollingswier for valuable comments, as well as seminar participants at the Netherlands Bank and conference participants at the Netherlands Economists Day. Declaration of interest: none.

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1 Introduction

Banks are a major financing source for non-financial corporations, especially those that are small or medium in size. Banks can overcome information asymmetry problems that are costly for markets (Boot, 2000). However, banks are leveraged institutions that may have to shrink their balance sheet during financial or sovereign crises (see e.g. Bocola, 2016). This may reduce bank lending (Ivashina and Scharfstein, 2010, Abbassi et al. 2016, Kurz and Kleimeier, 2019), deteriorate the performance of bank-dependent corporates (Chava and Purnanandam, 2011, Acharya et al. 2018), decrease employment growth at these corporates (Chodorow-Reich, 2014, Cingano et al. 2016) and exacerbate an economic downturn. Systemic risks and output costs of financial crises are relatively high in bank-based economies (see e.g. Gambacorta et al. 2014 and Bats and Houben, 2017). By implication, corporates' dependence on banks can undermine real economic activity in a bank-deleveraging environment when few alternative sources of financing exist.

Market financing can complement the bank credit channel and mitigate real economic losses during banking crises by acting as an alternative for bank credit reductions (Adrian et al. 2013, Becker and Ivashina, 2014, Crouzet, 2017, Grjebine et al. 2018). This 'spare tire' effect makes market financing less volatile and pro-cyclical than bank financing (Korajczyk and Levy, 2003, Levy and Hennessy, 2007, Covas and Den Haan, 2011, Becker and Ivashina, 2014). However, markets have limited scope to develop and function as a spare tire when bank financing dominates (Greenspan, 1999).¹ The substitution from bank to market credit may therefore be smaller in relatively bank-based financial structures such as in Europe (Langfield and Pagano, 2016), sustaining the bank dependence of European corporates. Especially smaller corporates face a comparative disadvantage in financial structures with relatively underdeveloped financial markets, as

¹Moreover, market fragmentation may limit cross-border financing within capital markets, as is the case in Europe (Horny et al. 2018).

they pay premia for primary issuances of new debt. This is because secondary corporate bond market transactions remain costly for trade sizes that are relatively small (Edwards et al. 2007) and have low transparency (Bessembinder and Maxwell, 2008). Any shift to more market financing on the aggregate level may thus be driven by the largest corporates, which generally have the lowest relative issuance costs and better access to capital markets.

To ease financing conditions in Europe, the Eurosystem (i.e. the ECB and euro area central banks) launched the Corporate Sector Purchase Programme (CSPP) in the first half of 2016. The CSPP is part of the Asset Purchase Programme (APP), which was launched in 2015.² Under the CSPP, the Eurosystem purchases large amounts of investment-grade euro-denominated corporate bonds in primary and secondary markets. Purchases involve bonds issued by corporates established in the euro area. Corporates cannot initiate transactions under the CSPP; the Eurosystem decides which corporate bonds will be purchased. Issuing eligible debt does therefore not necessarily imply that it will be purchased by the Eurosystem. In primary markets, banks function as brokers by intermediating between issuing corporates and investors. Banks function as dealers in secondary markets, intermediating between non-bank sellers and the Eurosystem, as banks generally hold relatively little corporate debt on their own balance sheets; Grosse-Rueschkamp et al. (2019) show that corporate debt securities account for 0.5% of assets of banks in the eurozone. The eligibility of small-sized bonds allows the Eurosystem to also purchase bonds issued by relatively small corporates. The net corporate bond purchases were temporarily ended between December 2018 and November 2019, but the Eurosystem continued to reinvest the principal payments from all redeeming corporate bonds during that time (ECB, 2019).

With the CSPP, the Eurosystem entered the corporate debt market as a new price-

²In addition to the CSPP, the APP consists of the Public Sector Purchase Programme (PSPP), Asset-Backed Securities Purchase Programme (ABSPP) and third Covered Bond Purchase Programme (CBPP3). Together, they make up the quantitative easing policy of the Eurosystem.

insensitive buyer and changed the relative demand for corporate debt. This puts downward pressure on corporate bond yields. Several studies find that the CSPP tightens corporate bond yields (Arce et al. 2017, Cecchetti, 2017, Abidi and Miquel-Flores, 2018, Todorov, 2019).³ In addition, the Eurosystem’s Public Sector Purchase Programme (PSPP) impacts corporate bond yields via portfolio rebalancing (see e.g. Albertazzi et al. 2018; see also Gagnon et al. 2011 and Krishnamurthy and Vissing-Jorgensen, 2011 for portfolio rebalancing effects in the United States). As a result, corporates may be incentivized to substitute bank financing with market debt financing. Indeed, the ECB has established that, at the aggregate level, corporates have shifted from bank to market financing as a consequence of tightening corporate bond spreads since the start of the CSPP (ECB, 2018).

The downward pressure on corporate bond yields is a market-wide phenomenon that may impact the financing conditions of all corporates within countries and rating classes. But the CSPP also creates effects at the micro-level, temporarily increasing the market liquidity of corporate debt securities targeted under the CSPP (see also D’Amico and King, 2013). This reduces price frictions of the debt securities eligible under the CSPP (Grosse-Reuschkamp et al. 2019) and increases the bond issuance of eligible corporates (De Santis and Zaghini, 2019).⁴ The effect of the CSPP on bank dependence may therefore be heterogeneous across corporates, depending on whether a corporate’s debt is purchased under the CSPP. Grosse-Reuschkamp et al. (2019) find that corporates whose debt is eligible for the CSPP started substituting bank loans with market debt after the announcement of the CSPP. This also benefits non-eligible corporates or corporates that do not have access to market debt financing, as freed up balance sheet space leads banks to increase their lending to these corporates (see also Betz and De Santis, 2019). In line

³Similarly, Boneva et al. (2018) find that the Bank of England’s corporate bond purchase scheme effectively reduces corporate bond spreads.

⁴Similarly, the Bank of England’s corporate bond purchase scheme and the Federal Reserve Bank’s Treasury purchase program improve the liquidity conditions of purchased bonds (Christensen and Gillan, 2018, Boneva et al. 2019).

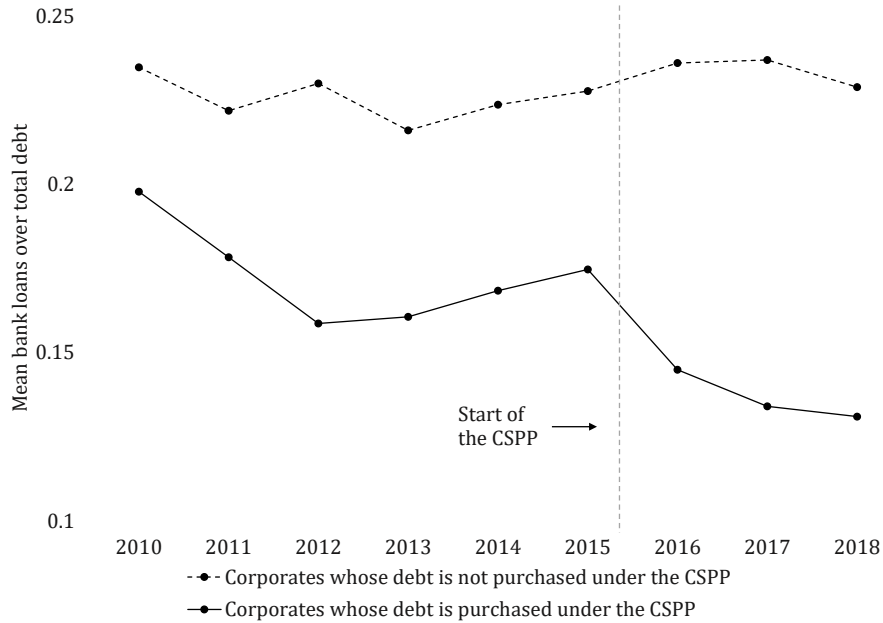


Figure 1: Corporates' dependence on bank financing

Notes: This figure shows that the mean of bank loans over total debt of corporates whose debt is not purchased by the Eurosystem has remained relatively stable, even after the introduction of the CSPP. By contrast, the mean of bank loans over total debt of corporates whose debt is purchased by the Eurosystem has reduced, especially after the start of the CSPP. The ratio of bank loans over total debt is considered an indicator for a corporate's dependence on bank financing. The end-of-year data (represented by the dots) stem from the microdata panel used in the rest of this paper.

with these findings, Figure 1 shows that corporates whose debt is purchased under the CSPP reduced their dependence on bank financing. By contrast, corporates with access to capital markets, but whose debt is not purchased under the CSPP, did not reduce their dependence on banks.

The goal of this paper is to empirically investigate the impact of the CSPP on bank dependence at the corporate level. The main hypothesis tested is that the CSPP effectively reduces the bank dependence of corporations whose debt is purchased under the CSPP. This paper is primarily interested in the corporate-level effect that stems from increasing the market liquidity of debt securities targeted under the CSPP. Regression

models are estimated over a unique microdata panel of 672 non-financial corporations headquartered in the euro area. These corporations are relatively homogeneous in terms of asset size and all have access to capital markets. In contrast to Grosse-Reuschkamp et al. (2019), this paper uses data on all Eurosystem CSPP purchases and the individual corporate balance sheet data from the Orbis database by Bureau van Dijk. Using the actual data on CSPP purchases solves the identification problem that the relative amount of eligible debt purchased varies between corporates, and that not all eligible bonds are purchased in the first years of the CSPP. The estimations make use of several fixed effects specifications, which include interacted fixed effects to control for changes in corporate bond yields across countries and sectors. As a robustness check, generalized method-of-moments (GMM) panel estimations are employed on a dynamic model to address potential concerns that the relationship is endogenous and/or dynamic.

The estimations lead to several key findings. The first finding is that the CSPP impacts the funding structure of non-financial corporates whose debt is purchased under the CSPP. These corporates significantly reduce their dependence on bank financing. The second finding is that the effect on a corporate's funding structure depends on its financing costs. Corporates only substitute bank loans with market debt when they face relatively high interest payments or financial expenses. The third finding is that the market valuation of a corporate determines whether the CSPP reduces a corporate's dependence on banks. Corporates only substitute bank loans with market debt when they have a relatively high price-to-book ratio. The last finding is that the effect of the CSPP on bank dependence is non-linear; the downward effect on bank dependence is largest for those corporates of which most debt is purchased under the CSPP, relative to their total stock of debt. These findings are robust to several alternative specifications and data changes.

The rest of this paper is organized as follows. Section 2 discusses the methodology. Section 3 describes the data. The empirical results are discussed in section 4. Section 5

discusses the results of the robustness checks. Section 6 concludes.

2 Methodology

Fixed effects estimations are performed on several regression models. The first model estimates the effect of the CSPP on a corporate's bank dependence. This is considered the baseline model. The second model augments the baseline model with several interaction variables that account for the influence of a corporate's financing costs and price-to-book ratio. The third model transforms the baseline model into a cubic model to determine whether the relationship between the CSPP and a corporate's bank dependence is non-linear.

2.1 CSPP's effect on a corporate's bank dependence

To analyze the impact of the accumulated Eurosystem corporate sector purchases on a corporate's bank dependence, the following baseline regression model is estimated:

$$BD_{i,j,s,t} = \alpha + \beta' CSPP_{i,s,j,t} + \zeta' X_{i,j,s,t} + \mu_{i,j,s} + \eta_t + \kappa_{s,t} + \nu_{j,t} + \varepsilon_{i,j,s,t} \quad (1)$$

where $BD_{i,j,s,t}$ is the measure for a corporate's bank dependence, $CSPP_{i,s,j,t}$ represents two CSPP indicators, $X_{i,j,s,t}$ is a set of corporate-specific control variables, $\mu_{i,j,s}$ denotes time-invariant fixed effects (either bank, country or sector fixed effects), η_t , $\kappa_{s,t}$ and $\nu_{j,t}$ are time, sector*time and country*time fixed effects respectively, $\varepsilon_{i,j,s,t}$ is the error term and the subscripts i , j , s and t denote the corporation, country, sector and time period, respectively.

The dummies $\mu_{i,j,s}$ and η_t capture unobserved differences between corporates, countries and sectors, and over time, reflecting e.g. differences in corporate structure and size, macro-economic and financial structure developments, developments in European

capital markets, flattening of the the corporate bond yield curve and M&A activity.⁵ The sector*time and country*time fixed effects take account of unobserved time-varying sector- and country-specific characteristics, such as a sector's and country's demand for credit, and changes in corporate bond yields across sectors and countries. These fixed effects thus contribute to the identification of CSPP's effect on a corporate's bank dependence stemming from increased market liquidity.⁶ The time, sector*time and country*time fixed effects are included separately to prevent multicollinearity issues in the two-dimensional panel data.

This paper is interested in the degree of bank funding relative to debt financing, rather than total financing (debt + equity financing). Corporate-specific bank dependence is therefore measured by the ratio of bank loans over total debt liabilities.⁷ This indicator is not affected by changes on the asset side of the balance sheet. If total assets would be used as a denominator, changes in equity would lead to incorrect signals that a corporate changed its degree of bank funding relative to total debt financing. As a robustness check, the bank dependence indicator is substituted with the ratio of bank loans over total assets.

The CSPP is represented by two indicators. The first indicator is defined as the ratio of a corporate's nominal debt purchased under the CSPP over a corporate's total debt liabilities.⁸ The yearly nominal CSPP purchases exclude a corporate's redeeming bonds in that year. The indicator thus represents the Eurosystem's total amount of claims on a corporate by the end of the year. This paper is also interested in whether the Eurosystem's yearly flow of purchases influences a corporate's funding structure. The second CSPP indicator is therefore defined as the first difference of the former CSPP indicator.

⁵Larger corporates are generally more involved in M&A's, which may result in new debt issuance.

⁶For a more extensive explanation on how to interpret interacted fixed effects, see Khwaja and Mian (2008).

⁷Non-bank loans are not included in the numerator.

⁸When a corporate's debt has not been purchased under the CSPP, the CSPP indicator equals 0 in that period.

In addition to the fixed effects, the model includes several time-varying corporate-specific control variables similar to Becker and Ivashina (2014) and Acharya et al. (2018): long-term debt over total assets and total debt over equity control for leverage, the total net amount of property, plant and equipment (PPE) over total assets controls for the net value of tangible collateral, return on assets (ROA) using net income controls for performance, retained earnings over total assets controls for dependence on internal financing and the interest coverage ratio controls for the rating (Standard & Poor's assigns ratings on the basis of coverage ratios, see e.g. Standard & Poor's, 2006).⁹ This paper uses the four-year rolling median EBITDA over the four-year median rolling interest paid as an indicator for the coverage ratio. Applying a four-year rolling median corrects for negative values of interest paid; negative denominator values misspecify the value of the coverage ratio. The series are extrapolated over time to make up for the missing values that result from the rolling median. Excluding this control variable gives statistically and economically similar results.

Total debt is included as the denominator in both the bank dependence and CSPP indicators. A simultaneity bias can therefore arise when a corporate's stock of bank loans and debt purchased under the CSPP are jointly determined. This can occur when the Eurosystem is more inclined to purchase a corporate's debt when it has recently shifted to market financing, since new debt issuance is generally associated with higher liquidity. However, estimating fixed effects regressions with instrumental variables to address these endogeneity concerns leads to inconsistent estimations when the instruments are weakly exogenous in samples with short time periods (Wooldridge, 2002, Arellano, 2003, Cameron and Trivedi, 2005). Moreover, the relationship between a corporate's bank dependence and the CSPP may be dynamic. Fixed effects estimations cannot account for dynamics in samples with short time periods since the Nickell bias becomes relatively large. Therefore, in a separate robustness check, two-step *system* GMM panel

⁹The interest coverage ratio is used as an alternative control for the rating, since not all corporates in the sample are rated; not all corporates are publicly listed while having access to capital markets.

estimations are carried out on a dynamic version of model (1).

In an additional robustness check, the model controls for linear and quadratic trends, specifically for corporates whose debt is purchased under the CSPP. The linear and quadratic trend variables are set at zero for corporates whose debt is not purchased under the CSPP. Controlling for treatment-specific trends seems necessary, as Figure 1 suggests that the dependence on banks of corporates whose debt is purchased by the Eurosystem already decreased in the first years of the sample period (although this downward trend reversed partly during 2012-2015). By contrast, the bank dependence of corporates whose debt is not purchased under the CSPP remained relatively stable over time. This paper also includes linear and quadratic trends that are homogeneous across all corporates in the sample.

Changes in the bank dependence indicator can stem from either changes in bank loans (numerator) or total debt (denominator). To focus on the numerator effect, fixed effects estimations are performed on a regression model that includes the log of a corporate's bank loans as the dependent variable:

$$\text{Log}(BL_{i,j,s,t}) = \alpha + \beta' CSPP_{i,s,j,t} + \zeta' X_{i,j,s,t} + \mu_{i,j,s} + \eta_t + \kappa_{s,t} + \nu_{j,t} + \varepsilon_{i,j,s,t} \quad (2)$$

where $\text{Log}(BL_{i,j,s,t})$ represents the log of a corporate's bank loan liabilities. This log-linear model estimates the effects of the CSPP indicators on the percentage change in a corporate's stock of bank loans. To focus on the denominator effect, fixed effects estimations are employed on a regression model that includes the log of a corporate's total debt as the dependent variable:

$$\text{Log}(TD_{i,j,s,t}) = \alpha + \beta' CSPP_{i,s,j,t} + \zeta' X_{i,j,s,t} + \mu_{i,j,s} + \eta_t + \kappa_{s,t} + \nu_{j,t} + \varepsilon_{i,j,s,t} \quad (3)$$

where $\text{Log}(TD_{i,j,s,t})$ represents the log of a corporate's total debt liabilities. This log-linear model estimates the effects of the CSPP indicators on the percentage change in a

corporate's total debt.

2.2 The influence of financing costs and the price-to-book ratio

The extent to which the CSPP incentivizes corporates to substitute bank loans with market debt may depend on the relative amount of a corporate's financing costs. This is because CSPP's negative effect on a corporate's cost of debt may be larger when higher interest rates or financial expenses are associated with higher price frictions of debt. Model (1) is therefore augmented with an interaction between the CSPP indicators and two separate dummy variables that indicate whether a corporate pays relatively high or low amounts of interest, or faces relatively high or low financial expenses:

$$\begin{aligned}
 BD_{i,j,s,t} = & \alpha + \beta'_{high}(CSPP_{i,s,j,t} * HighCosts_{i,j,s,t}) \\
 & + \beta'_{low}(CSPP_{i,s,j,t} * LowCosts_{i,j,s,t}) + \zeta' X_{i,j,s,t} \\
 & + \mu_{i,j,s} + \eta_t + \kappa_{s,t} + \nu_{j,t} + \varepsilon_{i,j,s,t}
 \end{aligned} \tag{4}$$

where $HighCosts_{i,j,s,t}$ and $LowCosts_{i,j,s,t}$ denote dummies that respectively indicate when a corporate pays amounts of interest higher or lower than the time-invariant sample median, or is subject to financial expenses (i.e. expenses incurred from owning or renting financial assets such as interest expenses, finance charges and financial asset write-offs) higher or lower than the time-invariant sample median.

The ability of a corporate to switch from bank to market financing may also be influenced by the market's valuation of a corporate. Corporates with a relatively high price-to-book ratio are better able to attract additional debt funding. To analyze the influence of a corporate's price-to-book ratio, fixed effects estimations are employed on

the following model:

$$\begin{aligned}
BD_{i,j,s,t} = & \alpha + \beta'_{high}(CSPP_{i,s,j,t} * HighPB_{i,j,s,t}) \\
& + \beta'_{low}(CSPP_{i,s,j,t} * LowPB_{i,j,s,t}) + \zeta' X_{i,j,s,t} \\
& + \mu_{i,j,s} + \eta_t + \kappa_{s,t} + \nu_{j,t} + \varepsilon_{i,j,s,t}
\end{aligned} \tag{5}$$

where $HighPB_{i,j,s,t}$ and $LowPB_{i,j,s,t}$ denote dummies that respectively indicate when a corporate has a price-to-book ratio higher or lower than the time-invariant sample median.

2.3 CSPP's non-linear effect on a corporate's bank dependence

The effect of debt purchases under the CSPP on a corporate's bank dependence may be non-linear. This is because market liquidity effects are likely to be larger when more of the same type of debt is purchased, increasing the incentives for corporates to substitute bank financing with market financing. The effects of the CSPP may therefore depend on the accumulated amount of debt purchased by the Eurosystem. The following model is estimated to examine whether the relationship between the CSPP and a corporate's bank dependence is non-linear:

$$\begin{aligned}
BD_{i,j,s,t} = & \alpha + \beta_1 CSPP_{i,s,j,t} + \beta_2 CSPP_{i,s,j,t}^2 + \beta_3 CSPP_{i,s,j,t}^3 \\
& + \zeta' X_{i,j,s,t} + \mu_{i,j,s} + \eta_t + \kappa_{s,t} + \nu_{j,t} + \varepsilon_{i,j,s,t}
\end{aligned} \tag{6}$$

where $CSPP_{i,s,j,t}$, $CSPP_{i,s,j,t}^2$ and $CSPP_{i,s,j,t}^3$ denote the indicator for the relative accumulated amount of debt purchased under the CSPP in linear, squared and cubic terms, respectively.

3 Data

The analysis uses a yearly microdata panel from 2010 until 2018. The panel includes 672 non-financial corporates with access to capital markets headquartered in euro area countries. All individual corporate balance sheet data (including data for the control variables) are taken from the Orbis database by Bureau van Dijk. Additional information on corporates' debt and equity issuance activity, as well as the structure between ultimate parent companies and their subsidiaries (needed to examine the impact of the CSPP) are obtained from Bloomberg. Data on all Eurosystem CSPP purchases are retrieved from the Eurosystem portfolio management system.¹⁰

To construct the panel, data on all the active euro area non-financial corporations in the Orbis database are taken as long as they have a known value for their stock of bank loans at least once in the sample period. The individual corporate balance sheet data are then merged with the CSPP data from the Eurosystem portfolio management system. Under the CSPP, debt from two types of corporates has been purchased. The first type constitutes ultimate parent companies. For these corporates, the CSPP data are matched with the corporate balance sheet data, unless Orbis has no data for these corporates. The second type consists of subsidiaries. For these corporates, two steps are followed for the integration of the datasets. First, the ultimate parent is matched with all corporates that are subsidiaries and of which debt has been purchased under the CSPP. Second, for each parent company and subsidiary, it is checked whether they are included in the Orbis dataset. Three scenarios exist for matching the data of these corporates. First, if the subsidiary is not a special financing vehicle and Orbis provides data for both the ultimate parent and its subsidiary, the CSPP data are matched with the subsidiary and the ultimate parent is dropped to prevent double-counting. Second, if the subsidiary is a special finance vehicle, the CSPP data are matched with the ultimate

¹⁰The details of all trades conducted under the APP are registered in the Eurosystem portfolio management system. This trade system is used by the ECB and all national central banks in the Eurosystem.

parent and the subsidiary is dropped from the sample. Third, in case Orbis provides data for either the ultimate parent or subsidiary only, the CSPP data are matched with the Orbis data irrespective of whether the corporate is an ultimate parent or subsidiary. 9 corporates have been dropped in the first two scenarios.

In the sample, debt has been purchased from 126 corporates under the CSPP.¹¹ This group of corporates is denoted as the treatment group in the sample. The group of corporates whose debt is not purchased under the CSPP is considered the control group. Of the treatment group, 62 corporates have at least once paid interest higher than the sample median, 58 corporates have at least once faced financial expenses higher than the sample median and 77 corporates have at least once a price-to-book ratio higher than the sample median. This is relevant, because the estimation of models (4) and (5) requires that treated corporates have observations for the interaction variables above and below the sample median.

Of all corporates in the treatment group, the mean amount of total assets is larger than the 7th decile of the sample mean amount of total assets. To make the treatment and control group relatively homogeneous in terms of asset size, all corporates with a mean amount of total assets smaller than the 8th decile have been deleted from the panel. This yields 546 corporations in the control group. Over the entire sample, the mean of the nominal amount of a corporate's total assets is above 600 million euros. Importantly, all corporations in the sample have access to capital markets, as they satisfy at least one of the following conditions: 1) the corporate is or has been publicly listed; 2) the corporate has at least once issued equity; 3) the corporate has at least once issued debt in a form other than a bank loan. Moreover, as these corporates are relatively large, they likely face relatively low issuance costs. The estimation of the CSPP's effect on a corporate's bank dependence requires that corporates without access to capital markets

¹¹Since the start of the CSPP, the Eurosystem has purchased corporate debt of more than 200 ultimate parent companies. Due to data availability restrictions, the sample does not include all corporates of which debt has been purchased under the CSPP.

are excluded; including corporates without access to capital markets creates endogeneity issues, as substituting bank loans with market debt is either very costly or practically impossible for these corporates. In addition, this paper follows the approach by Fama and French (1992, 2001) and excludes the 72 observations with negative book equity values from the sample. As a robustness check, similar estimations are performed on a sample that includes the relatively smaller corporates and the observations with negative book equity values.

Table 1 shows the descriptive statistics of all the variables for the treatment and the control group separately. The summary statistics on the CSPP variables are excluded due to the strict data confidentiality. Table 1 shows that the median values of the explanatory variables are relatively similar for the treatment and control group. The exception is the dependent variable; compared to the treatment group, the median of bank loans over total debt is more than twice as large in the control group (see also Figure 1). This suggests that corporates whose debt is purchased under the CSPP are less dependent on bank financing than the corporates whose debt is not purchased. Table 2 provides a correlation matrix. The correlation between the explanatory variables is low. Also, the financial costs indicators and the price-to-book ratio are not highly correlated, which indicates that equations (4) and (5) model different information sets.

Table 3 presents the descriptive statistics on total assets by sector and shows how asset size is distributed over the different sectors. There are 27 sectors in total. All sectors other than sectors 2, 6, 7 and 25 contain more than 50 observations. The restriction on the degrees of freedom is thus limited when including sector*time fixed effects. Table 3 demonstrates that the mean of the asset size is heterogeneous across sectors. The communication, transport manufacturing and utilities sectors include the largest corporates in terms of asset size. Smaller corporates operate in agriculture, horticulture & livestock and waste management & treatment.

The corporates whose debt is purchased under the CSPP are headquartered in the

Table 1: Descriptive statistics

Variables	Measurement	Obs		Median		Mean		Std Dev		Min		Max	
		Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
<i>Dependent variable</i>													
Bank dependence	Bank loans over debt	920	3,707	0.08	0.17	0.16	0.23	0.19	0.22	0.00	0.00	0.83	0.95
<i>Interaction variables</i>													
Interest paid	Interest paid over debt	1,074	4,418	0.02	0.02	0.02	0.03	0.01	0.07	0.00	0.00	0.14	3.14
Financial expenses	Financial expenses over assets	1,077	4,436	0.01	0.01	0.01	0.02	0.03	0.08	-0.21	-2.62	0.17	2.99
P/B ratio	Market to book value	968	3,932	1.41	1.37	1.92	2.01	1.84	3.86	0.00	24.07	0.00	188.26
<i>Control variables</i>													
Leverage (D/A)	Long-term debt over assets	1,077	4,437	0.25	0.20	0.26	0.21	0.14	0.15	0.00	0.00	0.87	0.99
Leverage (E/D)	Equity over debt	1,077	4,437	0.55	0.63	0.69	1.49	1.14	11.37	0.03	0.00	21.93	645.02
PPE	Net PPE over assets	1,070	4,394	0.23	0.19	0.26	0.24	0.21	0.21	0.00	0.00	0.92	0.96
ROA	Net income over assets	1,077	4,434	0.04	0.03	0.04	0.03	0.04	0.06	-0.12	-0.76	0.42	0.68
Retained earnings	Retained earnings over assets	983	4,217	0.08	0.08	0.12	0.13	0.15	0.27	-1.12	-5.80	0.64	2.54
Coverage ratio	EBITDA over interest paid	1,080	4,437	6.16	6.19	7.98	17.07	7.00	53.41	-11.80	-661.73	53.03	832.34

Notes: This table presents descriptive statistics for all variables, except for the CSPP indicator due to the confidentiality of the non-public CSPP data. The second column shows how the indicator variables are measured. The first variable represents the dependent variable which indicates bank dependence. The next three variables are used in models (4) and (5) and respectively indicate interest paid, financial expenses and the price-to-book ratio. The last six variables are corporate-specific control variables that indicate leverage, the total net amount of property, plant and equipment, return on assets, retained earnings and the coverage ratio. The last variable is measured as the four-year rolling median EBITDA over the four-year median rolling interest paid and controls for a corporate's rating. The series for the coverage ratio are extrapolated over time to make up for the missing values that result from the rolling median.

Table 2: Correlation matrix

Variables	CSPP	Interest paid	Expenses	P/B ratio	Leverage (D/A)	Leverage (E/D)	PPE	ROA	Retained earnings	Coverage ratio
CSPP	1.00									
Interest paid	-0.03	1.00								
Expenses	-0.06	0.36	1.00							
P/B ratio	0.00	0.00	0.04	1.00						
Leverage (D/A)	0.12	0.24	0.15	0.00	1.00					
Leverage (E/D)	-0.01	0.06	-0.14	-0.03	-0.15	1.00				
PPE	0.02	0.09	0.10	-0.06	0.17	-0.08	1.00			
ROA	0.03	-0.19	-0.47	0.17	-0.22	0.07	-0.04	1.00		
Retained earnings	0.00	-0.11	-0.18	-0.07	-0.22	0.07	0.04	0.34	1.00	
Coverage ratio	-0.03	-0.17	-0.06	0.20	-0.26	0.01	-0.01	0.29	0.15	1.00

Notes: This table presents the correlation matrix for all independent variables. The variables are a corporate's debt purchased under the CSPP over a corporate's total debt, interest paid over total debt, financial expenses over total assets, the price-to-book ratio, long-term debt over total assets, total shareholder's equity over total debt, the total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid and controls for a corporate's rating (extrapolated over time).

Table 3: Descriptive statistics on total assets by sector

Sectors	Obs	Mean (Bn)	Std dev (Bn)
1 Agriculture, horticulture & livestock	84	1.74	7.79
2 Biotechnology & life sciences	18	2.17	1.85
3 Business services	320	4.88	17.00
4 Chemicals, petroleum, rubber & plastic	520	10.10	17.70
5 Communications	235	23.30	38.00
6 Computer hardware	27	4.05	2.84
7 Computer software	44	3.51	2.53
8 Construction	295	10.50	13.20
9 Food & tobacco manufacturing	238	7.58	28.60
10 Industrial, electric & electronic machinery	642	7.80	18.30
11 Leather, stone, clay & glass products	132	9.65	13.10
12 Media & broadcasting	127	2.98	2.80
13 Metals & metal products	180	6.26	8.20
14 Mining & extraction	167	17.10	31.30
15 Miscellaneous manufacturing	54	1.89	0.65
16 Printing & publishing	91	3.23	2.90
17 Property services	533	4.41	7.09
18 Public administration, education & health social services	63	3.13	2.50
19 Retail	210	6.40	9.88
20 Textiles & clothing manufacturing	93	14.50	22.10
21 Transport, freight & storage	364	9.45	13.00
22 Transport manufacturing	268	41.50	77.50
23 Travel, personal & leisure	171	3.73	4.12
24 Utilities	368	29.40	54.40
25 Waste management & treatment	9	0.77	0.78
26 Wholesale	166	3.44	3.08
27 Wood, furniture & paper manufacturing	106	4.11	4.76

Notes: This table presents the descriptive statistics on the total assets variable per sector. The mean and standard deviation are given in EUR billions. Asset size is heterogeneous across the sectors. The communication, transport manufacturing and utilities sectors include the largest corporates in terms of asset size. Smaller corporates operate in agriculture, horticulture & livestock and waste management treatment.

following countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. These corporates are active in the following sectors: 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 17, 19, 20, 21, 22, 23, 24, 26, 27. The other euro area countries and sectors do not include corporates whose debt is purchased by the Eurosystem. The main reason for the exclusion of some countries is that the credit quality of corporates headquartered in these countries is considered non-eligible for the CSPP. Those countries and sectors that do not include corporates whose debt is purchased by the Eurosystem have been dropped from the sample in a separate robustness check.

4 Results

This section presents the main results. The results of the robustness checks are discussed in the following section. Robust standard errors clustered at the corporate level are used.

4.1 CSPP's effect on a corporate's bank dependence

Table 4 presents the estimations for model (1). It shows the effects of the accumulation and yearly flow of corporate debt purchases on a corporate's bank dependence. The results suggest that a corporate's bank dependence is significantly reduced if its debt measured relative to its total debt liabilities is purchased under the CSPP. The effects are significant at the 1% to 5% significance level in all columns. The estimations control for unobserved sector- and country-specific time variation and are thus robust to corporate bond yield developments within countries and sectors.¹² Columns 1 to 3 suggest that a corporate's ratio of bank loans to total debt decreases almost one-on-one with the accumulated amount of a corporate's debt purchased by the Eurosystem over time. This indicates that the CSPP causes corporates to substitute market debt for bank loans. Columns 4 to 6 show that the effect of the yearly flow of CSPP purchases on a corporate's ratio of bank loans to total debt is even larger than one.

Changes in the bank dependence ratio could stem from either decreases in bank loans or increases in total debt. To focus on developments in a corporate's bank loans as a result of the CSPP (i.e. the numerator-effect), Table 5 presents the estimations for model (2), where the dependent variable is the log of a corporate's stock of bank loans. The explanatory variables are similar to model (1). The results show that corporates reduce their stock of bank loans when their debt is purchased under the CSPP. The statistical significance varies between the 1% and 5% level in all columns. In line with the results of Table 4, the effects of the yearly flow of purchases are larger than the effects of the

¹²The effects of the time, sector*time and country*time dummies are significantly negative across sectors and countries, and over time (not shown in Table 4). This may indicate the impact of decreasing corporate bond yields on corporates' bank dependence over time.

Table 4: CSPP's effect on bank dependence

Regressors	1	2	3	4	5	6
CSPP aggregate	-0.89** (0.38)	-0.98*** (0.37)	-0.99*** (0.36)			
CSPP flow				-1.18** (0.52)	-1.34** (0.53)	-1.19** (0.54)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.27	0.27	0.26	0.26	0.26	0.25
N	4,216	4,216	4,216	3,706	3,706	3,706

Notes: This table presents the fixed effects estimations for model (1). The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

accumulation of debt purchases. The first three columns suggest that purchasing 5% of a corporate's total debt liabilities over time results in a decrease in a corporate's bank loans of at least 25%. The last three columns show that purchasing 5% of a corporate's total debt liabilities in a year leads corporates to reduce their dependence on bank financing with at least 37%.¹³

To focus on developments in a corporate's total debt as a result of the CSPP (i.e. the denominator-effect), Table 6 presents the estimations for model (3), where the dependent variable is the log of a corporate's total debt. The explanatory variables are similar to model (1). The results show that the CSPP does not impact the stock of a corporate's total debt. Combined with the previous results, this suggests that purchases under the CSPP leads to a shift towards market finance.

¹³These effects seem relatively large, but note that a corporate's total debt liabilities also includes (bank) loans and non-marketable debt, which cannot be purchased by the Eurosystem.

Table 5: CSPP's effect on the log of bank loans

Regressors	1	2	3	4	5	6
CSPP aggregate	-5.87** (2.26)	-5.07*** (2.20)	-6.87*** (2.42)			
CSPP flow				-8.72** (3.45)	-7.43** (3.39)	-8.63** (3.78)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.18	0.18	0.18	0.17	0.17	0.17
N	4,036	4,036	4,036	3,547	3,547	3,547

Notes: This table presents the fixed effects estimations for model (2). The dependent variable is the log of a corporate's stock of bank loans. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

Table 6: CSPP's effect on the log of total debt

Regressors	1	2	3	4	5	6
CSPP aggregate	0.07 (0.64)	0.32 (0.64)	0.00 (0.68)			
CSPP flow				-1.12 (0.95)	-0.73 (1.00)	-0.95 (1.04)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.27	0.27	0.22	0.25	0.24	0.20
N	4,985	4,985	4,985	4,429	4,429	4,429

Notes: This table presents the fixed effects estimations for model (3). The dependent variable is the log of a corporate's stock of total debt. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

4.2 The influence of financing costs and the price-to-book ratio

The effect of the CSPP on corporates substituting bank loans with market debt may depend on a corporate's financing costs. To analyze the influence of a corporate's relative financing costs, Tables 7 and 8 present the estimations for model (4). Table 7 shows that a corporate's bank dependence is significantly reduced if its debt is purchased under the CSPP and it pays relatively high amounts of interest. Columns 1 to 3 suggest that when a corporate pays relatively high amounts of interest, its ratio of bank loans to total debt decreases with a factor of 2 compared to the accumulated amount of a corporate's debt purchased by the Eurosystem over time. The effects are statistically significant at the 1% level. Columns 4 to 6 show that the effect of the yearly purchases on a corporate's bank dependence is slightly smaller; when corporates pay relatively high amounts of interest, the CSPP reduces their bank loans over total debt ratio with a factor of around 1.6 in a year. The effects are statistically significant at the 1 to 5% level. By contrast, the total amount of Eurosystem claims on a corporate does not significantly reduce a corporate's bank dependence when it pays relatively low amounts of interest. This supports the view that corporates substituting bank loans with market debt is a result of price incentives. However, the yearly flow of purchases does impact a corporate's dependence on bank financing when it pays relatively low amounts of interest, although the negative effect is smaller and less significant. When corporates pay relatively low amounts of interest, the CSPP flow reduces their bank loans over total debt ratio with a factor between 0.9 and 1.1 in a year. These effects are statistically significant at the 5 to 10% level.

Table 8 shows that a corporate's bank dependence is significantly reduced if its debt is purchased under the CSPP and it faces relatively high financial expenses. Columns 1 to 3 suggest that when a corporate faces relatively high financial expenses, its ratio of bank loans to total debt increases two-on-one with the accumulated amount of a corporate's debt purchased by the Eurosystem over time. These effects are statistically significant at the 1% level. Columns 4 to 6 show that the effect of the yearly Eurosystem

Table 7: CSPP's effect when paying high versus low amounts of interest

Regressors	1	2	3	4	5	6
CSPP aggregate * high interest paid	-1.84*** (0.51)	-1.92*** (0.49)	-2.02*** (0.47)			
CSPP aggregate * low interest paid	-0.34 (0.34)	-0.44 (0.37)	-0.40 (0.33)			
CSPP flow * high interest paid				-1.62** (0.65)	-1.75*** (0.65)	-1.56** (0.64)
CSPP flow * low interest paid				-0.91* (0.51)	-1.09** (0.53)	-0.91* (0.52)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.28	0.28	0.26	0.26	0.26	0.25
N	4,211	4,211	4,211	3,663	3,663	3,663

Notes: This table presents the fixed effects estimations for model (4). The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem for corporates which paid relatively high and low amounts of interest. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem for corporates which paid relatively high and low amounts of interest. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

Table 8: CSPP's effect when facing high versus low financial expenses

Regressors	1	2	3	4	5	6
CSPP aggregate * high expenses	-1.97*** (0.58)	-2.05*** (0.56)	-2.19*** (0.50)			
CSPP aggregate * low expenses	-0.29 (0.40)	-0.38 (0.39)	-0.33 (0.38)			
CSPP flow * high expenses				-1.99** (0.78)	-2.17*** (0.77)	-1.93*** (0.75)
CSPP flow * low expenses				-0.83 (0.58)	-0.98 (0.60)	-0.87 (0.60)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.29	0.29	0.28	0.25	0.25	0.24
N	4,207	4,207	4,207	3,660	3,660	3,660

Notes: This table presents the fixed effects estimations for model (4). The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem for corporates which faced relatively high and low financial expenses. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem for corporates which faced relatively high and low financial expenses. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

purchases on a corporate's bank dependence is roughly the same size; when corporates face relatively high financial expenses, the CSPP reduces their bank loans over total debt ratio with a factor of around 2 in a year. These effects are statistically significant at the 1% level in columns 5 and 6, and at the 5% level in column 4 (but close to the 1% significance level). The CSPP does not reduce a corporate's bank dependence when it faces relatively low financial expenses.

This paper is also interested in whether the market valuation of a corporate influences a corporate's ability to switch from bank to market financing. Table 8 therefore presents the estimations for model (5). The results show that a corporate's bank dependence is significantly reduced if its debt is purchased under the CSPP and it has a relatively high price-to-book ratio. Columns 1 to 3 suggest that when a corporate has a relatively

Table 9: CSPP's effect when the price-to-book ratio is high and low

Regressors	1	2	3	4	5	6
CSPP aggregate * high price-to-book	-1.05*** (0.37)	-1.17*** (0.37)	-1.07*** (0.38)			
CSPP aggregate * low price-to-book	-0.15 (0.61)	-0.32 (0.57)	-0.29 (0.54)			
CSPP flow * high price-to-book				-1.21** (0.49)	-1.41*** (0.50)	-1.23** (0.50)
CSPP flow * low price-to-book				-0.15 (0.45)	-0.39 (0.46)	-0.27 (0.46)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.27	0.26	0.26	0.26	0.26	0.25
N	3,789	3,789	3,789	3,274	3,274	3,274

Notes: This table presents the fixed effects estimations for model (5). The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem for corporates which have a relatively high and low price-to-book ratio. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem for corporates which have a relatively high and low price-to-book ratio. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

high price-to-book ratio, its ratio of bank loans to total debt increases one-on-one with the accumulated amount of a corporate's debt purchased by the Eurosystem over time. These effects are statistically significant at the 1% level. Columns 4 to 6 show that the effect of the yearly Eurosystem purchases on a corporate's bank dependence is slightly larger; when corporates have a relatively high price-to-book ratio, the CSPP reduces their bank loans over total debt ratio with a factor between 1.2 and 1.4 in a year. These effects are statistically significant at the 1% to 5% significance level. The CSPP does not reduce a corporate's bank dependence when it has a relatively low price-to-book ratio. This shows that the market's valuation of a corporate may to some extent determine the dependence of a corporate on bank financing.

4.3 CSPP’s non-linear effect on a corporate’s bank dependence

The effect of debt purchases under the CSPP on a corporate’s bank dependence may be non-linear. This is because market liquidity effects are likely to be larger when more of the same type of debt is purchased, increasing the incentives for corporates to substitute bank financing with market financing. The effect of the CSPP may therefore be dependent on the relative accumulated amount of debt purchased. To examine whether the relationship between the CSPP and a corporate’s bank dependence is non-linear, Table 9 shows the estimations for model (6). This model includes the CSPP indicator for the accumulated purchases in linear, squared and cubic terms. The results indicate that a cubic relationship exists.¹⁴ The effects are statistically significant at the 1% level.

The estimations in column 1 of Table 12 are more clearly illustrated in Figure 2, while Figure 3 depicts the marginal effect.¹⁵ The horizontal axis represents the CSPP indicator in both figures. The vertical axis is the predicted value of bank dependence in Figure 2 and the marginal effect in Figure 3. The dotted lines represent the 95% confidence interval. The figures show that the bank dependence of a corporate is reduced as soon as some of that corporate’s debt is purchased. This could reflect an announcement or signaling effect, as starting to purchase a corporate’s debt signals that its debt is targeted for the CSPP. However, the effect on bank dependence diminishes and even disappears as more debt is purchased. The marginal effect turns negative again once the Eurosystem has purchased almost 10% of a corporate’s total debt. This may be explained by CSPP’s increasing effect on the market liquidity of corporate debt. To the extent the market liquidity of a corporate’s debt securities continues to increase as more of its debt is purchased by the Eurosystem, the substitution effect from bank to market financing may be enhanced.

¹⁴Excluding the CSPP indicator in cubic terms shows that a quadratic relationship does not exist (available upon request).

¹⁵The illustrations of the estimations in the other columns look very similar.

Table 10: CSPP's non-linear effect on bank dependence

Regressors	1	2	3
CSPP aggregate	-3.36*** (0.92)	-3.81*** (0.91)	-3.02*** (0.93)
CSPP aggregate (squared)	58.96*** (19.66)	64.44*** (19.47)	48.98** (19.32)
CSPP aggregate (cubic)	-286.49*** (88.01)	-302.98*** (86.88)	-240.98*** (89.04)
Corporate controls	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes
Country fixed effects	No	Yes	No
Sector fixed effects	No	Yes	No
Time fixed effects	Yes	Yes	No
Country*time fixed effects	No	No	Yes
Sector*time fixed effects	No	No	Yes
R-sqr (within)	0.28	0.28	0.26
N	4,216	4,216	4,216

Notes: This table presents the fixed effects estimations for model (6). The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the cubic effect of the accumulated corporate debt purchases by the Eurosystem. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Column 1 controls for corporate and time fixed effects. Column 2 controls for country, sector and time fixed effects. Column 3 controls for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

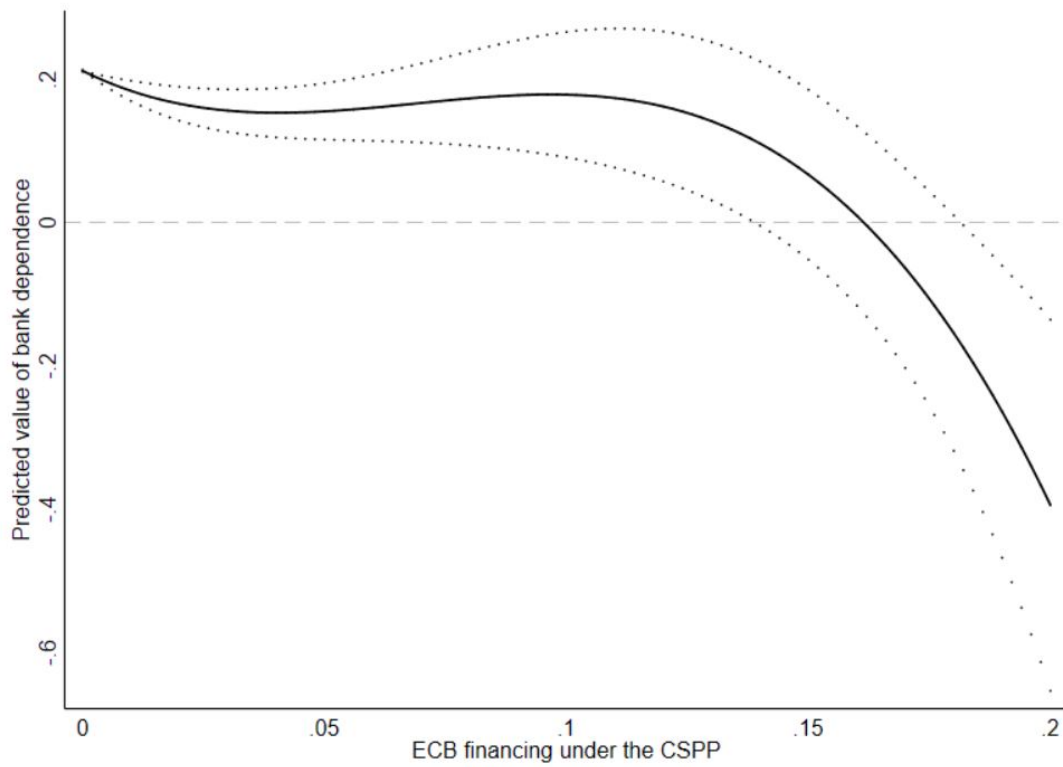


Figure 2: Relationship between the CSPP and bank dependence (Table 10; column 1)

Notes: This figure shows the non-linear relationship between the accumulated debt purchases under the CSPP and the predicted value of bank dependence as estimated by model (6). The vertical axis represents the predicted value of a corporate's bank loans over total debt. The horizontal axis is the ratio of a corporate's debt purchased under the CSPP over a corporate's total debt. The plotted line reflects the estimations in column 1 of Table 10, controlling for corporate and time fixed effects, but excluding country, country*time and sector*time fixed effects to prevent multicollinearity issues. The dotted lines represent the 95% confidence interval.

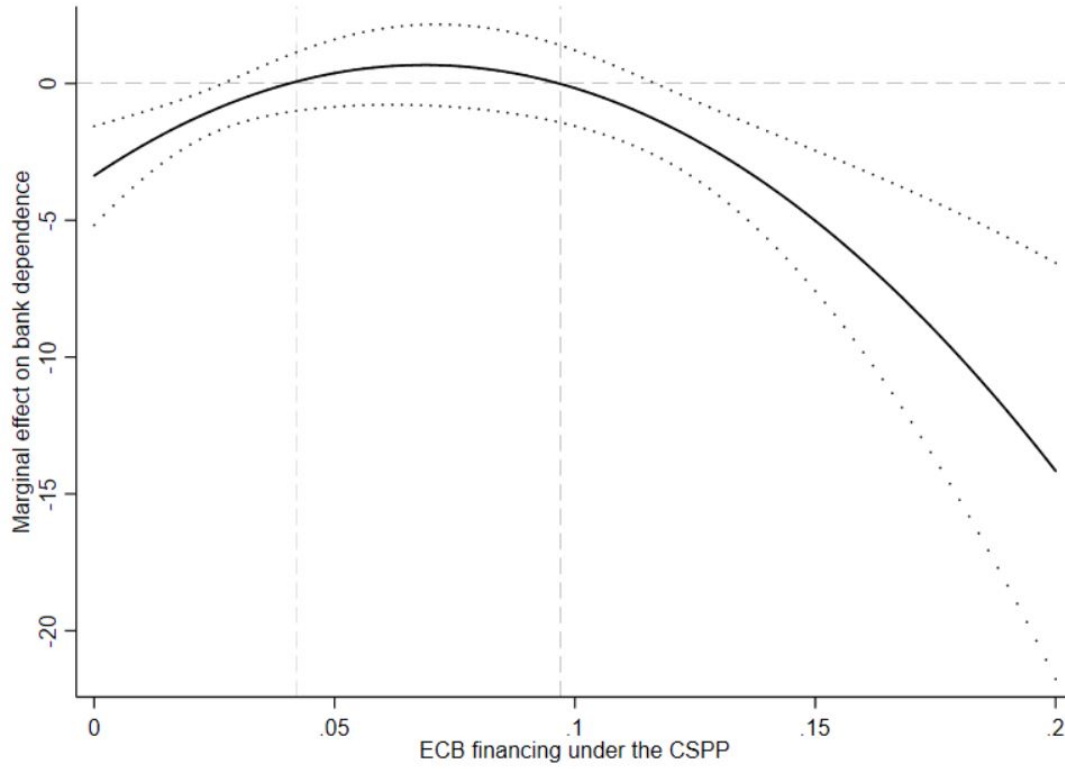


Figure 3: Marginal effect of the CSPP on bank dependence (Table 10; column 1)
Notes: This figure shows the marginal effect of the accumulated debt purchases under the CSPP on the predicted value of bank dependence as estimated by model (6). The vertical axis represents the marginal effect on the predicted value of a corporate's bank loans over total debt. The horizontal axis is the ratio of a corporate's debt purchased under the CSPP over a corporate's total debt. The plotted line reflects the first order derivative of model (6) with respect to the CSPP indicator, controlling for corporate and time fixed effects, but excluding country, country*time and sector*time fixed effects to prevent multicollinearity issues. The dotted lines represent the 95% confidence interval.

5 Robustness checks

5.1 Addressing endogeneity and dynamics

The previous estimations may be biased to the extent a corporate's debt purchased under the CSPP and stock of bank loans are jointly determined. Moreover, the relationship between a corporate's bank dependence and the CSPP may be dynamic. Therefore, as a robustness check, Table 11 presents two-step *system* GMM panel estimations for a dynamic version of model (1):

$$BD_{i,j,s,t} = \alpha + \gamma BD_{i,j,s,t-1} + \beta' CSPP_{i,s,j,t} + \zeta' X_{i,j,s,t} + \mu_{i,j,s} + \eta_t + \kappa_{s,t} + \nu_{j,t} + \varepsilon_{i,j,s,t} \quad (7)$$

where the first lag of the bank dependence indicator is included on the right-hand side of the equation.¹⁶ The estimations are based on Arellano and Bond (1991) and Arellano and Bover (1995). Unobserved corporate-specific effects are eliminated by taking the first difference of equation (7). It is assumed that the CSPP indicators and all other right-hand side variables are weakly exogenous, i.e. that they may be correlated with lagged observations of a corporate's bank dependence, but are uncorrelated with current and future realizations of the error term. To address this, the first lag of the right-hand side variables of model (7) are included as instruments for the regression in differences, also referred to as internal instruments.

The *system* GMM estimator combines the regression in first-differences with the original regression in levels. In contrast to the *difference* GMM estimator, the *system* GMM estimator increases the efficiency and reduces a potential finite sample bias (Blundell and Bond, 1998). The regression in levels includes the first lag of the difference of the CSPP indicators and all control variables as instruments. These instruments are appropriate under the assumption that the right-hand side variables may be correlated with

¹⁶Sector*time fixed effects for the sectors related to biotechnology and life sciences, and waste management and treatment are excluded. These sectors have relatively few observations (see Table 5) which leads to multicollinearity issues in the regression.

Table 11: CSPP's instrumented effect on bank dependence using GMM

Regressors	1	2	3	4	5	6
CSPP aggregate	-2.01*** (0.38)	-1.87*** (0.38)	-2.06*** (0.37)			
CSPP flow				-2.82*** (0.90)	-2.57*** (0.90)	-2.38** (0.96)
Lagged bank loans over debt	0.41*** (0.06)	0.40*** (0.07)	0.39*** (0.06)	0.42*** (0.06)	0.42*** (0.07)	0.42*** (0.06)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	No	No	Yes	No	No
Country*time fixed effects	No	Yes	No	No	Yes	No
Sector*time fixed effects	No	No	Yes	No	No	Yes
N	3,538	3,538	3,538	3,538	3,538	3,538
Sargan test	0.02	0.82	0.44	0.01	0.48	0.17
Arellano-Bond AR(2) test	0.36	0.00	0.75	0.57	0.44	1.00

Notes: This table presents the GMM estimations for model (7). The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country*time fixed effects. Columns 3 and 6 control for sector*time fixed effects. The first lag of all right-hand side variables are included as internal instruments in levels and differences in the system of regressions. The time, sector*time and country*time dummies are included as exogenous instruments in the system of regressions. The table reports the p-values from the Sargan test of over-identifying restrictions and the Arellano-Bond AR(2) test. Significance levels: * p0.1, ** p0.05, *** p0.01.

the time-invariant fixed effects when the right-hand side variables are in levels, but not when they are in differences (see Arellano and Bover, 1995). The time, sector*time and country*time dummies are included as exogenous instruments in the system of regressions.

Table 11 reports the p-values from the Sargan test of over-identifying restrictions and the Arellano-Bond AR(2) test. At the 10% significance level, the null hypothesis of valid instruments and no second-order serial correlation is rejected in the first and fourth column, but cannot be rejected in the other four columns. The GMM results indicate that the accumulation and yearly flow of CSPP purchases reduce a corporate's bank dependence at the 1% significance level in all columns. These estimations thus statistically validate the results of model (1). The value of the coefficients is close to -2 in the first three columns, suggesting that a corporate's stock of bank loans is reduced by more than its accumulated debt purchased under the CSPP. The negative effect on

a corporate’s bank dependence is even larger when looking at the yearly flow of CSPP purchases. The values of the coefficients estimates range between -2.4 and -2.8 in the last three columns. The effects of the CSPP indicators are statistically similar when including longer lags of all the right-hand side variables in levels and differences as internal instruments in the system of regressions (available upon request).

5.2 Addressing heterogeneity across countries and sectors

As explained in the data section, corporates whose debt is purchased under the CSPP are headquartered in only part of the countries in the sample. This is because the credit quality of corporates headquartered in some euro area countries is considered non-eligible for the CSPP. To check whether including these countries does not drive the results, model (1) is estimated on a sample that excludes countries with no CSPP activity. The results are presented in Table 12. Similarly, corporates whose debt is purchased under the CSPP are active in only part of the sectors in the sample. To check whether including these sectors does not drive the results, model (1) is also estimated on a sample that excludes sectors with no CSPP activity. The results are presented in Table 13. The results are relatively similar to the results in Table 4.

5.3 Other robustness checks

Several other robustness checks have been performed (all available upon request). First, all models have been augmented with trend variables that account for linear and quadratic trends for corporates whose debt is purchased under the CSPP. As an alternative, the models have also been augmented with linear and quadratic trends that are homogeneous across the treatment and control group. The results remain statistically and economically similar, even when the estimations control for treatment-specific trends. Second, the dependent variable is substituted with an alternative indicator for a corporate’s bank dependence, measured as bank loans over total assets. These estimations yield statis-

Table 12: Excluding countries with no CSPP activity

Regressors	1	2	3	4	5	6
CSPP aggregate	-0.89** (0.38)	-0.99*** (0.37)	-0.98*** (0.36)			
CSPP flow				-1.17** (0.52)	-1.37** (0.53)	-1.19** (0.54)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.28	0.28	0.27	0.27	0.26	0.26
N	4,009	4,009	4,009	3,527	3,527	3,527

Notes: This table presents the fixed effects estimations for model (1) over a sample that excludes corporates headquartered in countries with no CSPP activity. The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

Table 13: Excluding sectors with no CSPP activity

Regressors	1	2	3	4	5	6
CSPP aggregate	-0.90** (0.38)	-0.99*** (0.37)	-0.99*** (0.36)			
CSPP flow				-1.19** (0.52)	-1.35** (0.54)	-1.18** (0.54)
Corporate controls	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixed effects	Yes	No	Yes	Yes	No	Yes
Country fixed effects	No	Yes	No	No	Yes	No
Sector fixed effects	No	Yes	No	No	Yes	No
Time fixed effects	Yes	Yes	No	Yes	Yes	No
Country*time fixed effects	No	No	Yes	No	No	Yes
Sector*time fixed effects	No	No	Yes	No	No	Yes
R-sqr (within)	0.26	0.26	0.25	0.25	0.24	0.24
N	3,812	3,812	3,812	3,358	3,358	3,358

Notes: This table presents the fixed effects estimations for model (1) over a sample that excludes corporates active in sectors with no CSPP activity. The dependent variable is bank loans over total debt and indicates a corporate's bank dependence. Robust standard errors clustered at the corporate level are given in parentheses. Columns 1 to 3 show the effect of the accumulated corporate debt purchases by the Eurosystem. Columns 4 to 6 present the effect of the yearly flow of corporate debt purchases by the Eurosystem. All columns include the following corporate-specific control variables: long-term debt over total assets, total shareholders' equity over total debt, total net amount of property, plant and equipment over total assets, net income over total assets, retained earnings over total assets, the four-year rolling median EBITDA over the four-year median rolling interest paid. Columns 1 and 4 control for corporate and time fixed effects. Columns 2 and 5 control for country, sector and time fixed effects. Columns 3 and 6 control for corporate, country*time and sector*time fixed effects. Significance levels: * p0.1, ** p0.05, *** p0.01.

tically similar results. Third, similar estimations have been employed using the more heterogeneous control group that includes the relatively small firms and observations with negative book values of equity. This control group includes 2,116 non-financial corporations, many of which have not yet entered the capital market. These results are also statistically similar.

6 Conclusion

The CSPP impacts the funding structure of non-financial corporations. The large-scale corporate debt purchases by the Eurosystem reduce the dependence on bank financing of corporates whose debt is purchased. Purchasing corporate bonds on a large-scale improves the market liquidity of the assets purchased. This reduces price frictions and incentivizes corporates to shift to more market financing. While the Eurosystem also directly supports bank financing via covered bond purchases and longer-term refinancing operations, corporate debt purchases seem to have the strongest influence on corporates' funding structure.

However, the extent to which a corporate substitutes bank loans with market debt depends on its financing costs. The CSPP only incentivizes those corporates which are subject to relatively high amounts of interest or financial expenses. The market's valuation of a corporate also plays a role in the impact of the CSPP on a corporate's bank dependence. The CSPP only reduces the bank dependence of corporates which have a relatively high price-to-book ratio. The market's valuation of a corporate thus influences a corporate's ability to switch from bank to market financing.

The findings are encouraging, as corporates' reliance on bank funding can have negative implications. Banks are leveraged institutions which may have to reduce bank lending during financial or sovereign crises. This deteriorates the performance of bank-dependent corporates and may have adverse real economic implications, such as a drop

in the employment growth rate at these corporates. Market financing can mitigate these real economic losses by acting as an alternative source of financing. Reducing the dependence on bank financing can improve corporates' access to alternative financing sources. Over time, markets are likely to become more developed when banks are less dominant, making market financing more attractive. The design of financial sector and fiscal policies can take this into account and make the effect of the CSPP more persistent. The introduction of the European capital markets union is a case in point.

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