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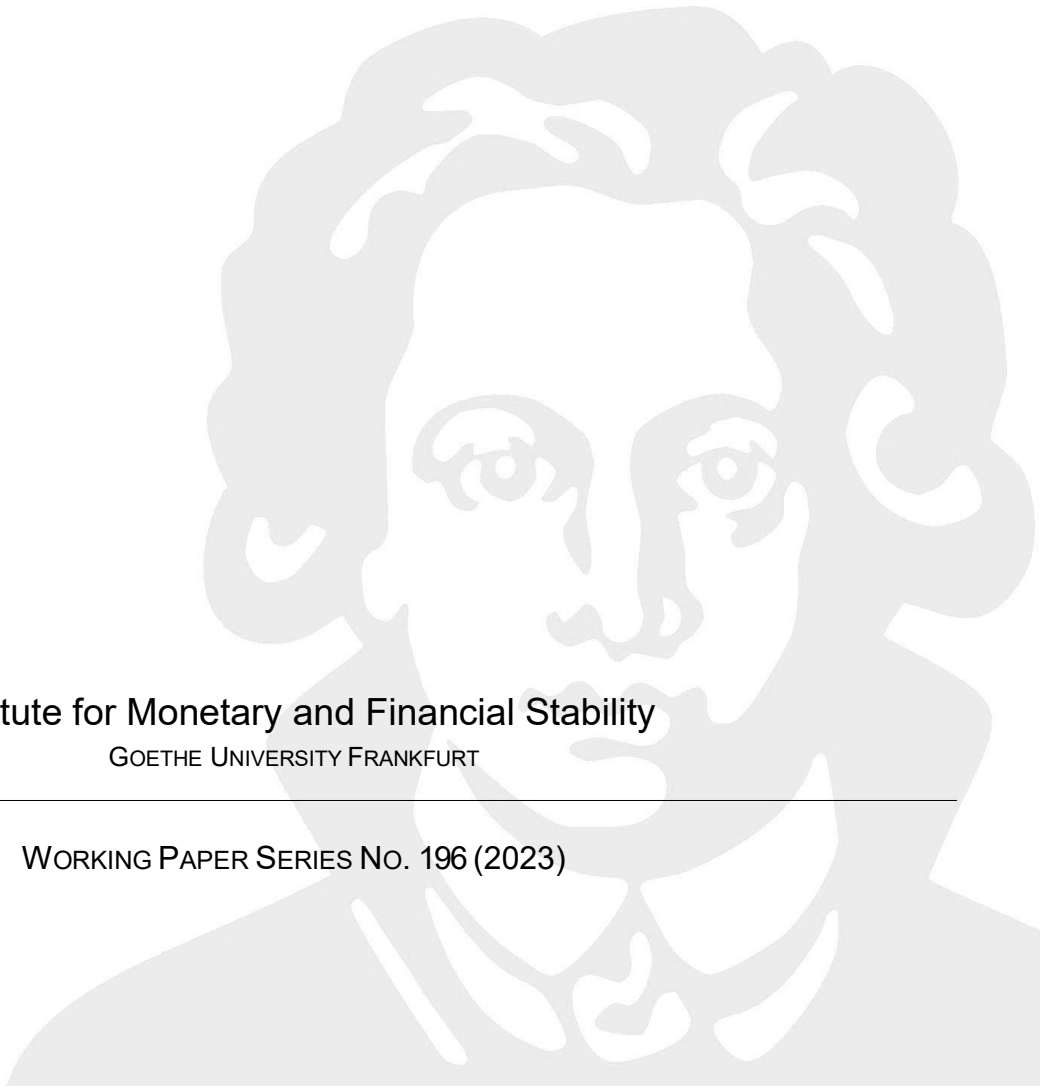

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Unintended Consequences of QE:

Real Estate Prices and Financial Stability*

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Abstract

We investigate how unconventional monetary policy, via central banks' purchases of corporate bonds, unfolds in credit-saturated markets. While this policy results in a loosening of credit market conditions as intended by policymakers, we report two unintended side effects. First, the policy impacts the allocation of credit among industries. Affected banks reallocate loans from investment-grade firms active on bond markets almost entirely to real estate asset managers. Other industries do not obtain more loans, particularly real estate developers and construction firms. We document an increase in real estate prices due to this policy, which fuels real estate overvaluation. Second, more loan write-offs arise from lending to these firms, and banks are not compensated for this risk by higher interest rates. We document a drop in bank profitability and, at the same time, a higher reliance on real estate collateral. Our findings suggest that central banks' quantitative easing has substantial adverse effects in credit-saturated economies.

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1 Introduction

With interest rates at the zero lower bound since the last decade, central banks shifted their focus to new unconventional monetary policy tools. The primary rationale for these quantitative easing (QE) policies is to further stimulate corporate investments via the provision of external funding to the real sector (Benmelech and Bergman, 2012). While recent literature has discussed the effectiveness of these monetary policy measures in general,[1] the consequences of QE in saturated credit markets is still an open question. Importantly, there is heterogeneity within currency areas, so some areas tend to be characterized by a booming economy while other areas experience weak economic conditions. Further, central banks might find it hard to unwind QE tools once economic conditions improve or inflation picks up.[2] For these reasons, it is essential to understand the consequences of QE policies conducted in saturated credit markets.

In this paper, we focus on the impact of an important QE policy by the ECB, the Corporate Sector Purchase Programme (CSPP), on Germany, an economy with a saturated credit market at that time. In 2016, the ECB started to purchase investment-grade rated corporate bonds to stimulate lending to the real sector. The main idea is that firms with direct access to bond markets issue more bonds, allowing banks to increase loan supply to firms without access to bond markets. The CSPP's impact on the European bond market is remarkable. Until June 2022, the ECB bought about €350bn of corporate bonds, equivalent to 31% of all outstanding eligible bonds and equivalent to 7% of bank lending to non-financial

[1] See, e.g., Acharya et al. (2019), Krishnamurthy and Vissing-Jorgensen (2011) and Heider et al. (2019).

[2] Despite high inflation rates, the ECB expanded its sovereign and corporate bond purchases until June 2022 and still reinvests the redemptions since then (until February 2023 fully, since March 2023 only partly (ECB, 2023)).

firms.[3]

In Germany, unemployment rates have been considerably low in absolute terms and relative terms compared to other Euro area economies around this period (see Figure IA.1). Survey evidence further suggests that large corporations and SMEs have low loan demand in Germany (see Figure IA.2). According to the ECB's access to finance survey, less than 5% of German firms consider access to finance a problem. Thus, Germany provides an ideal laboratory since it was characterized by a saturated credit market when the ECB initiated the corporate QE policy.

Based on proprietary data from Deutsche Bundesbank, we empirically investigate how the CSPP impacted credit markets, economic activity, and financial stability in Germany. Our identification strategy is as follows. Banks differed in their lending exposure to CSPP-eligible firms when the program was introduced. Importantly, the CSPP announcement was not anticipated by the market such that the event constitutes a credible source of exogenous variation.[4] Our difference-in-differences estimation thus compares those banks that had high exposure to CSPP eligible firms with banks that were less affected, before the CSPP announcement relative to after the CSPP announcement.[5] Three observations underscore the plausibility of our identification strategy: first, before the introduction of the CSPP, treated and control banks exhibited similar profitability, regulatory capital ratios, and reliance on real estate collateral. Second, treated and control banks show similar pre-trends across all our specifications. Third, results on bank lending post-CSPP are robust to using a within-firm

[3] In 2019, the end of our sample period, the ECB held about a quarter of all outstanding eligible bonds (ICMA, 2022).

[4] See, e.g., https://www.bloomberg.com/news/articles/2016-08-02/now-we-have-two-answers-to-the-ecb-corporate-liquidity-question

[5] See Grosse-Rueschkamp et al. (2019) for a similar identification strategy.

Khwaja-Mian strategy to isolate demand from supply.

Our empirical analysis yields the following three findings. First, we provide evidence of capital misallocation. In line with previous studies, we show that banks affected by the QE policy expand corporate lending to CSPP-ineligible firms relative to less affected banks. This credit expansion, however, does not affect all sectors but is concentrated in the real estate sector. Within the real estate sector, we find a zero effect for construction firms and developers, with the full effect stemming from real estate asset managers. These real estate firms invest in existing properties using a mix of debt and equity but do not build or develop the real estate themselves. This reallocation is consistent with real estate asset managers being both attractive to lend to for banks (as they pledge high amounts of real estate collateral) and very responsive to improvements in financing conditions compared to other sectors. Since the capacities in the construction sector do not constrain real estate asset managers compared to real estate developers, they can scale up their activities once lower funding costs improve the profitability of investment objects. Because real estate asset managers fare worse on traditional productivity measures, the QE policy is associated with reallocating funds to unproductive sectors.

Second, this credit expansion to real estate asset managers directly impacted real estate prices in Germany. There has been a drastic increase in the growth rate of real estate prices and the price-to-rent ratio following the implementation of the ECB policy. Following the diff-in-diff strategy suggested by Huber (2018), we compare regions where affected banks were particularly active with regions where these banks have been less active. We document a substantial increase in real estate prices in those affected regions. Proxies for the overvaluation of real estate prices, such as the price-to-rent ratio or price-to-income ratio,

suggest that the QE policy contributed to real estate overvaluation. The consequences of this development also triggered supervisory attention: The European Systemic Risk Board (ESRB) in 2019 issued a warning that residential real estate overvaluation and a loosening of real estate lending standards in Germany pose a risk to financial stability (ESRB, 2019).[6]

Third, several measures suggest that the ECB policy adversely impacted the banking sector's stability. Central banks' practice of only accepting high-quality assets from commercial banks as collateral to prevent moral hazard (see, e.g., Aghion and Bolton (1992)) impacts the composition of borrowers that demand bank debt: central banks selectively pick the safest customers and leave more risky borrowers for commercial banks. The average probability of default and industry sector concentration of affected banks' loan portfolios increased in response to the QE policy. At the same time, affected banks rely more on real estate collateral. Affected banks did not get compensated for carrying higher risk. While the net interest margin remained constant, we observe an increase in loan write-offs. Thus, the profitability of affected banks has been negatively affected.[7]

Overall, our assessment of the QE policy measure in a saturated credit market is quite negative. While financial stability deteriorated, the policy can potentially contribute to real estate bubbles and does not yield any benefits in stimulating the real sector.

In how far are our result specific to the central banks directly purchase corporate debt or

[6] As the situation on the German housing market further deteriorated, the ESRB reiterated on the topic in 2021 (ESRB, 2021). Further, Deutsche Bundesbank reported nationwide overvaluation in residential real estate of 20-35% in its February 2022 Monthly Report (Bundesbank, 2022). Anecdotal evidence is further provided by the UBS' Global Real Estate Bubble Index, in which Frankfurt and Munich are ranked among the five cities worldwide with the highest real estate overvaluation in any report since 2019 (UBS (2019), UBS (2020), UBS (2021), UBS (2022)).

[7] Due to the decrease in corporate bond yields, bond prices increase and banks holding long-term corporate bonds bonds experience capital gains. CSPP-eligible bond holdings account for less than 0.5% of total assets for the average bank in our sample, so that overall bank profitability was adversely impacted by the CSPP.

is it also applicable to other QE policies in more general? The allocation of funding to real estate asset managers results from a decrease in funding costs when other sectors do not demand more funds (or cannot further scale up their activities). Note this is independent from the CSPP and we would expect a similar impact of other QE policies in a saturated market. The impact on bank profitability is likely more pronounced for the CSPP as compared to other QE policies. The reason is that ECB decreases loan demand from particular safe borrowers (i.e., firms with an investment-grade rating). By taking away low risk customers, banks are forced to increase their risk-taking without and do not get compensated for it due to the lower lower spreads.

Our paper contributes to the literature evaluating the impact of QE measures. A meta-analysis of 54 studies standardizing QE program size to 1% of the country's GDP finds an average increase of the output level by 0.24% and price level by 0.19% (see Fabo et al. (2021)). Most of these studies document statistically significant output and price effects in response to QE programs. In line with these findings, several studies document more bank lending and easing of credit constraints in the corporate sector. Specifically for the ECB's CSPP, Grosse-Rueschkamp et al. (2019) document that the program relaxed banks' lending constraints, which results in banks increasing lending to private (and profitable) firms, which experience investment growth.[8]

Previous literature has also documented adverse effects of QE measures in non-saturated credit markets. Acharya et al. (2019) find negative consequences regarding credit allocation in response to the ECB's OMT program once banks are undercapitalized. They document zombie lending by banks that remained weakly capitalized even post-OMT. In turn, firms

[8]See Ertan et al. (2020), Arce et al. (2018) and De Santis et al. (2018) for similar evidence.

receiving loans used them not to foster real economic activity, such as employment and investment, but to build cash reserves. However, there is so far no evidence of the impact of QE in saturated credit markets. As firms are not credit-constrained and few zombies are out there, it is clear that the effects described above are not predominantly at play.

Our study further adds to the literature on Germany's housing boom after the financial crisis (Kindermann et al. (2021), Boddin et al. (2021), Bednarek et al. (2021)). However, our channel through which property prices increase, namely via banks' QE-driven reallocation towards real estate asset managers, is different compared to those studies. Our study illustrates how QE policies, in particular, can have an impact on real estate prices in addition to conventional monetary policy (see, e.g., Jordà et al. (2015) or Iacoviello (2005)).

In a broader sense, our paper further contributes to the literature on low-interest rates and capital misallocation. Cette et al. (2016) argue that the sharp decline in real interest rates in Southern Europe triggered unfavorable resource reallocations that were large enough to reduce total factor productivity. Müller and Verner (2021) find that lending booms to the non-tradable sector trigger worse economic contractions than those to the tradable sector. This is of relevance to us as we document a substantial increase in lending to the real estate sector, which constitutes a significant part of the non-tradable sector. Liu et al. (2022) identify a strategic effect of lower interest rates on market concentration which implies that aggregate productivity growth declines as the interest rate approaches zero.

Our findings further suggest that central bank corporate bond buying programs threaten bank profitability, which is already under pressure in times of historically low-interest rates (see, e.g., Borio et al. (2017), Brunnermeier and Koby (2018) and Heider et al. (2019)). Balloch (2018) provides empirical and theoretical evidence that as bond funding is facilitated

for large firms, banks' corporate loan portfolios decrease in quality to the extent that bank profitability decreases. Arce et al. (2018) document similar spillovers but conclude that the pool of bank borrowers does not become substantially worse, as spillover firms are rather large and not overly risky. Our study aims to rigorously tackle these rather vague predictions by providing exact information on who receives additional credit and to which extent this affected banks' corporate loan portfolio risk.

The rest of the paper is organized as follows. In Section 2 we describe the institutional details surrounding ECB's corporate bond purchase program. Section 3 presents our data sets and descriptive statistics. Our research design is explained in Section 4. Sections 5, 6 and 7 describe our empirical results on capital allocation, real estate valuation and financial stability, respectively. Section 8 concludes.

2 Institutional Setting: The ECB's Corporate Sector Purchase Programme (CSPP)

As part of its unconventional monetary policy package to stimulate the Euro Area economy in response to low inflation rates, the ECB in 2016 started to purchase corporate bonds under the Corporate Sector Purchase Programme (CSPP) (ECB, 2016). Concretely, the CSPP was announced on March 10^{th} 2016 and began operating from June 8^{th} 2016. Since then, on average, monthly net purchases amounting to around €5.5bn took place (except for January to October 2019, where no net purchases took place).[9] Since March 2020, the

[9]In this period, there were only reinvestments of matured bonds' principal. The restart of the CSPP in November 2019 was due to the weak economic outlook in the Euro Area. Since July 2022, which is out of our sample period, again, only reinvestments have taken place. The ECB expects these reinvestments to last

CSPP has been complemented by the ECB's Pandemic Emergency Purchase Programme (PEPP), under which further purchases of the same eligible universe were carried out.

The unexpected announcement of the CSPP in 2016 triggered eligible bonds' (and to some extent ineligible bonds') spreads to decline substantially even before the purchases began (see De Santis et al. (2018) and Figure IA.3).[10] This drastic decrease in funding cost translates into more bond issuances, as can be seen in Figure IA.3. The ECB's corporate bond holdings are sizable. As of June 2022, CSPP holdings amount to around €305bn, which, together with around €40bn of corporate bond holdings under the PEPP, amounts to €345bn. This represents about 31% of the eligible universe of corporate bonds (ICMA, 2022), and it is equal to 2.5% of outstanding bank lending in the Eurozone and 7% of outstanding bank lending to non-financial corporations in the Eurozone.[11]

In order to qualify for the CSPP, a bond must be Euro-denominated and issued by a non-financial firm incorporated in the Euro Area. It further must have a remaining maturity of between 6 months and 30 years[12], a yield to maturity that exceeds the ECB's current deposit facility rate and an Investment Grade (IG) rating (BBB- or better on the S&P scale) by at least one external credit rating institution out of those four that the ECB accepts (S&P, Moody's, Fitch, DBRS). In contrast to the ECB's Public Sector Purchase Programme (PSPP), purchases not only take place in the secondary market but also in the primary

at least until the end of 2024

[10]"The ECB's surprise announcement in March to extend its asset-purchase program to investment grade non-bank corporate bonds triggered a rapid, and indiscriminate, tightening of credit spreads and a jump in primary-market issuance. And that was all before the central bank purchased a single corporate bond." (Bloomberg (August 2016))

[11]Loans to Euro Area Residents were €14trn as of June 2022, of which €5trn are loans to non-financial corporations. See https://sdw.ecb.europa.eu/reports.do?node=10000029 and http://sdw.ecb.europa.eu/reports.do?node=10000031 for details.

[12]Since the announcement of the PEPP in March 2020, commercial paper, i.e., bonds with remaining maturity below six months but at least 28 days, is also eligible for purchase.

market. Further, purchases are carried out not directly by the ECB but by six national central banks under the coordination of the ECB. A purchase limit of 70% per ISIN applies, i.e., the ECB must not hold more than 70% of an individual bond. Notably, the purchases are supposed to be market neutral because bonds from no country or industry shall be bought disproportionally relative to the eligible universe (Cœuré, 2015). This feature already alludes to the issue that the ECB cannot focus its corporate bond purchases on potentially needy market segments but must also intervene in saturated markets if it decides to buy corporate bonds.

The CSPP had a substantial impact on corporate bond spreads and bond issuance. As documented by several policy reports and previous research papers, corporate bond spreads decreased significantly in response to the start of the CSPP and spreads continued to trend downwards afterwards (see Appendix Figure IA.3, Panel A). All else equal, this trend makes bond funding relative more attractive than bank funding for corporations active on bond markets. In line with this prediction, there is an increase in corporations' issuance of euro-denominated long-term debt (Appendix Figure IA.3, Panel B).

3 Data and Descriptive Statistics

3.1 Loan information from the German Credit Register and Supervisory Data

Our main data sources are proprietary supervisory datasets provided by Deutsche Bundesbank. The German Credit Register collects each quarter all outstanding exposures of at least

€1m by German banks.[13] All of a bank's loans to a specific firm are consolidated into a single data point, so that there is one observation (i.e., one "loan") per bank-firm-quarter. The Credit Register includes information on borrower's identity, industry classification, the outstanding exposure amount, and several other loan characteristics as the assigned Probability of Default (PD) and the amount of collateral associated with the exposure.

We narrow down the Credit Register to banks' Eurozone non-financial corporate loan portfolio, as it comprises both CSPP-eligible firms and potential spillover firms.[14] We manually flag those firms that are CSPP eligible, i.e., have at least one bond outstanding that fulfills all CSPP criteria in the quarter prior to the CSPP, i.e. as of 2015q4. Our sample runs from 2012 to 2019.

As the German baking systems comprises at large number of very small banks (that consequently have very few loans above the reporting threshold of €1m/€1.5m to non-financial corporations), we impose two restrictions in order to let a bank enter our sample. We only include those banks that between 2012 and 2015 i) on average lend more than €250m to Eurozone non-financial corporations and ii) have at least one loan to a CSPP-eligible firm. Criterion i) ensures that banks have sizeable Eurozone non-financial corporation portfolios and criterion ii) ensures that we do not deal with very specialized banks. Our results are comparable for other thresholds and/or when omitting the second assumption. We further drop banks that engage in mergers throughout our time period.

We then enrich the credit register with bank balance sheet and P&L information and

[13] As there is a reporting threshold of €1m (before 2015: €1.5m), we exclude bank-firm relationships that never exceed €1.5m (as in Behn et al. (2022)).

[14] We keep financial holdings of non-financial corporations (i.e., have NACE Code 64.20), as several CSPP eligible corporations often use these holdings to issue bonds and/or loans (e.g., BMW Finance N.V. for BMW AG).

from the Bundesbank's BAKIS and SON datasets, respectively. We winsorize all variables that are not in logs and that are not shares bounded to [0,1] at the 1% and 99% level.

Table 1, Panel A, provides descriptive statistics on the main variables used throughout our bank-level analysis, separately for treated banks and control banks. All variable definitions can be found in the Variable Appendix. We consider a bank as treated if its lending to CSPP eligible borrowers divided by total Eurozone corporate lending averaged between 2014q1 and 2015q4 (*Share Eligible (Static)*) is above-median. Treated banks on average have 13.75% of their total corporate lending to CSPP-eligible firms, while the average for control banks is 1.69%.

As they have a larger fraction of CSPP eligible (and therefore IG-rated) borrowers, treated banks have fewer high-yield borrowers in their loan book (20.58% vs 25.82%) and the volume-weighted PD of their loan book is considerably below that of control banks (2.21% vs 3.70%). In Figure 2, we plot the volume of lending by treated and control banks during our sample period. The graph illustrates a constant increase in the outstanding loan balance already before the ECB intervention as well as after the ECB intervention for both types of banks. Interestingly, treated banks keep increasing their lending at a virtually identical rate compared to control banks. This observation could be interpreted as a success of the ECB policy since treated banks do not reduce lending (even loan demand by eligibles has likely dropped). To understand how treated banks reshuffle their loan book to keep up their loan supply, we add industry classifications to the credit register firms below.

Treated and control banks are equally profitable (with an average RoA of 0.79%), but treated banks have a lower net interest income (1.82% vs. 1.91% of total assets) due to lending to on average safer borrowers, but for the same reason face fewer profit-impeding

loan write-offs (0.19% vs. 0.28% of total assets). All other return components again are virtually equal for treated and control banks.

What is less clear a priori is that treated banks on average are larger (in terms of both total corporate lending and total assets). However, when considering the median, the differences vanish, suggesting that among the treated banks some are very large. The size difference might also account for the fact that treated banks have a higher off-balance-sheet ratios than control banks. While the deposit ratio and the share of fee income are roughly equal for treated and control banks, treated banks are slightly better capitalized, again possibly due to less risky borrowers and therefore lower Risk-Weighted Assets (RWA).

We apply the 21 NACE-industry classification to all banks' borrowers. All industries that account for less than 1% pre-CSPP portfolio share are summarized under 'Other Industries'. In addition, we summarize all firms with an outstanding investment-grade bond under 'Eligibles'. We further divide the NACE category 'Real estate' into 'RE - Asset Management', 'RE - Development' and 'RE - Construction'. While 'RE - Construction' firms can be directly identified based on their NACE-industry classification code, we use the legal identity and the corporate structure to differentiate among the two others. 'RE - Asset Management' are either companies under civil law (GbR) or limited partnership (GmbH & Co KG). The reason is that this legal entity allows to optimize trade income tax after real estate objects are sold with capital gains. 'RE - Development' are generally limited liability companies (GmbH) and stand-alone firms, since real estate developers typically founding separate legal entities for each project and liquidating them once a project is finished. The existence of firms that both engage in asset management and project development (e.g. when a firm originally wants to develop an apartment but then decides to rather sell it) could therefore

add noise to our results. We therefore hand-checked the resulting classification to verify that our classification is appropriate. There are only very few firms that fall in both categories and therefore add noise.

Table 1, Panel B, provides summary statistics of our sample of non-financial corporations according to their industry classification described above. The 559 firms that are eligible for the CSPP are clearly the largest firms based on total assets and the average outstanding loan amount for a given bank-firm lending relationship is about €100m. There are about 21,000 real estate asset managers and 15,000 real estate developers. The remaining 6,000 firms are construction firms. Both real estate developers and asset managers corporations are the youngest, since entrepreneurs tend to create new companies for each project. The real estate sector tends to be the most leveraged sector - but there considerable differences regarding the ratio employees to assets within the real estate sector. This ratio is about six times higher for construction firms compared to asset managers and developers. However, developers in contrast to asset managers require construction firms to undertake a project. Thus, real estate asset managers can be classified as labor unintensive with external funding being their main constraint to grow.

Table 1 provides further evidence on the nature of real estate asset managers in comparison to firms of other industries. Real estate asset managers are numerous, with 21,330 firms in our sample, in contrast to only 559 CSPP eligible firms. However, the average real estate asset manager is relatively small with about €29m in total assets, and about €7m in quarterly lending from sample banks. Real estate asset managers' capital structure also differs from that of eligible firms, as the former employ considerably more leverage.

3.2 Real Estate Prices and County-level Data

The second part of our empirical analysis investigates the impact of the CSPP on real estate prices. Our analysis exploits variation in the regional presence of affected banks. We construct our county x year level dataset, based firm-level balance sheet data from BvD Amadeus, real estate price data from Bulwiengesa and public macroeconomic data from the German statistical agencies *(Volkswirtschaftliche Gesamtrechnungen der Länder)*. We aggregate firms' total assets (separately for real estate firms and non-real estate firms) per county and year. In case of Bulwiengesa, we bring data for the municipal to the county level by calculating the mean across all municipalities in a county.

Comparable to Huber (2018), we consider those counties as treated, i.e. highly affected by CSPP spillovers, whose firms' weighted CSPP affectedness (measured by the affectedness of their lenders) is above-median.[15] Table 1, Panel C, provides descriptive statistics on the county level, separately for treated and control counties. The mean treated county firms' have about €15.63bn in assets, thereof €1.35bn are from real estate firms. While the latter number is comparable for control counties (€1.38bn), control county non-real estate firms' only have about €10.39bn total assets, such that the real estate fraction in control counties is about 50% higher than in treated counties (11.91% vs 8.18%).

Treated and control counties further differ in terms of their real estate prices: Both the price and the rent of existing (i.e. not newly built) apartments are higher in treated counties. As this difference between treated and control counties is higher for prices than for rents, the average price to rent ratio is also higher for treated counties (21.72 vs 20.30). However, the price to income ratio is almost identical, suggesting that higher prices in treated counties are

[15] See the Variable Appendix for a numerical example.

set off by higher income. Indeed, the average GDP per capita amounts to €37,819 in treated counties and clearly exceeds the one in control counties (€33,031). The same holds for GDP per hour. These differences between counties do not come by chance as CSPP eligible firms are incorporated disproportionally often in counties with high economic power.

4 Research Design

4.1 The effect of central bank corporate bond purchases on affected banks' credit allocation

To examine the impact of the CSPP on banks' allocation of credit, we first investigate how banks change the composition of their loan portfolio around the CSPP. For identification purposes, we exploit the fact that banks have been affected differently by the CSPP depending on their lending exposure to CSPP-eligible firms at the time of the policy announcement. Those banks that previously lend a large proportion of their loans to CSPP-eligible firms are relatively more affected by the ECB policy compared to banks with a small exposure to CSPP. Comparing the loan portfolio composition of these two types of banks around the CSPP announcement.

We estimate the following bank-level difference-in-differences specification:

$$y_{bt} = \beta \times Treat_b \times After_t + Controls_{bt-1} + \gamma_b + \gamma_t + \varepsilon_{bt} \tag{1}$$

where b indicates bank and t period (i.e. quarter or year depending on the specification). y_{bt} is a bank portfolio composition or profitability measure. $Treat_b$ is equal to one for banks

whose share of lending to CSPP eligible firms (relative to total Eurozone corporate lending) in the two years before the CSPP is above the median. $After_t$ is equal to one for quarters after 2015q4 or years after 2015. γ_b and γ_t are bank and quarter/year fixed effects. We further include lagged control variables (Log Total Assets, Capital Ratio, Deposit Ratio, Off-Balance-Sheet Ratio and Share of Fee Income). We cluster standard errors on the bank level, i.e. the level of treatment (Bertrand et al., 2004). The coefficient of interest, β, measures whether highly CSPP-affected banks differ in terms of portfolio composition or profitability after the CSPP was announced, relative to less CSPP-affected banks. Our identifying assumption therefore is that after including the above-mentioned controls and fixed effects, treatment (i.e. lending to a large fraction of CSPP eligible borrowers) is as good as randomly assigned, i.e. that treatment and control banks do not differ in their loan granting based on unobservables. We find evidence for this parallel trend assumption to hold throughout all our tests (see e.g. Figures 1, 3, 8 and 9).

Previous results allow us to observe CSPP-induced changes in credit allocation of affected vs. unaffected banks. We are further interested what of these changes can be attributed to a change in loan demand (e.g., eligibles demanding less loans due to more bond financing) and which changes are driven by a change in banks' loan supply due to CSPP. To do so, we move from bank-level analysis to loan-level analysis which allows us to systematically control for loan demand à la Khwaja and Mian (2008). For the intensive margin we estimate the following specification:

$$\Delta Ln(LoanAmount)_{bf} = \beta \times Treat_b + Controls_b + \gamma_f + \varepsilon_{bf} \tag{2}$$

where b indicates bank and f indicates firm. $\Delta Ln(LoanAmount)_{bf}$ is the difference in log loan amount between the post and the pre period. $Treat_b$ is a dummy that is equal to one for treated banks. γ_f are firm fixed effects to control for firms' loan demand.

4.2 The effect of central bank corporate bond purchases on real estate prices

To measure the impact of the CSPP on real estate prices, we follow Huber (2018) and compare the development of real estate prices around the CSPP in treated vs control counties, i.e. in countries with a high vs low CSPP affectedness. We therefore estimate difference-in-differences regressions at the county x year level of the following type:

$$y_{dt} = \beta \times Treat_d \times After_t + Controls_{dt-1} + \gamma_d + \gamma_t + \varepsilon_{dt} \tag{3}$$

where d indicates county and t year. y_{dt} is a measure on the county level, such as some average real estate price. $Treat_d$ is equal to one for counties whose firms' weighted CSPP affectedness (measured by the affectedness of its lenders) is above-median. E.g. suppose in some county there is only one firm. In 2015, the firm borrows €2m in total, thereof €1m from bank A (whose share eligible is 0% in 2015) and €2m from bank B (whose share eligible is 15% in 2015). Share county (Static) is then equal to €1m/(€1m+€2m)×0%+€2m/(€1m+€2m)×15% =10%. $After_t$ is equal to one for years after 2015. γ_d and γ_t are bank and year fixed effects. We further include lagged control variables (Log GDP per capita and log GDP per hour worked). We cluster standard errors on the county level, i.e. the level of treatment.

Our identifying assumption therefore is that after including the above-mentioned controls

and fixed effects, treatment (i.e. CSPP affectedness) is as good as randomly assigned across counties. We find evidence for this parallel trend assumption to hold throughout all our tests (see e.g. Figures 6 and 7).

5 CSPP-Induced Reallocation of Bank Lending to the Real Estate Sector

5.1 Impact of the CSPP on Banks' Portfolio Composition

We first estimate how the substitution of bank debt with bond debt by eligbile firms impacts banks' loan allocation. Our identification strategy compares the reaction by banks having a high share of eligible firms in their loan portfolio (referred to as treated banks) compared to those that have a low share of these borrowers (referred to as control group banks). Treated banks have a mean share of eligible firms of 13.75% in their loan portfolio compared control group banks that have a mean share of eligible firms of 1.69%.

Results from estimation specification (1) are provided in Table 2, Panel A. The CSPP resulted in a substitution of bank lending from eligible firms to ineligible firms. This substitution effect affects treated banks more than control group banks. Therefore, the fraction of lending to eligible firms over total lending decreases by 1.56-1.65 percentage points more for treated banks than for control group banks (see Columns (1)-(2)). We illustrate the dynamics of our coefficient of interest graphically for each year of our sample taking 2015 as a base year in Figure 1, Panel A. There is no difference in lending to CSPP eligible borrowers relative non-eligible borrowers between our two types of banks before the event. After the

CSPP has been initiated, we observe that the share of eligible borrowers decreases significantly over time for treated banks relative to control group banks. The relatively unchanged coefficient on eligibles from 2018 to 2019 can be rationalized by the fact that the ECB did not increase its CSPP holdings from January to October 2019 as described in Section 2.

Two facts are worth highlighting: first, the effect is economically sizable. Lending to eligible firms accounts for 12.98% of the portfolio of treated banks pre-CSPP. The decline by 1.56-1.65 percentage points, thus, represents 12-13% of the pre-event share of eligible lending at treated banks. Second, the coefficient of interest is stable across specifications with and without controls and with and without fixed effects. This suggests that the selection on observable variables is small: it moves the coefficient of interest by less than 0.1, or less than a tenth of the coefficient value. Using the arguments made by Altonji et al. (2005), the selection on unobservable variables would need to be at least a factor ten larger than the selection on observable variables to invalidate our results. Reassuringly, this coefficient stability holds not only for our first regression, but throughout all specifications that we report in the following.

Columns (3)-(4) of Table 2, Panel A, suggest no effect of the CSPP on overall lending amounts. Thus, the drop in lending to eligible firms was fully substituted by an increase in lending to ineligible firms. Reassuringly, this finding is in line with prior evidence provided by e.g. Grosse-Rueschkamp et al. (2019).[16] Again, we illustrate the dynamics of the treatment effect in Figure 1, Panel B. Throughout our sample period, we observe no significant differences in total corporate lending for the two type of banks. This evidence is in line with

[16]In Table IA.1, we further validate this finding by not only considering the Eurozone corporate loan portfolio, but banks' entire loan portfolio apart from interbank lending. Column (1) in Table IA.1 again shows that treated banks do not adjust their overall lending. Columns (2)-(9) in Table IA.1 suggest that the substitution is centered to the Eurozone, with no spillovers to e.g. retail lending.

the raw volumes we have presented in Figure 2 before, that illustrates that the CSPP did not have an impact on overall corporate lending.

CSPP eligible firms must have an investment grade rating and are therefore by definition low risk borrowers. Thus, the ECB selectively buys low risk debt which should result into a drop of loan demand by low risk borrowers. This fact should all else equal impact the average share of high-yield borrowers of the lending portfolio of treated banks. We determine for each bank portfolio in each year the share of high-yield firms defined as firms whose PD-implied rating is BB+ or worse. Columns (5)-(6) of Table 2, Panel A, suggest that treated banks substituted lending from low risk to high risk firms following the CSPP. The share of high-yield firms increases by about 1.5 percentage points relative to control group firms after the CSPP. Lending to high-yield ineligible firms can per se constitute an intended consequence of the CSPP. It increases funding for ineligible – and potentially constrained – firms and can therefore foster investment (Draghi, 2018). On the other hand, the riskiness of these firms might not be prices adequately, which is detrimental to banks' overall profit. We provide evidence for the latter in Section 7.

We now analyze in detail *where* the additional lending to those ineligible firms is going to.

5.2 Impact of the CSPP on Real Estate Lending

Table 2, Panel B, depicts changes in lending shares across industries. The dependent variable is the share of lending to industry X on the bank x quarter level, where the industry X is listed at the top of each column.

Strikingly, almost the entire decrease in lending to CSPP eligible firms (-1.65 percentage points) is allocated to the real estate sector (+1.53 percentage points). Figure 3 plots the dynamic treatment effect of the coefficients reported in Table 2, Panel B, Columns (1)-(3). The figure illustrates that the share of lending to the real estate sector by treated relative to control group banks has increased consecutively since the CSPP has been rolled out, which is in line with the ECB's increasing CSPP holdings.

The last three columns in Table 2, Panel B, deconstruct further the reallocation of funds by treated banks post-CSPP towards the real estate sector by subdividing the real estate sector into three mutually exclusive categories: construction firms, real estate developers and real estate asset managers. The crucial difference is that while firms of the former two categories build or renovate real estate, those of the latter buy existing buildings in order to sell or rent them at higher prices. Incremental fund flows to construction firms or developers should thus c.p. translate into incremental real estate supply while flows to real estate asset managers would translate into incremental real estate demand, potentially spurring prices. We examine this argument below in Table 5. We find that treated banks after the CSPP mainly allocated capital to real estate asset managers (+1.49 percentage points), whereas developers receive some additional funds (+0.29 percentage points) and the construction subsector even receives slightly less funds (-0.23 percentage points). We do not observe any significant changes in the portfolio share for any other NACE-21 industry, as Figure 4 shows.

We so far presented results mainly in Dif-in-Dif form. However, simple back-of-the-envelope calculations shows that our results are sizeable in the aggregate as well: 121 treated banks on average have €3bn in total corporate lending (see Table 1) and reallocate about 2% of their portfolio to real estate asset managers until 2019 (see Figure 3).

Therefore, about 121×€3bn×2%=€7.3bn are reallocated to real estate asset managers via the ECB's CSPP. As the average apartment in Germany costs about €1,750/m^2 (see Table 1, Panel C) and is about 92m^2 in size (German Federal Statistical Office, 2022), about €7.3bn/(€1,750/m^2*92m^2)=45,000 incremental transactions in existing apartments are triggered by the CSPP between 2016 and 2019. Since the total number of apartment transactions in Germany between 2016 and 2019 amounts to about 1,278,000, the CSPP contributed to about 3.5%.[17]

Previous results document the reallocation of loans by banks due to the CSPP. The bank-level analysis did not allow us to differentiate whether these results are driven by loan demand or banks' changing their supply. We therefore move from bank-level to loan-level analysis and apply a within-firm estimation in Table 3. As in Table 2, Panel B, we divide banks' corporate lending portfolio into the mutually exclusive categories 'Eligibles', 'Real Estate' and 'Other Ineligibles'. The within-firm estimation is not too informative when we investigate lending to 'Eligibles', since we already know that these firms shifted their funding from bank loans to bonds (i.e., reduced their demand for bank loans). We still find that statistically borderline significant decrease in loan supply by treated banks to these eligible firms. Given that treated banks have by definition higher loan exposures to 'Eligibles' (i.e., investment grade loans) compared to non-treated banks, the shift to bond funding by these firms results also in a relative stronger decrease in the new outstanding loan exposures by these firms. The same issue does not exist when we focus on non-eligible firm. Here we can apply the within-firm estimator to differentiate between demand and supply. We find that

[17]The number 1,278,000 is obtained by multiplying the number of all residential real estate transactions in Germany between 2016 and 2019 (2,906,200; see Figure 4.18 in Gutachterausschüsse in der Bundesrepublik Deutschland (2021)) with the fraction thereof represented by apartments (44%; see Figure 4.20 in Gutachterausschüsse in der Bundesrepublik Deutschland (2021).

treated banks increase their loan supply to real estate firms by 8-10%, while loan supply to other firms is not increased in a statistically or economically meaningful magnitude.

Why do we observe that the reduction in lending to 'Eligibles' is exclusively allocated to real estate asset managers? Evidence suggests that this is combination of demand and supply-side factors. First, 'Eligibles' are large, investment-grade rated firms with a low PD. Banks under the IRB approach have to hold little regulatory capital for their loan exposures to these firms. Once these firms shift to bond funding and reduce their loan demand, banks are required to either shift their lending to very safe firms or lenders that are able to offer a high fraction of collateral (if they want to hold their regulatory capital is constant). Firms in the real estate sector fulfill the second condition, because they are able to pledge a relatively large amount of collateral (see Figure IA.4).[18] On top of that, collateral values increase during housing booms (as throughout our sample period), incentivizing banks to channel even more credit to the real estate sector (Chakraborty et al., 2018). So from a supply side perspective real estate asset managers constitute are an attractive alternative if banks need to keep their regulatory capital constant.

While a supply side theory seems plausible, it cannot explain why within the real estate sector, all funds are allocated to asset managers rather than to project developers (that have equally high collateral at disposal, see Figure IA.4). One therefore also has to consider demand-side explanations. As illustrated in Figure IA.2 overall loan demand has been low for bith, SMEs and all enterprises, around the CSPP implementation. Under low loan demand,

[18] As can been seen in Figure IA.4, real estate asset manager pledge based on the credit register information the highest share of collateral per industry. However, also real estate developer and the accommodation sector (comprising e.g. hotel services) offer a high collateral share to banks. As explained below, these sectors are, however, not able to scale up their activities in response to lower funding costs compares to real estate asset managers.

but many funds to reallocate, banks improve their credit terms to attract borrowers.[19] This particularly induces capital intense industries to demand more funds, as these are highly responsive to even small improvements in financing conditions. Real estate asset managers represent such an industry: when receiving (cheap) incremental funds, a real estate asset manager can directly purchase e.g. another apartment.[20] Real estate developer will only consider these additional funds for a new project, if construction firms have enough capacities. As the German construction sector operated at full utilized capacity even before the CSPP (Rein, 2018), real estate developers are not able to easily scale up their projects in response to better, CSPP-induced, financing conditions and therefore do not increase lending as much as real estate asset managers do.

The results provided in this Section illustrate a reallocation of banks' funding from eligible to real estate asset managers in response to the QE policy. Subsequently, we will investigate the impact of this reallocation on real estate prices and the stability of the banks. While we do not aim to evaluate how this reallocation impact the overall efficiency of banks' capital allocation, it is important to note that the real estate asset management sector is not considered as a productive sector. According to Figure IA.5, where we depict the average product of capital (see e.g. Cong et al. (2019)) per industry, real estate asset managers are relatively unproductive, i.e. require many fixed assets to generate revenue. In comparison to the set of eligible firms, which stem from many industries, the credit reallocation should all else be detrimental to productivity.

[19]Due to the ECB's negative deposit facility in our sample window, parking the incremental funds at the ECB rather than lending it out represents no valuable option for banks.

[20]Note that in Germany and Europe, it is uncommon for real estate asset managers, which are virtually never listed firms and often SMEs, to finance via bonds. Bank financing hence practically represents the sole source of leverage.

6 Impact of the CSPP on Real Estate Prices

We now analyse the impact of CSPP affected banks reallocating funds to the real estate sector on the county (x year) level, where treated counties are those whose firms borrow more from treated banks, as described in Section 4.2.

Table 4 and Figure 5 present results regarding firms' total assets per county-year, subdivided into real estate firms and non-real estate firms. We sum up the total assets of all real estate firms per county-year.[21] In line with the tests presented so far, we find that real estate firms' total assets increase after the CSPP in treated counties was about 6.28%-7.00% depending on the specification (Columns (1) and (2)). This is not driven by more funds generally being channeled to these counties, as the asset growth of non-RE firms is considerably smaller and statistically insignificant (Columns (3) and (4)). Consequently, real estate firms play a larger role (in terms of total assets) in treated counties post-CSPP (Columns (5) and (6)).

We now examine the impact of the credit reallocation to real estate asset managers on real estate prices. We use real estate price data on the county x year level from Bulwiengesa, a German real estate price agency. As commercial real estate data is only available for cities (representing about 25% of all 401 German counties), we focus on residential real estate data, which is available for all counties. As argued in Section 5.2 and shown in Table 2, funds are reallocated from CSPP-eligible firms to CSPP-ineligible real estate firms, thereof primarily to asset managing real estate firms, i.e. firms that do rather not engage in building new houses or apartments but in buying existing ones. In line with this, we find in Table 5 Panel

[21] We only drop those firms that in some year report missing values on total assets.

A Columns (1)-(3) that in particularly CSPP-affected counties, apartment prices increase after the CSPP relative to control counties relative to before the CSPP. In the strictest specification in Column (3), the effect is statistically highly significant with a magnitude of 3.13%. Note however that this number broadly speaking is the average across the post-period rather than the cumulative price growth at the end of our sample period. Therefore, in order to calculate the magnitude of the CSPP on residential real estate prices in Germany, we relate the coefficient in Figure 6 for 2019, which is roughly 5%, to the growth rate in the price of existing apartments in the post-CSPP period in our sample (i.e. from 2015 to 2019), which is 28.7% (German Federal Statistical Office, 2023). The CSPP therefore contributes to about (5%/(28.7%)=17.4% in a back-of-the-envelope calculation.[22] Interestingly, we do not observe a similar increase for house prices: here, the effect only amounts to a statistically insignificant 0.66% in the strictest specification in Column (6). This finding is in line with houses being less liquid, indivisible, and bearing higher transaction cost relatively to apartments, therefore making the former less attractive for short-term investors (Himmelberg et al., 2005). In Panel B, we assess whether the increase in apartment prices alludes to overvaluation. Column (2) suggests that apartment rents in highly CSPP-affected counties also increase post-CSPP, but slower than prices (1.66% vs 3.13%). Figure 6, mapping out Columns (1) and (2) over time, verifies that the effects we find are in line with the gradual implementation of the CSPP. Column (3) shows that consequently, the price to rent ratio increases, which is an indicator for overvaluation (Case and Shiller, 2003). The increase in the price to rent ratio

[22] One can also calculate this more formally. Under the simplifying assumption that all counties would have had a similar growth rate in absence of the CSPP and with the results that price growth due to the CSPP was by 5% higher in treated counties and that average price growth in presence of the CSPP is 28.7%, this means that price growth must be 28.7%-5%/2=26.2% in control counties and 28.7%+5%/2=31.2% in treated counties. Therefore, (5%/31.2%=)16.0% of the price growth in treated counties is due to the CSPP.

by 0.4370 represents an increase by 2.3% relatively to the pre-CSPP average of 19.86 and means that due to the CSPP, in treated counties it takes almost half a year longer until the earned rents amortize the purchase price. Column (4) shows that also the price to income ratio increases significantly, namely by around 3.1% (=0.1480/4.79) relative to the pre-CSPP sample mean. This means that, given an average apartment size of about 92m^2 in Germany (German Federal Statistical Office, 2022), in highly CSPP affected counties real estate purchasers have to invest an additional amount equal to (0.1480*92=)13.6% of a year's income relatively to less CSPP affected counties. In Columns (5) and (6) we employ our two controls variables, Ln(GDP per Capita) and Ln(GDP per Hour) as regressors. The coefficient found in Column (5) suggests that CSPP affected counties are economically more powerful and that controlling for this is important: GDP per capita grows by an additional 0.77% after the CSPP relative to control counties relative to pre-CSPP. For GDP per hour in Column (6) we obtain a null result. Figure 7 verifies that the presented results on the price to rent ratio and the price to income ratio hit in only after the CSPP, and do so relatively steadily, which is in line with the gradual increase of CSPP holdings and banks' rebalancing towards the real estate sector.

Our results in this sector therefore suggest that the CSPP-triggered bank portfolio reallocation towards the real estate sector is also reflected in a substantial increase in real estate overvaluation.

Finally, our results also allow us to calculate the elasticity of our documented effects. Given that an increase of loan volume to real estate asset managers by 1.47%/10.28%=7.6% (last column in Table 2 Panel B) leads to an increase in residential real estate prices by about 5% as argued above, the elasticity is 7.6%/5%= 1.52.

7 The CSPP and Financial Stability

7.1 Impact of the CSPP on Bank Risk Taking and Diversification

After documenting adverse effects on capital allocation and real estate prices, we now turn to examining the impact of unconventional monetary policy on financial stability.

CSPP eligible firms must have an investment grade rating and are therefore by definition low risk borrowers. Thus, the ECB selectively buys low risk debt which should result into a drop of loan demand by low risk borrowers. This fact should all else equal impact the average risk of the lending portfolio of treated banks. Columns (5)-(6) of Table 2 Panel A suggest that treated banks substituted lending from eligible firms with lending to higher-risk ineligible firms. This is qualitatively not surprising. However, the effects are quantitatively astonishingly large, as Table 6 shows: control group banks have an average PD that is 67% higher than the average PD of treated banks (3.70% versus 2.21%). This gap narrows by roughly 1/3 due to the CSPP. The upper panel in Figure 8 shows the dynamic treatment effect of the coefficient reported in Table 6 Column (2) graphically. Relative to the base year 2015, treated banks' average PD of their value-weighted loan portfolio was relatively low compared to control group banks. This drastically changed in the post-CSPP period. From 2016 onward we observe a significant increase in loan portfolio PD for treated banks relative to control banks.

We now examine whether treated banks' corporate lending portfolios become more concentrated (i.e. less diversified) as a result of the CSPP. Concretely, we determine the Herfindahl index across industries per bank x quarter. The Herfindahl index is a continuous measure from 0 to 1, where 1 indicates no diversification, so in our case a bank only lending to one

industry (Herfindahl, 1997). Table 6 Columns (3)-(4) show the empirical results. The HHI increases by about 3% independent of the econometric specification, meaning that treated banks' portfolios indeed become more concentrated after the CSPP. This is in line with Table 2, where we show that affected banks increase lending to the real estate sector, which is already the sector with the largest lending exposure. The lower panel in Figure 8 shows the dynamic treatment effect of the coefficient reported in Table 6 Column (4) graphically. The question whether banks' portfolios should be diversified or concentrated across industries is controversially debated (see e.g. Acharya et al. (2006) and Rossi et al. (2009)). Our finding that highly CSPP exposed banks reallocate their portfolios almost exclusively to the real estate sector provides a new angle on potential drawbacks of bank portfolio concentration.

Lastly, we examine the impact the CSPP had on affected banks' collateralization policy in Table 6 Columns (5)-(6). In line with our reported shift in lending towards real estate borrowers, the fraction of collateral pledged to banks by real estate firms increases by 2.32%. The estimate is statistically significant as well as economically significant as it represents about 4.60% of the pre-CSPP sample mean across all banks. The finding that banks' credit reallocation toward the real estate sector also passed through to their collateral composition is potentially problematic as declining real estate valuations are directly detrimental to banks' collateral.

7.2 Impact of the CSPP on Financial Stability

Ultimately, we examine whether bank profitability responds to previously documented changes in banks' portfolio composition brought about by the CSPP. One may conjecture that banks

earn higher interest rates since they issue more risky loans on average. However, the drop in bond spreads has dampened overall corporate loan demand which likely has reduced interest spreads (which is an intended consequence of the CSPP (Draghi, 2018)). We employ the previous bank level specification to examine bank profitability and its components (loan write-offs, net interest margin and other income).

Table 7 reports the results for bank profitability and its components. The dependent variable in Columns (1)-(2) is loan write-offs divided by total assets. Loan write-offs is a flow measure, measuring the yearly addition to loan loss provisions. Loan write-offs increase by 4.9-5.2bps of total assets for treated banks after the CSPP relative to control group banks. This effect is economically large: loan write-offs pre-CSPP are equal to 19bps (treated banks) and 28bps (control banks), so the effect of 4.9-5.2bps constitutes approximately one-half of the difference between treatment and control group banks. Thus, the increase in average PD of the loan portfolio of treated banks is accompanied with higher average write-offs.

Interestingly, we do not observe any effect on net interest income, see Columns (3) and (4) of Table 7. Even though treated banks increase risk-taking, this is not compensated with higher net interest income. Note that this no-result is not only due to statistical insignificance, but the coefficients in Column (3)-(4) are economically small, constituting only one-fourth of the effect documented on loan write-offs in Columns (1)-(2).

We combine the other items of the profit and loss statement (such as fee income, trading income, or operational costs) in the variable *Rest* that we scale again be total assets. As shown in Columns (5)-(6) these items are not affected by the CSPP. Overall, the return on assets (RoA) decreases by an amount equal to the increase in loan write-offs. The mean pre-CSPP RoA in our sample is 0.79% (both for treated banks and control banks). Thus, a

decrease by 0.05-0.06pp constitutes a decrease in RoA by 6-7% of the sample mean.

Figure 9 documents the dynamics of the treatment effects from 2012-2019 for the P&L items of most interest, namely loan write-offs and net interest margin. Loan write-offs increase over time, in line with the increase in the ECB's holdings of CSPP securities, and effects therefore tend to be larger towards the end of our sample period compared to the mean treatment effects documented in the prior tables.

In sum, we observe that the CSPP did have a substantial impact on banks' operations. Due to the drop in loan demand by eligible firms, banks shifted their lending to ineligible firms. While overall lending volumes remained constant, banks increased their lending to high PD-borrowers. The latter finding is in line with banks facing a lower demand from exactly those borrowers that are associated with low PD (since ECB bought directly only investment-grade debt). Banks however did not get compensated for taking higher risk. While loan write-offs increased, the net interest margin was constant, which resulted in a drop in bank profitability.[23]

8 Conclusion

In this paper, we have explored how central bank corporate bond purchases, namely the ECB's CSPP, unfold in credit-saturated markets. First, the CSPP makes bond financing for eligible firm more attractive than bank financing and therefore triggers a reallocation of loan volume from CSPP eligible to CSPP ineligible firms. These ineligible firms are almost

[23]This drop is not offset by potential valuation gains on CSPP eligible securities, as banks only hold small amounts of these: in line with Grosse-Rueschkamp et al. (2019) we find that CSPP eligible bonds account for less than 0.5% of sample banks' total assets.

exclusively high-yield firms from the real estate sector that rather act as asset managers than as construction firms or project developers. As real estate asset managers purchase existing real estate instead of building new houses or offices, we observe in highly CSPP-affected counties an increase in demand for real estate, which is reflected by an increase in apartment prices as well as the price to rent ratio and the price to income ratio. This suggests that the central bank corporate bond purchases in saturated economies have a first-order effect on the real estate market and contribute to its overvaluation. Furthermore, affected banks' profitability decreases significantly after the introduction of the CSPP due to an increase in risk-taking that is not compensated by higher net interest income. This finding is consistent with more competition among banks for CSPP ineligible borrowers. Therefore, by eroding bank profits, the CSPP poses a threat to financial stability.

Overall, our finding suggests that unconventional monetary policy in credit-saturated markets comes with substantial negative consequences. We document potential detrimental effects on capital allocation, the real estate sector as well as on financial stability. Any benefits of unconventional monetary policy – such as lower bond spreads and lending rates – need to be balanced against these unintended side effects in order to assess the overall effect on financial markets and the real economy. This is particularly true of heterogeneous monetary unions such as the Eurozone.

Our micro data only cover Germany, yet we believe that our results generalize to other countries or local economies that face similar conditions. Within the Eurozone, Figure IA.2 suggests that despite Germany having the least credit constrained firms, also e.g. the French economy (that accounts just like Germany for about a quarter of the ECB's CSPP holdings) was rather credit-saturated in 2016. We believe that our effects can, maybe to a

less pronounced degree, also be spotted here, but open such detailed cross-country analyses for further research.

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Table 1: Descriptive Statistics

Panel A: Descriptive Statistics on the Bank (x Time) Level

	Unit	Level	Treat				Control			
			n	Mean	SD	Median	n	Mean	SD	Median
Measure on bank affectedness										
Share Eligible (Static)	%	Bank	121	13.75	10.72	9.32	120	1.69	1.28	1.52
Quarterly measures on bank corporate loan portfolio composition										
Share Eligible	%	Bank x Quarter	3,559	12.98	10.00	9.71	3,551	2.22	2.22	1.79
Lending to Eligibles	€m	Bank x Quarter	3,559	372	1,460	74	3,551	35	98	13
Lending to Ineligibles	€m	Bank x Quarter	3,559	2,645	8,792	540	3,551	1,785	4,788	700
Total Corp Lending	€m	Bank x Quarter	3,559	3,018	10,004	625	3,551	1,819	4,862	718
PD	%	Bank x Quarter	3,559	2.21	2.12	1.62	3,551	3.70	5.16	2.39
HHI		Bank x Quarter	3,559	0.12	0.05	0.10	3,551	0.18	0.14	0.14
Fraction RE Collateral	%	Bank x Quarter	3,512	51.50	18.62	53.90	3,521	52.85	21.04	56.08
Share HY	%	Bank x Quarter	3,559	20.58	9.63	18.87	3,551	25.82	15.50	21.70
Yearly measures on bank profitability										
NII / Toas	%	Bank x Year	908	1.82	0.43	1.90	913	1.91	0.45	1.91
Loan write-offs / Toas	%	Bank x Year	908	0.19	0.16	0.15	913	0.28	0.26	0.21
Rest / Toas	%	Bank x Year	908	-0.84	0.36	-0.89	913	-0.85	0.35	-0.86
RoA	%	Bank x Year	908	0.79	0.35	0.80	913	0.79	0.41	0.77
Yearly lagged control variables										
Capital Ratio	%	Bank x Year	908	17.03	3.38	16.65	913	16.14	3.57	15.53
Deposit Ratio	%	Bank x Year	908	49.10	12.07	48.77	913	49.80	12.21	48.67
Off-BS Ratio	%	Bank x Year	908	3.04	2.63	2.18	913	2.47	1.83	2.11
Share of Fee income	%	Bank x Year	908	18.32	8.26	17.32	913	18.28	8.00	17.58
Quarterly lagged control variables										
Total Assets	€bn	Bank x Quarter	3,559	13.38	39.60	3.35	3,551	7.41	13.14	3.68

Panel B: Descriptive Statistics on the Industry/Firm Level

Industry	# of Firms	Avg. Loan Amount (€m)	Portfolio Share (%)	Date of Incorp.	Total Assets (€m)				Empl./ Toas	Debt/ Toas
					Mean	p25	p50	p75		
Eligibles	559	99.93	7.45	1991	18,878	171	1,438	20,246	1.31	0.69
RE - Asset Management	21,390	7.18	19.28	2004	29	5	10	23	0.27	0.84
RE - Development	15,212	9.45	12.83	2005	35	5	10	21	0.24	0.86
RE - Construction	6,396	5.02	4.75	1998	18	4	7	15	1.56	0.85
Transport	5,971	12.55	3.97	2002	40	5	10	20	2.43	0.82
Electricity	9,580	8.09	8.34	2009	38	4	7	17	0.40	0.83
Manufacturing	14,655	5.97	11.93	1989	73	6	12	30	7.91	0.67
Professional Activities	7,734	16.66	11.07	2001	237	7	21	95	1.64	0.68
Administrative Activities	4,373	8.40	2.59	2001	76	5	10	26	1.94	0.76
Wholesale and Retail Trade	12,838	4.75	8.65	1991	47	4	8	17	5.86	0.76
Health	3,415	5.36	4.52	1997	54	7	17	55	11.50	0.60
Water	972	8.06	1.16	1995	44	7	14	33	2.86	0.69
Accomodation	1,316	4.74	1.01	2003	12	3	6	11	8.52	0.84
Other Industries	4,229	4.90	2.45	1994	39	4	8	16	3.56	0.69

Panel C: Descriptive Statistics on the County (x Time) Level

	Unit	Level	Treat				Control			
			n	Mean	SD	Median	n	Mean	SD	Median
Measure on county affectedness										
Share county (Static)	%	county	200	10.23	2.35	9.45	201	6.01	1.24	6.18
Yearly measures on county real estate firms										
Toas RE	€bn	county x Year	1,594	1.35	5.26	0.33	1,545	1.38	6.16	0.46
Toas Non-RE	€bn	county x Year	1,594	14.28	32.97	4.68	1,545	10.39	32.32	3.81
Frac Toas RE	%	county x Year	1,594	8.18	8.07	5.96	1,545	11.91	8.23	9.89
Yearly measures on county real estate prices and economic strength indicators										
Price Existing Apartments	€/m^2	county x Year	1,594	1,845	845	1,650	1,545	1,660	732	1,488
Rent Existing Apartments	€/m^2	county x Year	1,594	6.82	1.81	6.50	1,545	6.59	1.62	6.20
Price to Rent Ratio		county x Year	1,594	21.72	4.55	21.16	1,545	20.30	4.46	19.67
Price to Income Ratio		county x Year	1,594	5.16	2.11	4.68	1,545	5.24	1.92	4.77
GDP per Cap.	€	county x Year	1,594	37,819	16,366	33,003	1,545	33,031	14,658	29,313
GDP per Hour	€	county x Year	1,594	49.21	8.47	47.84	1,545	45.95	8.61	44.90

Panel A presents descriptive statistics on the bank (x time) level, separately for treated and control banks. Panel B provides descriptive statistics for firms by NACE-21 industry, with the adjustments that i) CSPP eligible firms from any industry are included separately, ii) the real estate sector is subdivided into construction, development and asset management, and iii) all industries with less than 1% portfolio share are summarized under 'Other Industries'. 'Avg. Loan Amount' is the average quarterly amount a firm in an industry has outstanding to any sample bank. 'Portfolio Share' is the pre-CSPP share of lending to firms of a certain industry averaged across all sample banks. 'Date of Incorp.' is the median date of incorporation of firms in a certain industry. 'Empl. / Toas' is the median number of employees divided by total assets (in €m) across all firms per industry. 'Debt / Toas' is the median fraction of debt to total assets across all firms per industry. Information on Date of Incorporation, Total Assets, Employees / Total Assets and Debt / Total Assets and are retrieved from BvD Amadeus and therefore only available for those firms that can be matched (35% of all firms). Panel C presents descriptive statistics on the county (x time) level, separately for treated and control counties. Variable definitions are provided in the Variable Appendix.

Table 2: CSPP Induced Capital Reallocation

Panel A: Banks' Substitution from CSPP Eligible Firms to CSPP Ineligible Firms

Dependent variable:	Share Eligible		Ln(Total Corp Lending)		Share HY	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat x After	-1.5600***	-1.6497***	0.0089	0.0045	1.4664***	1.4852***
	(-2.99)	(-3.25)	(0.32)	(0.21)	(2.74)	(2.81)
Controls	no	yes	no	yes	no	yes
Quarter FE	yes	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes	yes
Observations	7,110	7,110	7,110	7,110	7,110	7,110

Panel B: Capital Allocation by Industry Sector

Dependent variable:	Portfolio Share per Industry			Portfolio Share per Real Estate Subindustry		
	Eligibles	Real Estate	Other	Construction	Development	Asset Man.
Treat x After	-1.6497***	1.5247**	0.1249	-0.2311	0.2864	1.4694***
	(-3.25)	(2.28)	(0.18)	(-0.90)	(0.71)	(3.02)
Controls	yes	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes	yes
Quarter FE	yes	yes	yes	yes	yes	yes
Observations	7,110	7,110	7,110	7,110	7,110	7,110
Sample Mean in %	7.45	36.86	55.69	4.75	12.83	19.28

Panel A examines how the corporate lending portfolio of highly CSPP-affected banks evolves in relation to that of less CSPP-affected banks. Panel B examines changes in portfolio composition by industry. Eligibles comprises all CSPP eligible firms, independent of their industry classification. The last row indicates the pre-CSPP average (sub-)industry share. Variable definitions are provided in the Variable Appendix. We include one fixed effect for each bank and one fixed effect for each quarter as in Panel A Columns (2), (4) and (6) and Panel B lagged control variables (Log Total Assets, Capital Ratio, Deposit Ratio, Off-Balance-Sheet Ratio and Share of Fee Income). T-statistics with standard errors adjusted for clustering at the bank level are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

Table 3: Khwaja-Mian Within-Firm Analysis

	Δ Ln(Loan Amount)							
	Eligibles		Real Estate		Other		All	
Treat	-0.0773*	-0.0772*	0.1041***	0.0790***	0.0737	0.0117	0.0546	0.0094
	(-1.67)	(-1.96)	(3.32)	(3.40)	(1.62)	(0.38)	(1.48)	(0.37)
Controls	no	yes	no	yes	no	yes	no	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
N	5,922	5,922	8,695	8,695	21,310	21,310	36,025	36,025

This table examines how treated banks' loan supply changes in response to the CSPP. We start with the credit register on the bank x firm x quarter level, then collapse the time dimension to pre vs post event and then calculate the difference in log loan amount between the post and the pre period such that we end up with one observation per bank x firm (see Khwaja and Mian (2008)). All firms are sorted into the mutually exclusive categories 'Eligibles', 'Real Estate' and 'Other Ineligibles'. The last two columns contain all firms. Variable definitions are provided in the Variable Appendix. The control variables are on the bank level and comprise pre-CSPP averages of Log Total Assets, Capital Ratio, Deposit Ratio, Off-Balance-Sheet Ratio and Share of Fee Income as well as banking group indicators (savings bank, cooperative bank, mortgage bank or private bank). T-statistics with standard errors adjusted for clustering at the bank level are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

Table 4: Spatial Impact: Total Assets by County

	Ln(Toas RE)		ln(Toas Non-RE)		Frac Toas RE	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat x After	0.0700***	0.0628***	0.0207	0.0131	0.6092**	0.6240**
	(2.86)	(2.64)	(1.19)	(0.74)	(2.10)	(2.15)
Controls	no	yes	no	yes	no	yes
county FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Observations	3,139	3,139	3,139	3,139	3,139	3,139

This table examines the impact the CSPP had on particularly affected counties' firms. In Columns (1) and (2), we aggregate all assets of real estate firms per county x year, while in Columns (3) and (4) we do the same for non-real estate firms. In Columns (5) and (6), we calculate the fraction of real estate firms w.r.t. total assets. Variable definitions are provided in the Variable Appendix. We include one fixed effect for each county and one fixed effect for each year. In Columns (2), (4), and (6), we also include lagged control variables (Log GDP per Capita, Log GDP per Hour Worked). T-statistics with standard errors adjusted for clustering at the county level are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

Table 5: Impact of the CSPP on Real Estate Prices

Panel A: Prices

	Ln(Price Existing Apartments)			Ln(Price Existing Houses)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat x After	0.0790***	0.0346***	0.0313***	0.0422***	0.0081	0.0066
	(5.27)	(3.03)	(2.74)	(3.94)	(1.05)	(0.87)
Controls	no	no	yes	no	no	yes
county FE	no	yes	yes	no	yes	yes
Year FE	no	yes	yes	no	yes	yes
Observations	3,139	3,139	3,139	3,139	3,139	3,139

Panel B: Comparison of Prices, Rents, Overvaluation Proxies and Controls

	Ln(Price Exist. Apartments)	Ln(Rent Exist. Apartments)	Price to Rent Ratio	Price to Income Ratio	Ln(GDP per cap.)	Ln(GDP per hour)
	(1)	(2)	(3)	(4)	(5)	(6)
Treat x After	0.0313***	0.0166***	0.4370**	0.1480**	0.0077**	-0.0017
	(2.74)	(3.29)	(2.09)	(2.02)	(2.11)	(-0.54)
Controls	yes	yes	yes	yes	no	no
county FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Observations	3,139	3,139	3,139	3,139	3,139	3,139

Panel A examines the impact the CSPP has on affected counties' apartment prices and house prices, respectively. Panel B examines proxies for real estate overvaluation in (3) and (4) as well as control variables in (5) and (6). Variable definitions are provided in the Variable Appendix. We include one fixed effect for each county and one fixed effect for each year. In Columns (3) and (6) of Panel A and Columns (1)-(4) of Panel B, we also include lagged control variables (Log GDP per Capita, Log GDP per Hour Worked). T-statistics with standard errors adjusted for clustering at the county level are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

Table 6: Bank Portfolio Risk, Concentration, and Collateralization

Dependent variable:	Ln(PD)		Ln(HHI)		Fraction RE Collateral	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat x After	0.2228***	0.2239***	0.0301*	0.0308**	2.1295***	2.3173***
	(3.49)	(3.53)	(1.89)	(1.99)	(2.72)	(3.12)
Controls	no	yes	no	yes	no	yes
Quarter FE	yes	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes	yes
Observations	7,110	7,110	7,110	7,110	7,033	7,033

This table shows how treated banks' corporate loan portfolio evolves in response to the CSPP in terms of risk, measured by the log volume-weighted Probability of Default (PD), industry concentration, measured by the log Herfindahl index (HHI), and collateralization by real estate, measured by the fraction of collateral from real estate firms. Variable definitions are provided in the Variable Appendix. We include one fixed effect for each bank and quarter. The (lagged) control variables introduced in (2), (4) and (6) comprise Log Total Assets, Capital Ratio, Deposit Ratio, Off-Balance-Sheet Ratio and Share of Fee Income. T-statistics with standard errors adjusted for clustering at the bank level are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

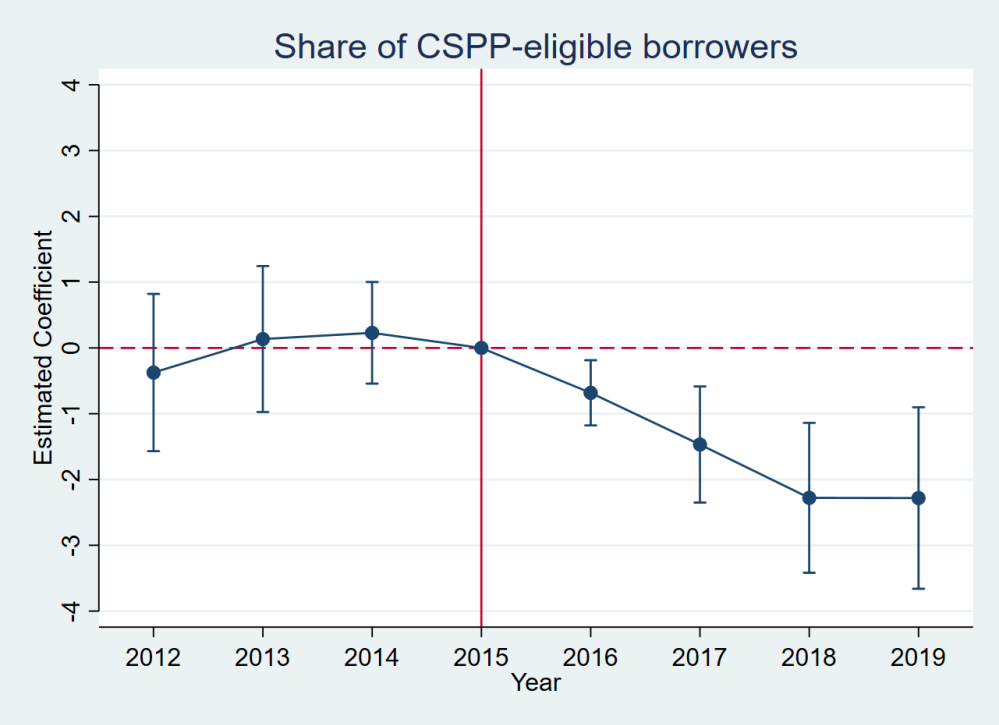
Table 7: Impact of the CSPP on Bank Profitability

Dependent variable:	Loan Write-offs / Toas		NII / Toas		Rest / Toas		RoA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat x After	0.0516***	0.0487***	0.0179	0.0129	-0.0183	-0.0209	-0.0521**	-0.0567**
	(2.97)	(2.88)	(0.72)	(0.57)	(-0.75)	(-0.93)	(-2.02)	(-2.25)
Controls	no	yes	no	yes	no	yes	no	yes
Bank FE	yes	yes	yes	yes	yes	yes	yes	yes
Quarter FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,821	1,821	1,821	1,821	1,821	1,821	1,821	1,821

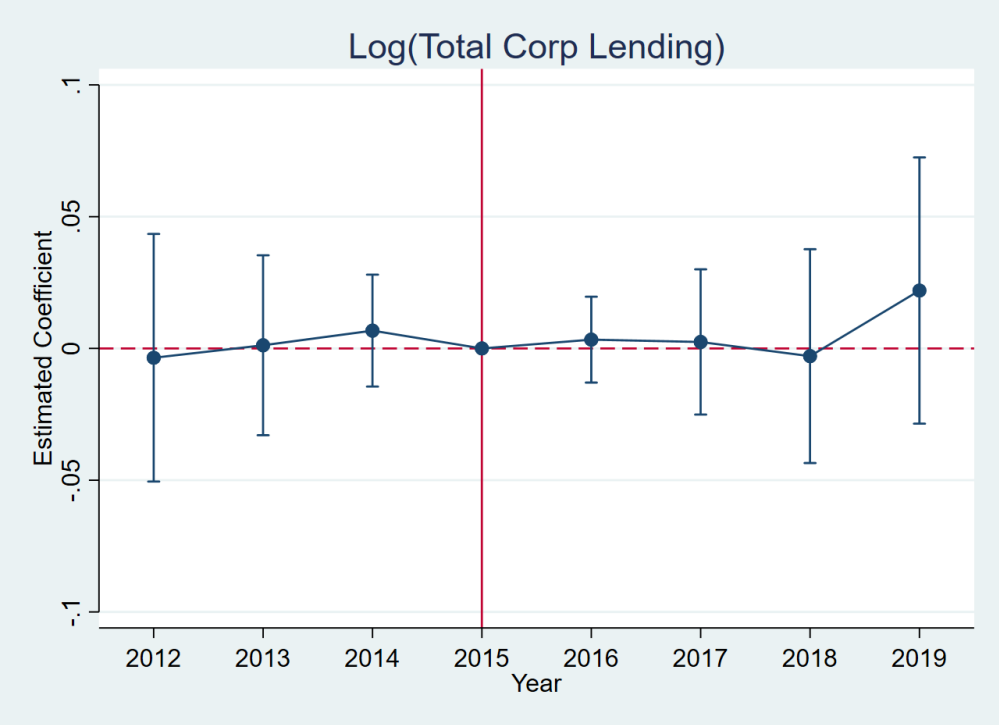
This table examines how selected return components are affected by the CSPP. Variable definitions are provided in the Variable Appendix. We include one fixed effect for each bank and one fixed effect for each quarter. In Columns (2), (4), (6), and (8), we also include lagged control variables (Log Total Assets, Capital Ratio, Deposit Ratio, Off-Balance-Sheet Ratio and Share of Fee Income). T-statistics with standard errors adjusted for clustering at the bank level are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

Figure 1: Evolution of the Corporate Loan Portfolio

Panel A: Share of CSPP-Eligible Borrowers

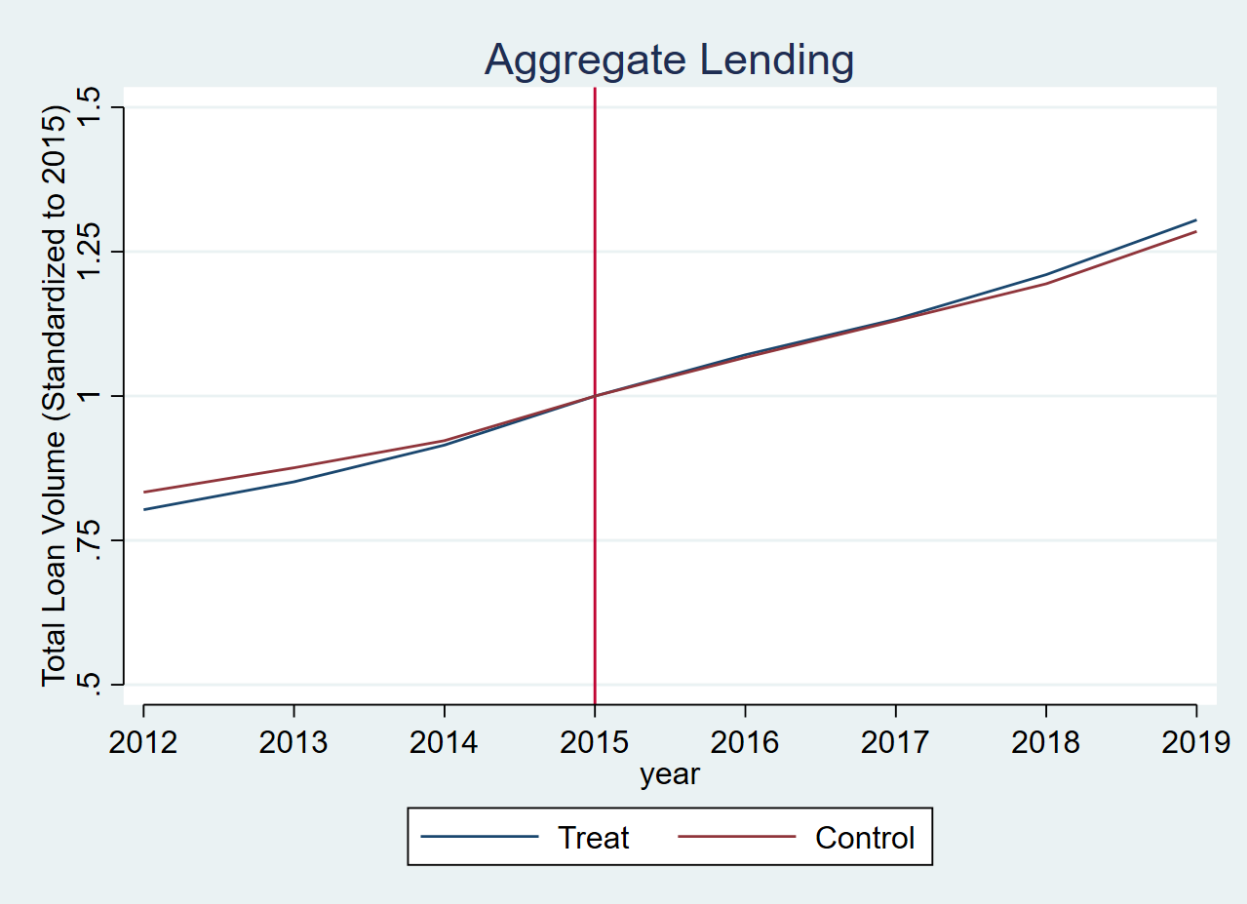


Panel B: Total Corporate Lending



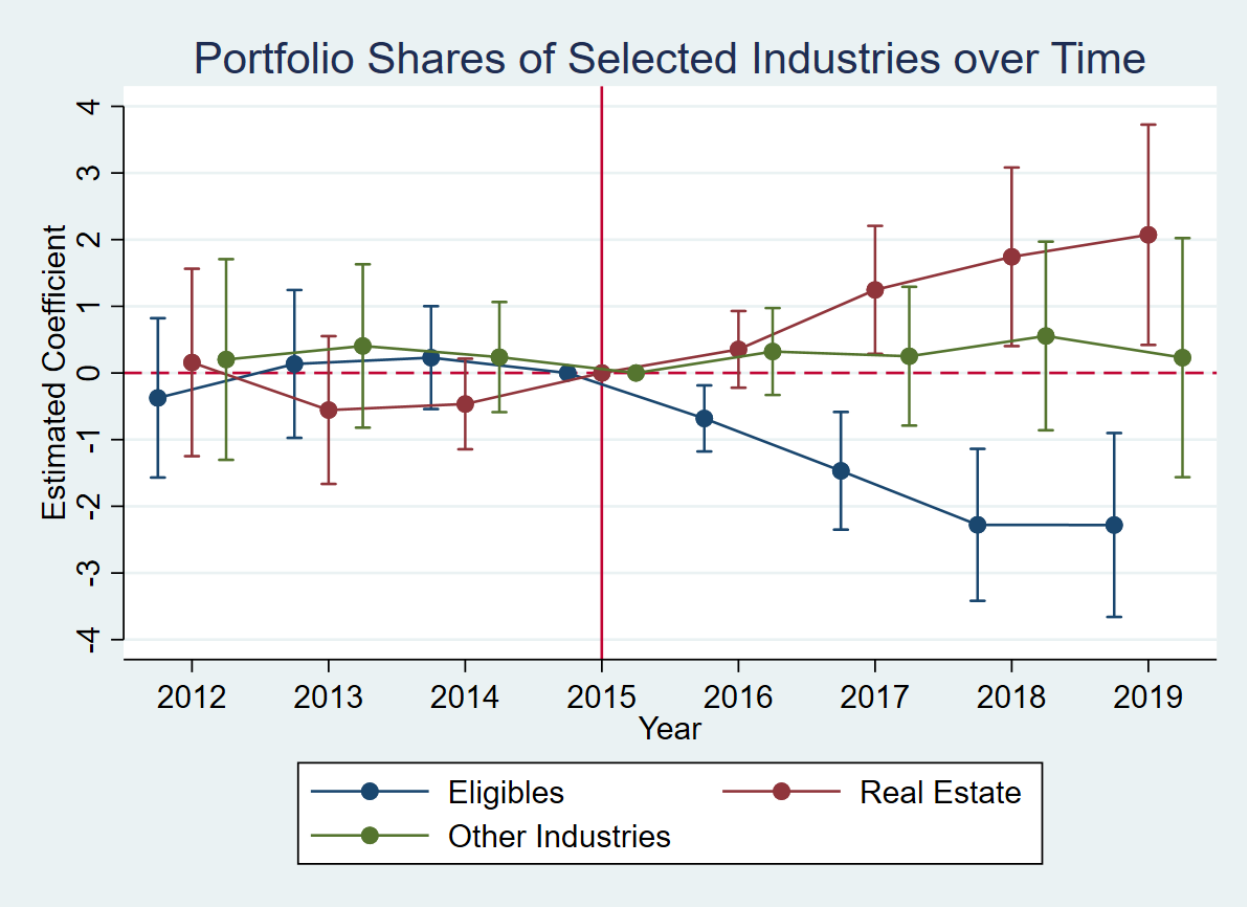
The upper (lower) figure depicts estimated coefficients from mapping out Column (2) (Column (4)) in Table 2 over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

Figure 2: Total Lending by Treat vs Control Banks



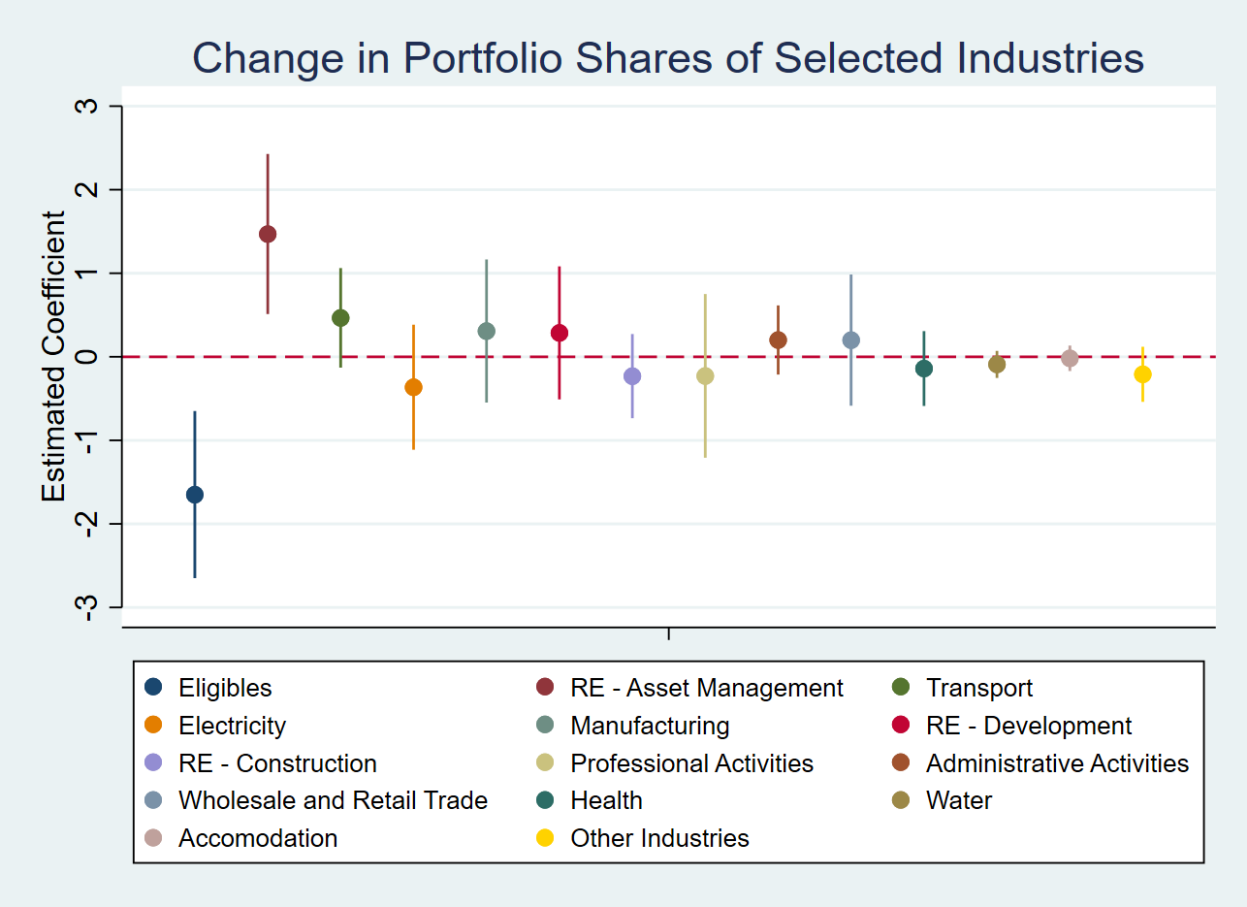
This figure depicts total lending of treated vs control sample banks. We aggregate lending by all sample banks except those that at some point face substantial restructurings such as mergers (which we proxy for by a quarter-to-quarter change in total lending by +-25% or +-€2bn at some point).

Figure 3: Evolution of Capital Allocation over Time



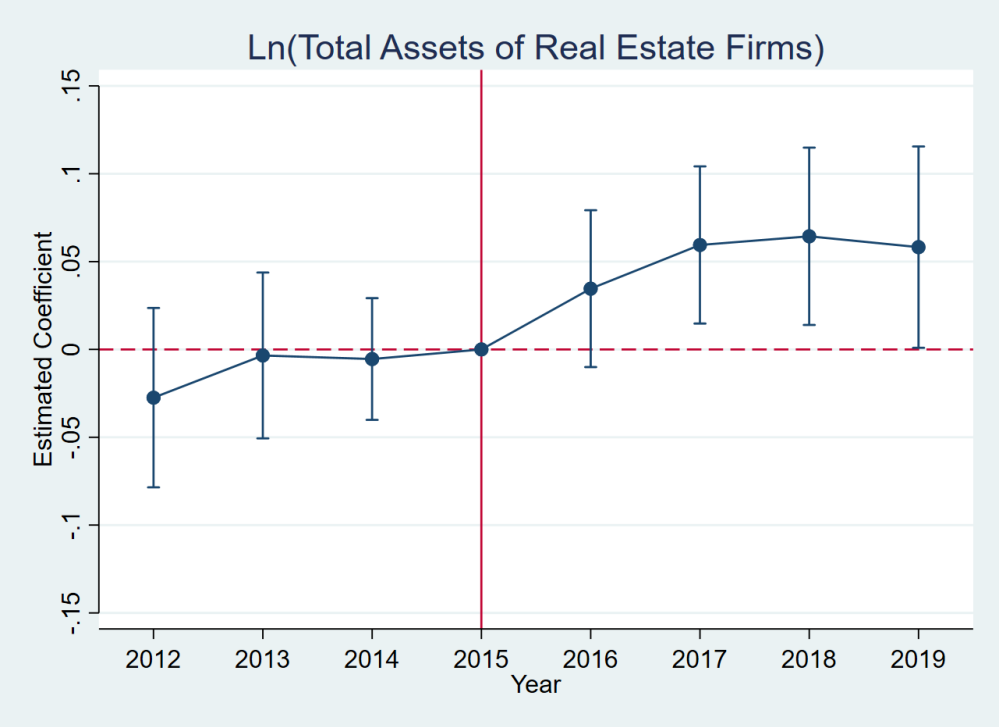
This figure depicts estimated coefficients from mapping out the three industries from Table 2 Panel B over time with 2015 as base year. 'Eligibles' corresponds to CSPP eligible firms from any industry. 'Real Estate' and 'Other Industries' therefore only comprise CSPP ineligible firms. The solid lines around coefficients indicate 95% confidence intervals.

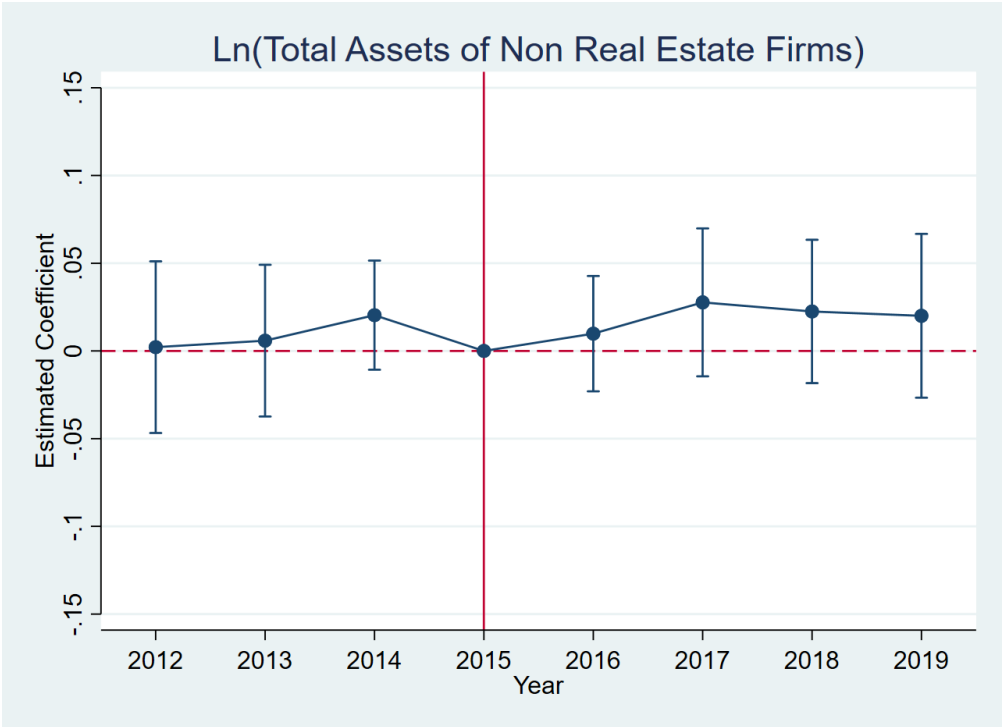
Figure 4: Capital Allocation per NACE Industry



This figure depicts estimated coefficients from Table 2 for all 21 NACE-industries, with those industries that account for less than 1% pre-CSPP portfolio share summarized under 'Other Industries'. Note that we only consider banks' non-financial Eurozone corporate portfolio (see Section 3.1 for more details). Industries are sorted from left to right according to the absolute magnitude of the depicted coefficient. The solid lines around coefficients indicate 95% confidence intervals.

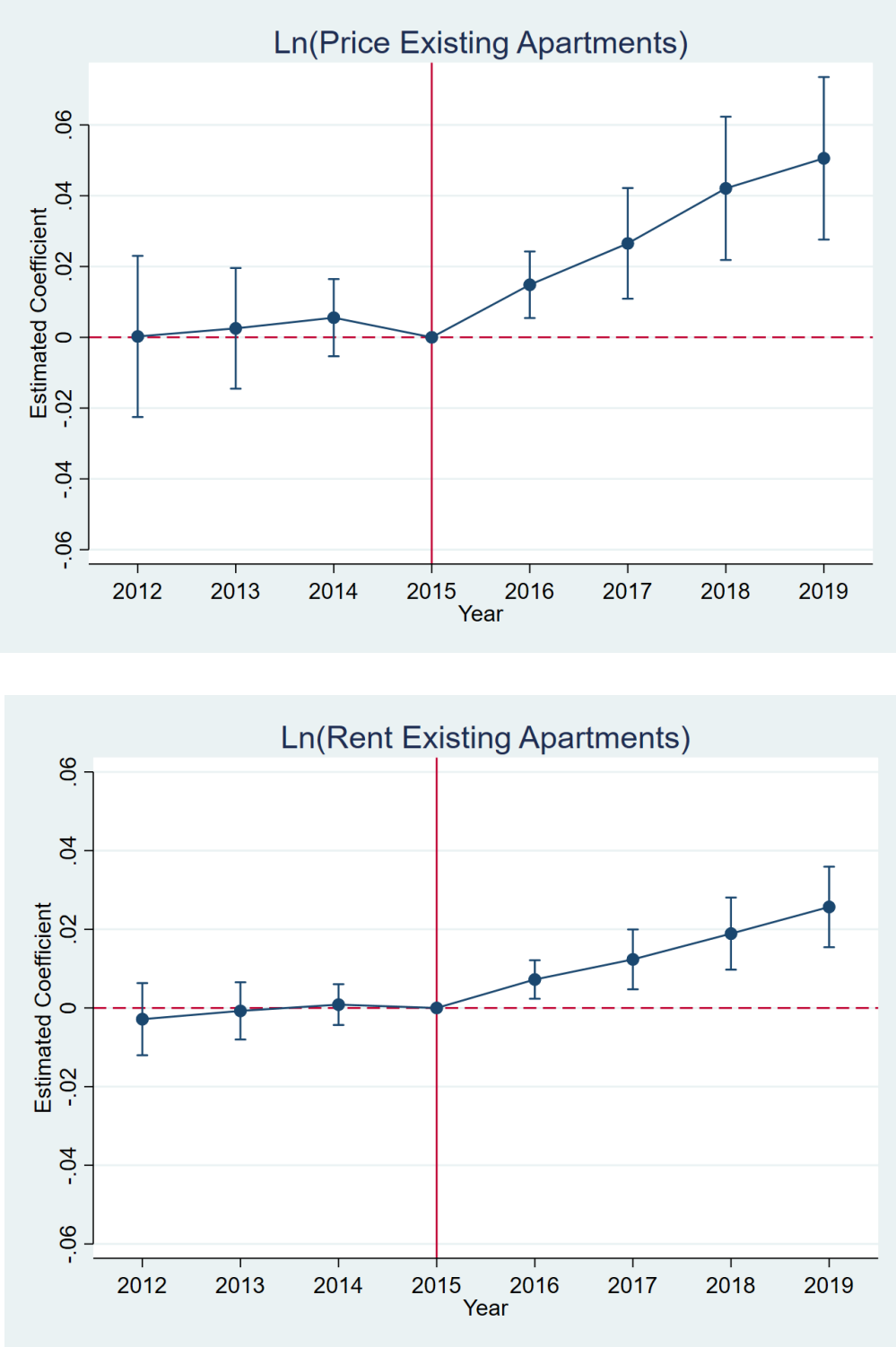
Figure 5: Effect of the CSPP on Capital Allocation





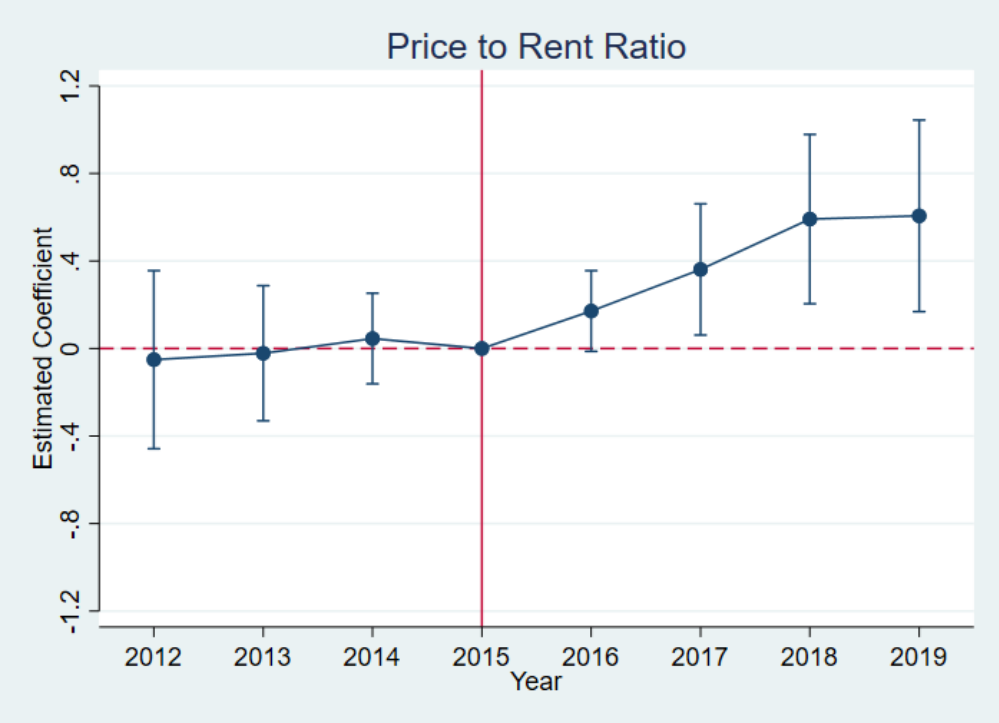
This figure depicts estimated coefficients from mapping out Table 4 Column (2) (upper figure) and (4) (lower figure) over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

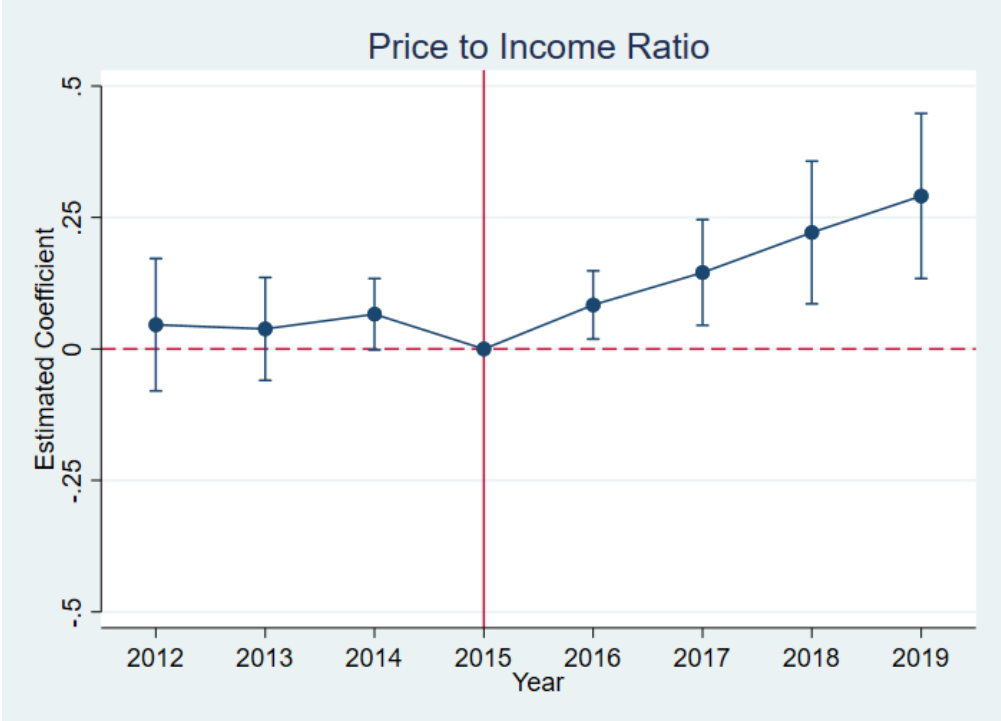
Figure 6: Impact of the CSPP on Real Estate Prices and Rents



This figure depicts estimated coefficients from mapping out Table 5 Panel B Column (1) (upper figure) and (2) (lower figure) over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

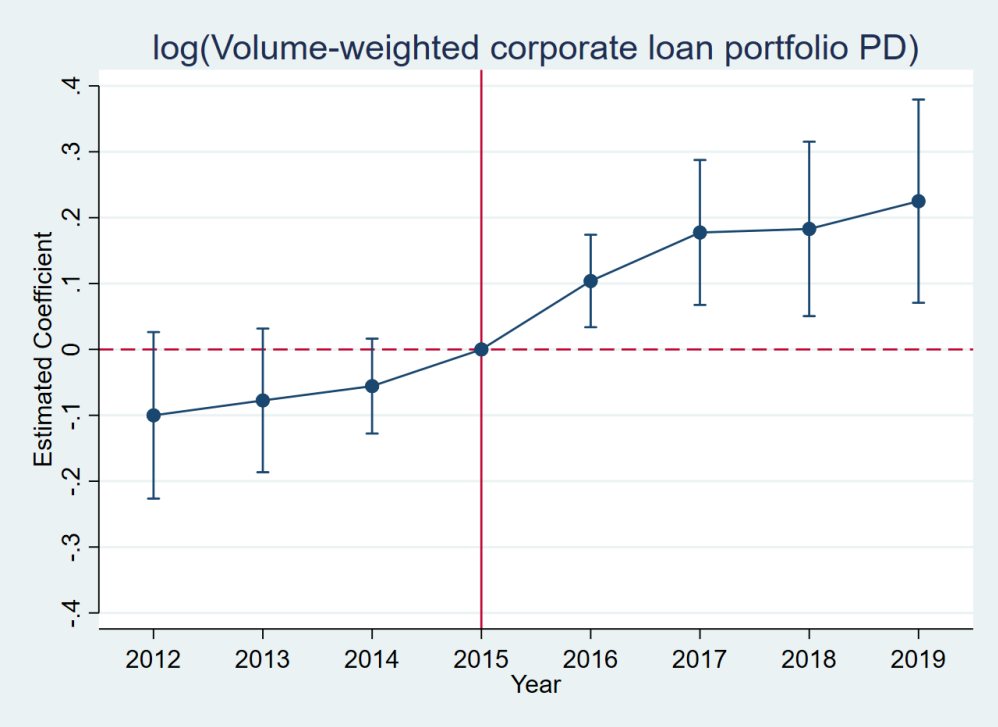
Figure 7: Impact of the CSPP on Real Estate Overvaluation

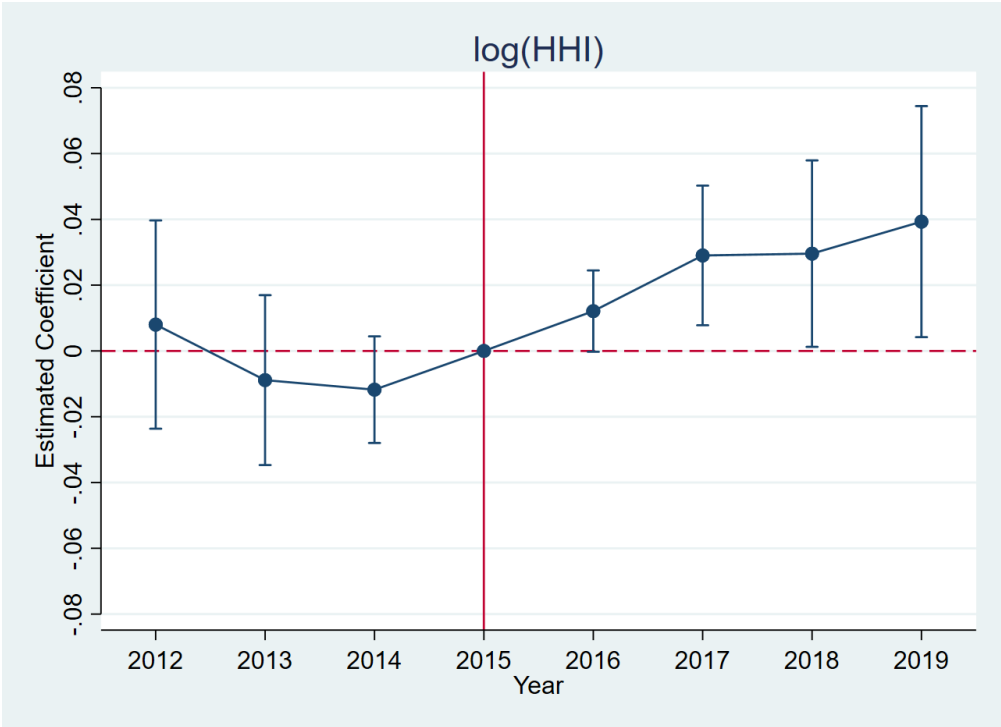




The upper (lower) figure depicts estimated coefficients from mapping out Table 5 Panel B Column (3) (Column (4)) over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

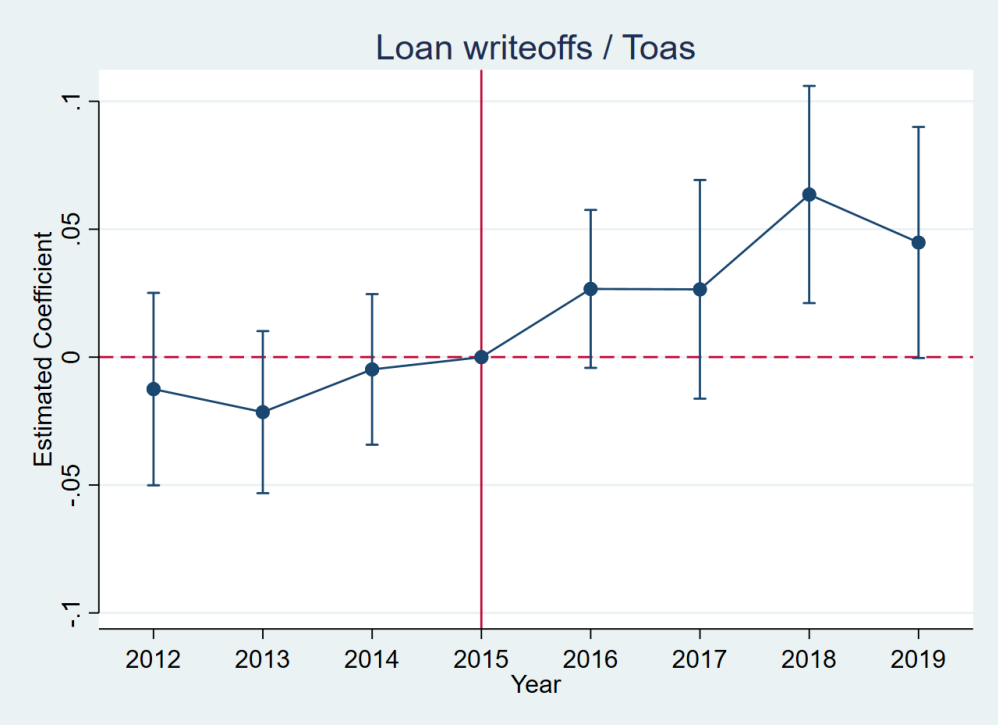
Figure 8: Bank Portfolio Risk and Concentration

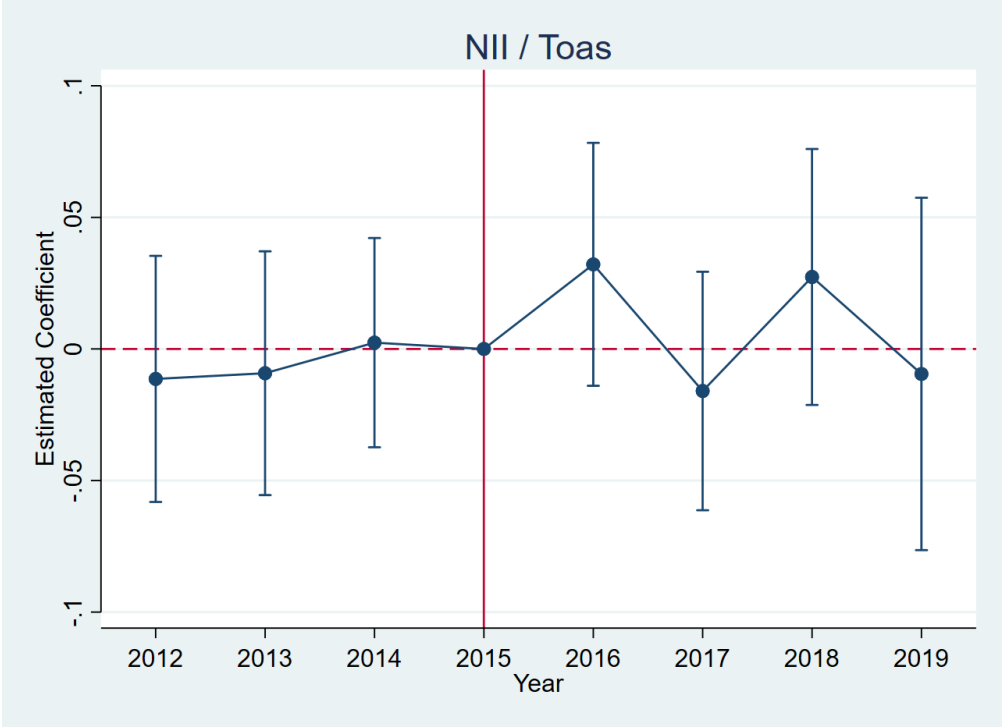




The upper (lower) figure depicts estimated coefficients from mapping out Table 6 Column (3) (Column (6)) over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

Figure 9: Evolution of Loan Write-offs and Net Interest Income





The upper (lower) figure depicts estimated coefficients from mapping out Column (2) (Column (4)) in Table 7 over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

Variable Appendix

Panel A: Bank (x Time) Level Variables

Variable Name	**Definition**	**Source**
Share Eligible (Static) (%)	(Average lending to CSPP eligible firms between 2014q1 and 2015q4) / (Average lending to all firms between 2014q1 and 2015q4)	Credit Register
Share Eligible (%)	Fraction of a bank's Eurozone corporate portfolio that is to CSPP-eligible firms	Credit Register
Lending to Eligibles (€m)	Lending to CSPP-eligible Eurozone non-financial corporations (NFCs)	Credit Register
Lending to Ineligibles (€m)	Lending to CSPP-ineligible Eurozone non-financial corporations (NFCs)	Credit Register
Total Corp Lending (€m)	Lending to CSPP-eligible Eurozone NFCs + Lending to CSPP-ineligible Eurozone NFCs	Credit Register
PD (%)	Volume-weighted PD of a bank's Eurozone NFC portfolio. Calculation: first, each firm is assigned a static PD as the median PD across all banks as of 2015q4 (if no 2015q4 PD is available, take the one from 2015q3,..,2012q1,2016q1,..2019q4). Do not consider firms with missing PD. Then, value-weight the firm PDs per bank-quarter.	Credit Register
HHI ([0,1])	Herfindahl-Index for each bank x quarter across industries. Higher values indicate less industry-diversified bank portfolios.	Credit Register
Fraction RE Collateral (%)	(Collateral by Real Estate firms) / (Total Collateral)	Credit Register
Share IG (%)	(Lending to firms with (internal PD-implied) Investment Grade Rating) / (Total Corporate Lending)	Credit Register
Share HY (%)	(Lending to firms with (internal PD-implied) High-Yield Rating) / (Total Corporate Lending)	Credit Register
Share Nonrated (%)	(Lending to firms with no (internal PD-implied) Rating available) / (Total Corporate Lending)	Credit Register
NII / Toas (%)	Net Interest Income / Total Assets	SON
Loan write-offs / Toas (%)	Write-offs on loans / Total Assets	SON
Rest / Toas (%)	(Fee Result + Trading Result + Other Noninterest Income – Administrative and Personnel Cost + Loan Write-ons + Revaluation Result + Extraordinary Result) / Total Assets	SON
RoA (%)	NII/Toas - Loan write-offs / Toas + Rest/Toas	SON
Capital Ratio (%)	(T1 and T2 capital) / RWA	BAKIS
Deposit Ratio (%)	(Overnight deposits + term deposits) / Total Assets	BAKIS
Off-BS Ratio (%)	Off-BS-Activities / Total Assets	BAKIS
Share of Fee income (%)	Fee Income / Total Income	BAKIS
Total Assets (%)	GDP-Deflated Total Assets	BAKIS

Panel B: county (x Time) Level Variables

Variable Name	**Definition**	**Source**
Share county (Static) (%)	Volume-weighted average of *Share Eligible* of all the firms in a county as of 2015. E.g. suppose in some county there is only one firm. In 2015, the firm borrows €2m in total, thereof €1m from bank A (whose *share eligible* is 0% in 2015) and €2m from bank B (whose *share eligible* is 15% in 2015). *Share county (Static)* is then equal to €1m/(€1m+€2m)×0%+€2m/(€1m+€2m)×15% = 10%	Credit Register
Toas RE (€bn)	Total Assets of all Real Estate Firms per county x Year. We delete those firms that have missing values for total assets in some year.	BvD Amadeus
Toas Non-RE (€bn)	Total Assets of all Non-Real Estate Firms per county x Year. We delete those firms that have missing values for total assets in some year.	BvD Amadeus
Frac Toas RE (%)	*Toas RE* / (*Toas RE*+*Toas Non-RE*)	BvD Amadeus
Price Existing Apartments (€/m^2)	Price for existing apartments	Bulwiengesa
Rent Existing Apartments (€/m^2)	Monthly rent for existing apartments	Bulwiengesa
Price to Rent Ratio	*Price Existing Apartments* / (*Rent Existing Apartments* × 12)	Bulwiengesa
Price to Income Ratio	*Price Existing Apartments* / (*GDP per Capita*) × 100	Bulwiengesa
GDP per Capita (€)	GDP per capita	German Statistical Agencies
GDP per Hour (€)	GDP per hour worked	German Statistical Agencies

Internet Appendix to accompany

Unintended Consequences of QE: Real Estate Prices and Financial Stability

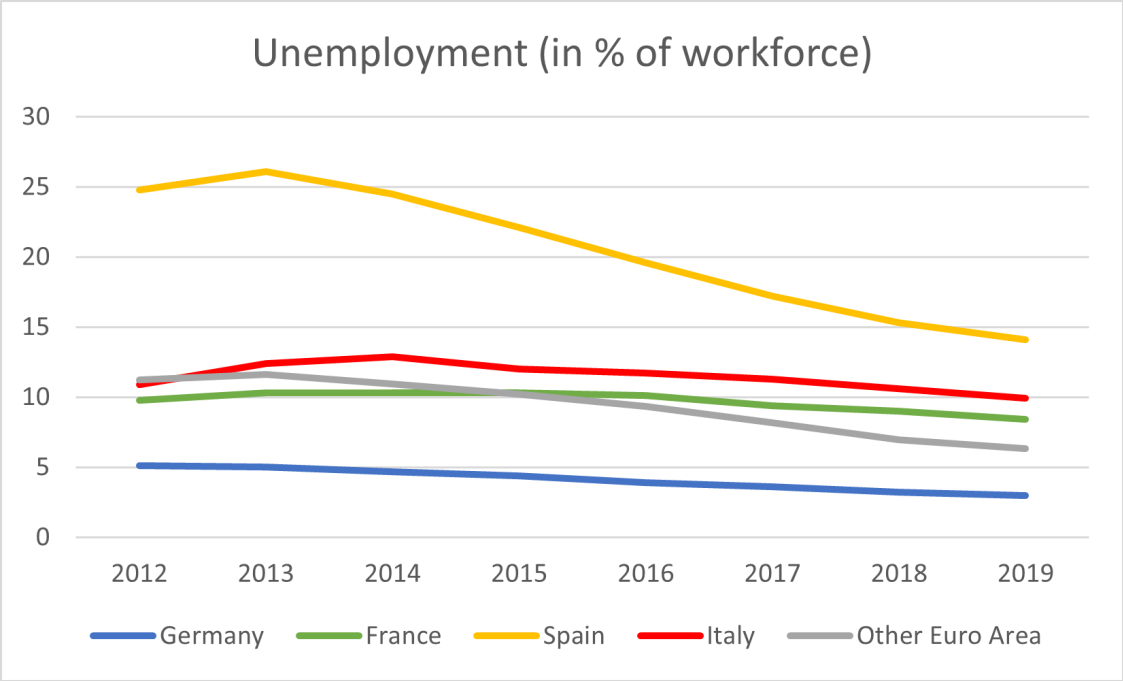
(for online publication)

Table IA.1: Entire Loan Portfolio

	Ln(Lending)	Share of Total Lending							
		Corporate				Gov.	Retail	Fin.	Rest
		Eligible	Ineli. Ger.	Ineli. Oth. EZ	Non-EZ				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat x After	0.0084	-0.0153***	0.0194***	-0.0047*	0.0073*	-0.0068	-0.0002	-0.0029	0.0033
	(0.47)	(-4.48)	(2.64)	(-1.89)	(1.91)	(-0.99)	(-0.08)	(-0.63)	(0.98)
Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Quarter FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110	7,110
Sample Mean in %		4.19%	50.77%	3.44%	4.40%	16.84%	6.38%	4.24%	9.74%

This table examines how treated banks adjust their total lending (Column 1) as well as certain parts of their loan portfolio (Columns 2-8). Variable definitions are provided in the Variable Appendix. We include one fixed effect for each bank, one fixed effect for each quarter as well as lagged control variables (Log Total Assets, Capital Ratio, Deposit Ratio, Off-Balance-Sheet Ratio and Share of Fee Income). T-statistics with standard errors adjusted for clustering at the bank level are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

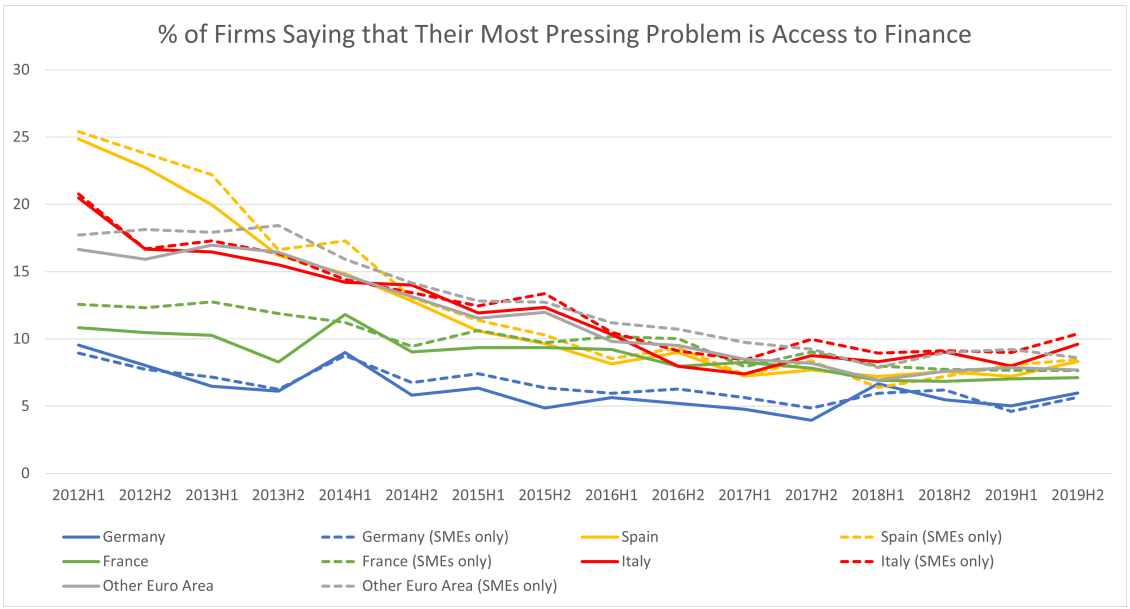
Figure IA.1: Unemployment in the Euro Area



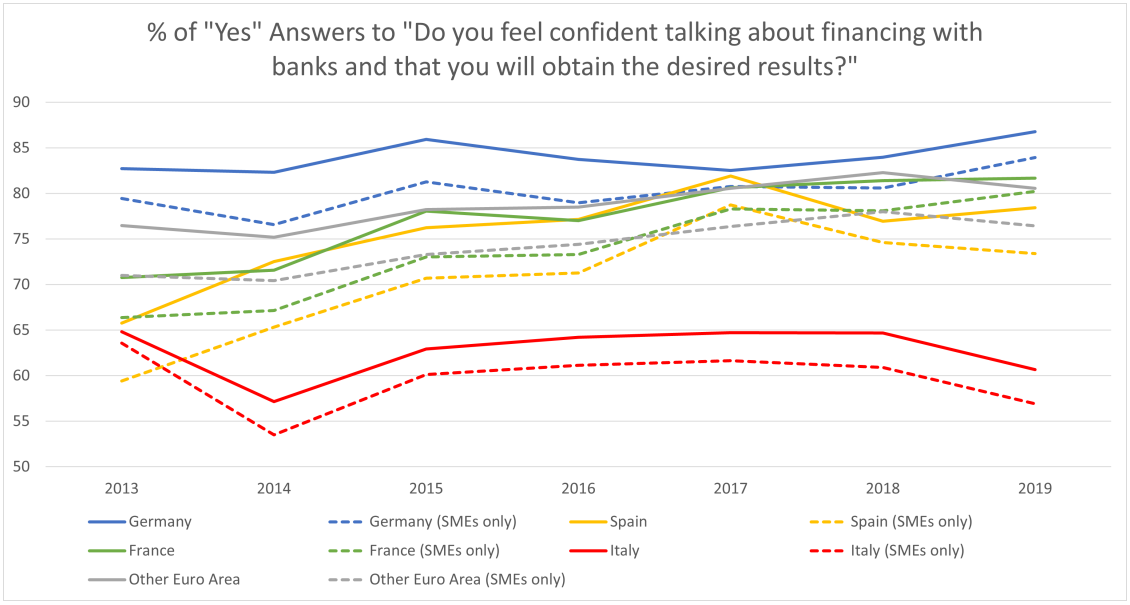
The figure plots the unemployment ratio, measured as unemployed divided by workforce, for selected Euro Area countries. Source: Eurostat.

Figure IA.2: Firm Credit Constrainedness

Panel A: Firms' Most Pressing Problem



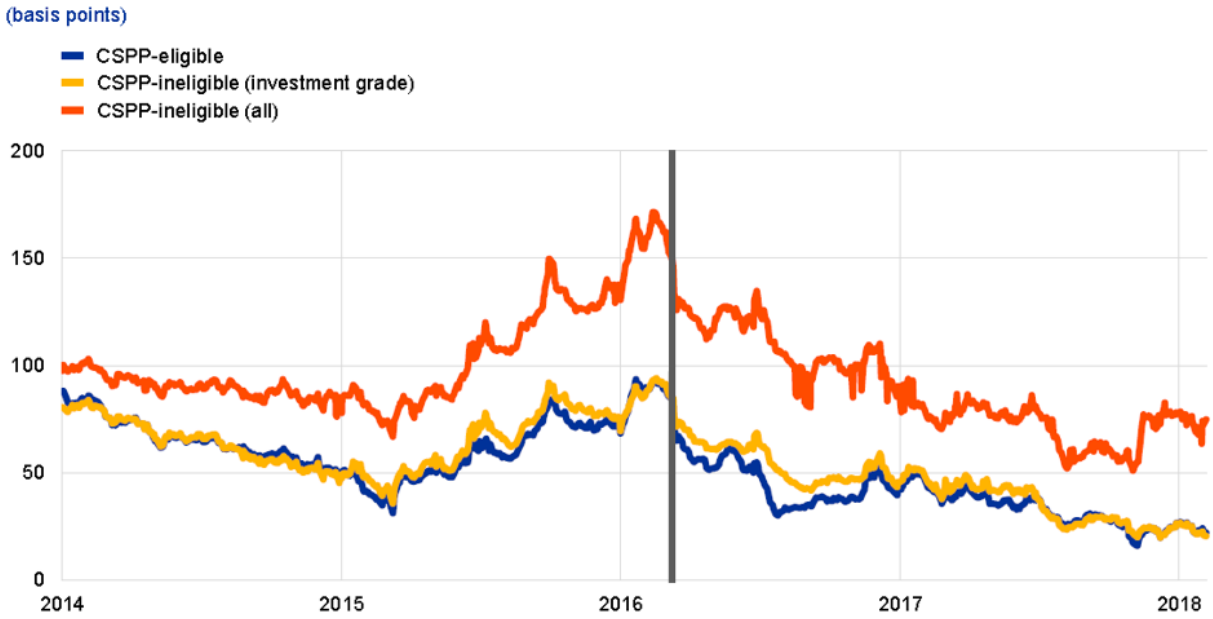
Panel B: Firms' Confidence in Talks with Banks



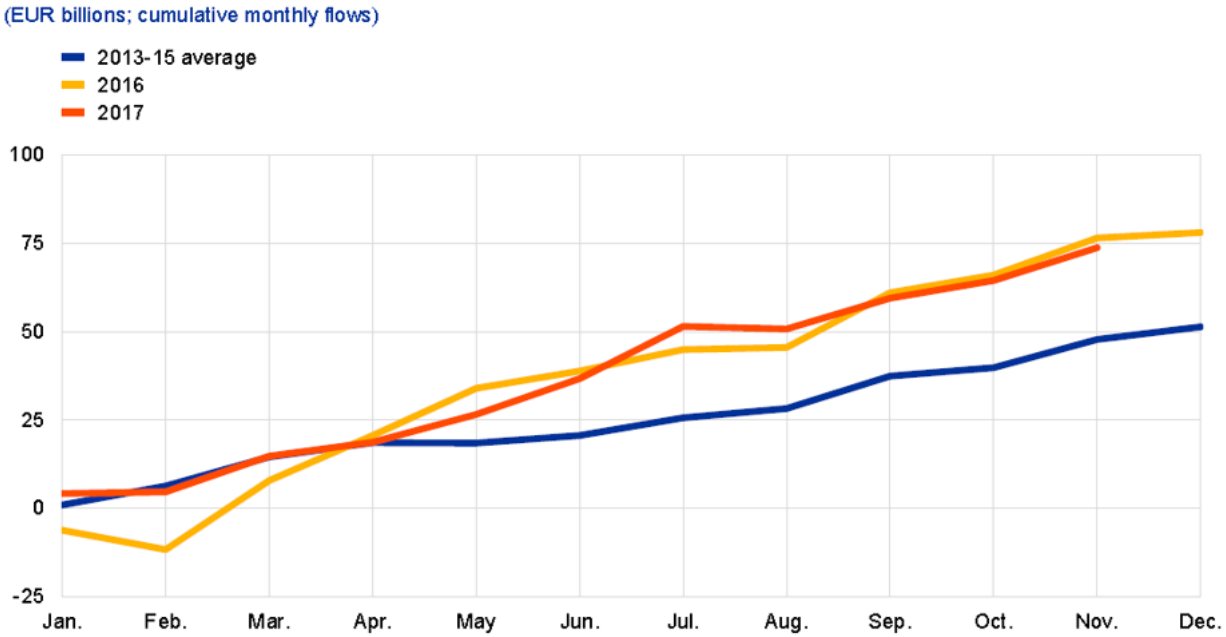
The upper figure plots the percentage of firms whose most pressing problem is access to finance (Question #0 in the Survey on the Access to Finance of Enterprises (SAFE)). The lower figure plots the percentage of firms that feels confident talking about financing with banks and to obtain the desired result (Question #19 in the SAFE; only available from 2013 on).

Figure IA.3: Effect of the CSPP on Bond Spreads and Issuance

Panel A: Bond Spreads

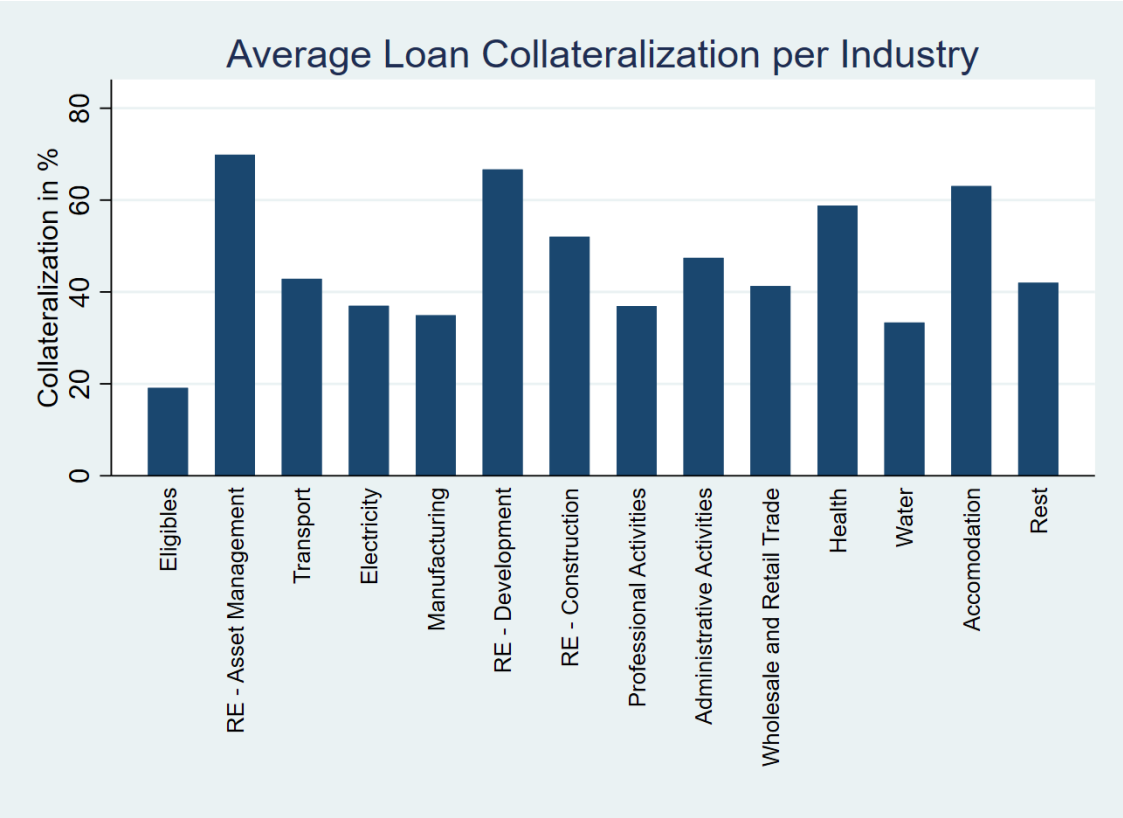


Panel B: Bond Issuances



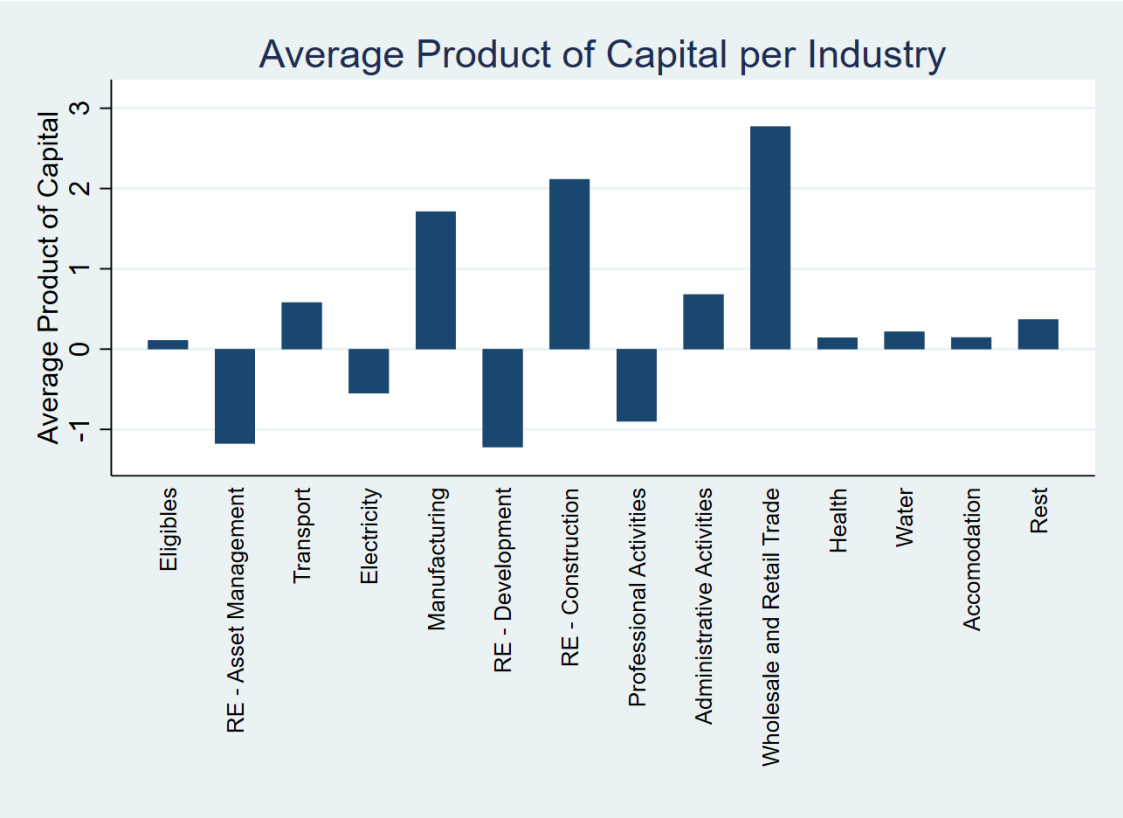
Source: De Santis et al. (2018). Figure 1.A depicts the impact the CSPP announcement had on CSPP eligible/ineligible bonds' spreads. Figure 1.B indicates how the CSPP spurred issuance of euro-dominated NFC long term debt.

Figure IA.4: Collateralization per Industry



The figure depicts the average pre-CSPP collateralization per NACE-21-industry. Collateralization of an industry is calculated as total collateral pledged divided by total loans outstanding. Industries are ordered and summarized as in Figure 4.

Figure IA.5: Average Product of Capital per Industry



The figure depicts the average pre-CSPP Average Product of Capital per NACE-21-industry. Average Product of Capital is calculated as log(Operating Revenue divided by Fixed Assets). Industries are ordered and summarized as in Figure 4.

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