Unintended Consequences of QE: Real Estate Prices and Financial Stability*

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Abstract

We analyze the effects of central bank corporate debt purchases in a setting where the banking sector frictions they are supposed to address do not exist. We find that banks reallocate funding almost entirely to the real estate sector, which fuels real estate overvaluation and impairs financial stability. Our results imply an elasticity of residential real estate prices to credit supply of 0.67, which is 2-5 times higher than prior estimates in the literature. Our findings show that in economies that do not suffer from credit supply frictions, central bank policies that further stimulate loan provision come with substantial adverse effects.

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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. Quantitative easing (QE) policies aim to stimulate corporate investment by providing external funding directly to the real sector, thereby overcoming financial frictions that impede credit supply via the financial 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 markets that do not suffer from credit supply frictions - what we label saturated credit markets - is still an open question. Importantly, there is heterogeneity within currency areas, so some regions tend to experience credit supply frictions, while other regions do not. Further, central banks might find it hard to unwind QE tools once credit supply frictions have eased (Acharya et al., 2023).[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.[3] 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 (Draghi, 2018). The CSPP's impact on the European bond market is remarkable with the ECB at peak holding about €350bn of corporate bonds in June 2022, equivalent to 31% of all outstanding eligible bonds and equivalent to 7% of bank lending to non-financial firms.[4]

In Germany, credit supply frictions were not a major concern for firms at that time. According to the ECB's Survey on the Access to Finance of Enterprises (SAFE), only 5% of German firms considered access to finance a problem in 2015, just before the start of the CSPP program. Germany was an exception in Europe, with firms in Spain and Italy reporting significantly higher problems in accessing finance (see Figure IA.1). Consequently,

[1]See, e.g.,Acharya et al. (2019), Cui and Sterk (2021) and Krishnamurthy and Vissing-Jorgensen (2011).

[2]Despite access to finance becoming a significantly less important issue for firms over time (see Figure IA.1), the ECB expanded its sovereign and corporate bond purchases until June 2022 and afterwards (partly) reinvested the principal payments from maturing securities until June 2023 (ECB, 2023)).

[3]Central banks around the world have implemented similar programs. The Secondary Market Corporate Credit Facility (SMCCF) by the FED was initiated on March 23, 2020 to provide liquidity to the market for outstanding corporate bonds. The Bank of England first bought corporate bonds in 2016, to support the economy after Britain voted to leave the European Union. The Bank of Japan has started to purchase corporate bonds as part of its asset purchases program already in 2011.

[4]In 2019, the end of our sample period, the ECB held about €185bn of corporate bonds, which at that time represented a quarter of all outstanding eligible bonds (ICMA, 2022).

the CSPP program has been fairly exogenous to the conditions in Germany[5] and this country provides an ideal laboratory to analyze the effects of corporate QE policy in a credit saturated market.

Based on proprietary data from Deutsche Bundesbank, we empirically investigate how the CSPP impacted bank lending, real estate prices, and financial stability in Germany. Our identification is as follows. Similarly to Grosse-Rueschkamp et al. (2019), we exploit that banks differed in their lending exposure to CSPP-eligible firms when the program was introduced. Our difference-in-differences estimation compares changes in bank lending for banks that had a high exposure to CSPP-eligible firms to banks that had a low exposure to CSPP-eligible firms. Four observations underscore the plausibility of our identification strategy: first, before the introduction of the CSPP, treated and control banks exhibited similar observable characteristics, such as 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 are robust to using a within-firm Khwaja-Mian and Amiti-Weinstein specification to isolate demand from supply. Fourth, results are robust to the inclusion of region x time fixed effects, mitigating any concern that bank lending patterns are driven by a differential exposure of regions to the CSPP program.

Our empirical analysis yields the following three findings. First, we provide evidence that the CSPP induced banks to reallocate lending from CSPP eligible firms to real estate asset managers. In line with previous studies, we show that CSPP affected banks expand corporate lending to CSPP-ineligible firms relative to less affected banks. This credit expansion, however, does not affect all economic sectors but is *entirely* 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.[6] Real estate asset managers invest in existing properties, typically residential housing with multiple apartments, 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. Because real estate asset managers fare worse on traditional productivity measures, the QE policy is associated with reallocating funds to unproductive sectors.

Second, the credit expansion to real estate asset managers directly impacted real estate prices in Germany. Following the difference-in-difference strategy suggested by Huber (2018),

[5] See Jiménez et al. (2012) and Jiménez et al. (2014) for a similar argument for monetary policy in Spain before the financial crisis of the year 2008.

[6] Note that real estate asset managers in Germany are small with mean total assets of €29m, do not access bond markets, and are highly reliant on bank lending.

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 after the CSPP, while pre-trends are very similar across 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).[7] We estimate an elasticity of real estate prices to credit supply of 0.84, indicating that a 1 percent increase in debt of real estate firms results in a 0.84 increase in real estate prices. This elasticity is 2-7 times higher than prior estimates in the literature (Favara and Imbs (2015), Di Maggio and Kermani (2017)). We attribute the high elasticity to the fact that Germany was a credit saturated economy, with little to no unmet credit demand by construction firms, developers, or firms outside of the real estate sector. This finding suggests that real estate booms can materialize in credit saturated economies even with relatively modest expansionary shocks in credit supply.

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, and profitability decreased. At the same time, affected banks rely more on real estate collateral, making them more vulnerable to reversals in real estate prices.

Overall, our analysis points to significant unintended consequences of QE in saturated credit markets: bank lending is reallocated to real estate asset managers, pushing up real estate prices and adversely affecting banking sector stability. Our results have two implications: first, when there is significant heterogeneity in credit supply conditions within a currency area, central banks need to take into account negative effects in credit saturated economies when designing corporate QE policies. Second, elasticities of real estate prices to credit supply are alarmingly high in credit saturated economies. This implies that a delayed

[7] 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 between 2019 and 2022 (see UBS (2019) and later reports).

unwinding of QE policies may quickly sow the seeds for real estate bubbles.

Our paper contributes to the literature evaluating unintended effects of conventional and unconventional QE measures. While there is evidence that these programs have been successful in significantly dampening recessions (Cui and Sterk (2021)) as well as increasing output and prices (see Fabo et al. (2021) for a summary), several adverse effects of these policies have been documented. A low interest rates environment has been argued to be responsible for capital misallocation towards the non-tradeable sector and particular the real-estate sector which results in lower productivity growth (see e.g. Reis (2013), Liu et al. (2022), Müller and Verner (2024), and Cette et al. (2016)). Very low interest rates might force banks to shift to more risk borrowers and can be a threat to the stability of the banking sector (see, e.g. Borio et al. (2017), Abadi et al. (2023) and Heider et al. (2019), Agarwal et al. (2018)).[8] The latter effect is particular pronounced once banks are undercapitalized at the time of the central bank policy measure which may result in zombie lending (Acharya et al. (2019)). While these papers focus on QE policies that aim to stimulate loan demand to facilitate more investments, our paper is the first to focus on policies that aim to directly address credit supply frictions.

Several previous studies have focused on the impact of the ECB's CSPP in particular. 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.[9] Similarly Adelino et al. (2023) document that CSPP eligible firms issue more bonds and tend to allocate these funds to financially constrained customers as trade credit. These studies focus on the quantity of lending in response to the QE program, but not where the extra credit goes to. We contribute to these papers by showing that the credit allocation in credit saturated markets goes towards a non-productive sector, i.e. real estate asset managers.

Our paper also contributes to the literature on monetary policy, credit supply and real estate prices. Several studies document an exogenous increase in credit supply or easier access to credit results in an increase in house prices (Favara and Imbs (2015), Di Maggio and Kermani (2017), Adelino et al. (2024)).[10] The documented elasticities in our paper

[8] Balloch (2018) argues that as bond funding is facilitated for large firms, banks' corporate loan portfolios decrease in quality to the extent that bank profitability decreases.

[9] See Ertan et al. (2020), Arce et al. (2021) and De Santis et al. (2018) for similar evidence.

[10] According to Drechsler et al. (2022), FED's increase in interest rates resulted in a contraction of mortgages during the US housing boom between 2003 and 2006. Our study further adds to the literature on Germany's real estate 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)).

are considerably higher than estimates of these papers. This difference can be explained by the fact that credit supply expansion goes only to real estate asset managers while housing supply is inelastic.

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

As part of its unconventional monetary policy package to provide further monetary accommodation and to improve financing conditions for the real economy in response to low inflation rates, the ECB started to purchase corporate bonds under the CSPP in 2016 (ECB, 2016). The CSPP was announced on March 10^{th} 2016 and began operating from June 8^{th} 2016. Until the end of our sample in 2019, the ECB bought €5.5bn of corporate bonds per months, except for January to October 2019, where no net purchases took place.[11] As of December 2019 – the end of our sample period – CSPP holdings amount to €185bn. This represents 24% of the eligible universe of corporate bonds (ICMA, 2022), and it is equal to 1.5% of outstanding bank lending in the Eurozone and 4.2% of outstanding lending to non-financial corporations in the Eurozone.[12]

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, 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). 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 De Santis et al. (2018) and Appendix Figure IA.3, Panel A). All else equal, this trend makes bond funding relative more attractive than bank funding for

[11] From January to October 2019, 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.

[12] Loans to Euro Area Residents were €12.6trn as of December 2019 (ECB, 2019a), of which €4.5trn are loans to non-financial corporations (ECB, 2019b).

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 and bank-level 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. We then enrich the credit register with bank balance sheet and P&L information 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. Our sample runs from 2012 to 2019.

We impose two restrictions on the sample of banks: i) we only include banks that on average lend more than €250m to Eurozone non-financial corporations between 2012 and 2015 and that have at least one loan to a CSPP-eligible firm between 2012 and 2015, ii) we drop banks that engage in mergers throughout our time period. Condition i) drops very small banks or banks that do not engage in major corporate lending activities, condition ii) ensures that changes in bank lending are not inorganic, but can actually be decomposed into demand and supply effects. The two restrictions drop banks that make up 13% of total corporate lending in our sample.

Table 1, Panel A, provides descriptive statistics, separately for treated banks and control banks. 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*

[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 for financing via bonds and/or loans (e.g., BMW Finance N.V. for BMW AG).

(Static)) is above-median. Treated banks on average have 13.59% of their total corporate lending to CSPP-eligible firms, while the average for control banks is 1.69%. All variable definitions can be found in the Variable Appendix.

Treated banks are – by construction – different from control banks in all those characteristics that relate to the average credit quality of their portfolios. Treated banks have fewer high-yield borrowers in their loan book (19.52% vs 24.71%), a lower volume-weighted PD of their loan book (2.18% vs 3.62%), a lower net interest income (1.82% vs. 1.91% of total assets), and lower write-offs (0.19% vs. 0.27% of total assets).

Treated and control banks are, however, very similar in all other aspects. They are equally profitable (with an average RoA of 0.79% for both treated and control banks), have similar shares of fee income (18.70% vs. 18.37%), similar other operating income and costs (-0.84% vs. -0.85%), similar capital ratios (17.14% vs. 16.14%), a similar reliance on deposit funding (48.89% vs. 49.88%), and a similar reliance on real estate collateral (51.27% vs. 52.88%).

Two differences stand out: First, lending to real estate asset managers is somewhat lower for treated banks compared to control banks (17.43% vs. 22.86%), suggesting treated banks are not more specialized in lending to real estate asset managers than control banks. Second, treated banks are larger on average (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. When we drop the largest five banks in our sample, mean assets are similar in the control and treatment group, and all our results remain robust.

3.2 Firm-level data

We apply the NACE 21-industry classification to all banks' borrowers and summarize all industries that account for less than 1% pre-CSPP portfolio share under 'Other Industries'. Real estate firms either belong to the NACE industry 'Construction' or to the NACE industry 'Real Estate Activities'. We further divide the latter category into 'RE - Construction' – i.e., firms that develop properties – and 'RE - Asset Management' – i.e., firms that buy and rent properties.[15] We further summarize all CSPP eligible firms, i.e. those with an outstanding investment-grade bond as of 2015q4, under 'Eligibles'.

Table 1, Panel B, provides summary statistics of our sample of non-financial corporations

[15]'RE - Asset Management' and 'RE - Development' are both part of the NACE industry 'Real estate activities' and we use the legal identity and the corporate structure to differentiate among these. '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. We also hand-check the resulting classification to verify that the classification is appropriate.

according to their industry classification described above. The 563 firms that are eligible for the CSPP are clearly the largest firms based on total assets and the average loan amount. There are about 21,000 real estate asset managers, 15,000 real estate developers, and 6,000 construction firms, making up 20%, 14%, and 5% of the lending volume, respectively. The largest industries outside of the real estate sector are professional services (8,000 firms, 12% portfolio share), manufacturing (15,000 firms, 11% portfolio share), electricity (10,000 firms, 8% portfolio share), and wholesale and retail trade (13,000 firms, 8% portfolio share).

Compared to other industries, real estate developers and real estate asset managers have fewer employees per million euro of total assets (that is, they are capital-intensive, but not labor-intensive), they are younger (because some firms tend to create new companies for each project), and they are more highly leveraged (unsurprisingly, given the role of real estate collateral in bank lending).

Real estate firms are relatively small with mean total assets of €29m for real estate asset managers, €35m for real estate developers, and €18m for construction firms. They are also highly reliant on bank funding: the real estate and construction sector makes up 37% of bank lending volume in our data, but they make up less than 12% of the eligible CSPP universe end of 2019.[16]

3.3 County-level data

We construct a county x year level dataset using firm-level balance sheet data from Bureau van Dijk' Amadeus database, real estate price data from the German provider 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 from the municipal level 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.[17]

Table 1, Panel C, provides descriptive statistics on the county level, separately for treated and control counties. Total firms debt is higher in treated counties than in control counties (€8.99bn vs. €6.97bn). However, the amount of real estate debt is almost identical to the treated counties (€0.86bn vs. €0.87bn). Treated counties have somewhat higher apartment

[16] According to the ECB, bonds of real estate firms make up 7% of the eligible universe. The ECB combines the construction sector with the materials sector which make up a combined 5% of the eligible universe (ECB, 2023).

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

prices per m^2 (€1,845 vs. €1,660), rents per m^2 (€6.82 vs. €6.59), and GDP per Cap. (€37,819 vs. €33,031). These differences between counties are due to the fact that CSPP eligible firms are somewhat more likely to be incorporated in high-income counties. However, there is a significant overlap between treated and control counties: for example, differences in mean apartment prices per m^2 are €185 (€1,845 minus €1,660), which is low compared to the standard deviation of mean apartment prices across control counties (€732). Once we scale by income, prices are comparable between treated and control counties (Price to Income Ratio of 5.16 vs. 5.24).

4 CSPP-induced reallocation of bank lending

4.1 Research design

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 (because eligible firms substitute bank debt by bond debt) compared to banks with a small exposure to CSPP. We therefore 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, 2, IA.6 and IA.8).

4.2 Lending to eligible firms and total lending

We first estimate how the CSPP 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). Our dependent variable is the fraction of the corporate loan portfolio that is to eligible firms. Treated banks have a mean share of eligible firms of 13.59% 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 1.56-1.64 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.

Two facts are worth highlighting: first, the effect is economically sizable. Lending to eligible firms accounts for 13.40% of the portfolio of treated banks pre-CSPP. The decline by 1.56-1.64 percentage points, thus, represents 12% 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.

In columns (3)-(4) of Table 2, Panel A, we use the total corporate lending as the dependent variable. The results suggest no effect of the CSPP on overall corporate 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).[18] 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 types of banks.

4.3 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 (-1.64 percentage points) is allocated to the real estate sector (+1.48 percentage points). Figure 2 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 2. We find that treated banks after the CSPP mainly allocated capital to real estate asset managers (+1.45 percentage points), whereas effects for developers (+0.28 percentage points) and the construction sector (-0.24 percentage points) are close to zero and statistically insignificant. We do not observe any significant changes in the portfolio share for any other NACE-21 industry, as Figure 3 shows. Note that the +1.45 percentage point effect for real estate asset managers is a mean effect throughout the post period, the effect as of end of our sample period is even higher (+2 percentage points, see Figure 2).

We so far presented results mainly in Diff-in-Diff form. However, simple back-of-the-

[18] 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.

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 (assuming no spillovers and a zero effect for control banks). Therefore, about 121×€3bn×2%=€7.3bn are reallocated to real estate asset managers via the ECB's CSPP by treated banks. 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,[19] the CSPP contributed to about 3.5% in total transactions, or 7.0% of those transactions financed by treated banks.

4.4 Channel

Previous results document banks' CSPP induced reallocation of loans from CSPP eligible firms to real estate asset managers. 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 and apply a within-firm estimation in Table IA.2.

The sample consists of all CSPP ineligible real estate asset managers. We start with the credit register on the bank x firm x quarter level and then collapse the time dimension to pre vs post event. In columns (1)-(3), we calculate the difference in log loan amount between the post and the pre period, i.e., the intensive margin. Columns (4)-(6) and (7)-(9) analyze the extensive margin by looking at entry and exit. We report results for specifications without any fixed effects (1), (4) and (7), with size decile x 2 digit zipcode fixed effects comparable to Degryse et al. (2019) in Columns (2), (5) and (8) and firm fixed effects in Columns (3), (6) and (9). Note that the sample size drops by 74% when introducing firm fixed effects because most real estate asset managers are small and borrow only from a single bank.

We find that treated banks increase their loan supply to real estate asset managers by about 10% on the intensive margin in the strictest specification (Column (3)). On the extensive margin, there is evidence for treated banks starting more new loan relationships with real estate asset managers (Columns (4)-(6)) and modest (yet statistically insignificant) evidence for them exiting existing loan relationships with real estate asset managers less frequently.

[19]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)).

Panel B of Table IA.2 provides estimates using the Amiti-Weinstein methodology (Amiti and Weinstein, 2018). The methodology decomposes firm-bank level lending growth into firm and bank shocks that satisfy the adding-up constraint, that is, bank and firm shocks can be aggregated to match aggregate changes in lending. The approach differs from Khwaja-Mian in two key aspects, namely (i) loan growth rates are specified in percentage terms and (ii) regressions are estimated using a weighted-least squares, where weights are equal to lagged lending volumes.

Panel B reports the mean of the bank fixed effects using (Amiti and Weinstein, 2018) for both treated and control banks, as in Panel A limited to the sample of real estate asset managers. The results confirm a strong bank supply effect for treated banks, with a mean bank fixed effect of 7.01% ($p < 0.01$). In contrast, we do not observe a signifcant bank supply effect to real estate asset managers for control banks.

Why do we observe that the reduction in lending to 'Eligibles' is exclusively allocated to real estate asset managers? We argue that this is due to a 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).[20] On top of that, collateral values increase during real estate 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 an attractive alternative if banks need to keep their regulatory capital constant.

Both the Kwhaja-Mian and Amiti-Weinstein estimators as well as the arguments above support a supply side narrative. Banks can, however, only supply additional lending to the market if there is a matching demand. Germany in 2015, i.e. before the CSPP, was characterized by low unmet credit demand (see Figure IA.1) and a low unemployment rate (see Figure IA.2). Banks can stimulate demand by improving loan prices or loan terms. This induces industries that are capital intense, but need little labor, to demand more funds, as these firms are highly responsive to even small improvements in financing conditions and are

[20] 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.

not constrained by a tight labor market. Real estate asset managers are a prime example of such an industry: when receiving cheap incremental funds, a real estate asset manager can directly purchase e.g. another apartment.[21] 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.

While we do not aim to evaluate how this reallocation impacts 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 is all else equal detrimental to productivity.

4.5 Robustness: Bank matching and time-varying regional effects

In Table 3, we provide robustness tests for the main results of Table 2. These robustness tests address two key concerns: First, treated banks might be different from control banks on observable dimensions, and linear controls in Table 2 might not be able to appropriately control for these differences. Columns (1) and (4) apply Mahalanobis distance matching based on banks' pre-CSPP size (where Table 1 revealed differences in means between treated and control banks) and profitability (where means are identical across the entire sample, see Table 1, but treated banks have a slightly higher profitability in the pre period).[22] The results suggest that a matched sample even increases the coefficients reported above for both banks' portfolio share of CSPP eligible firms and real estate asset managers.

Second, we control for region x time fixed effects. Regions with many CSPP-eligible firms might face higher growth in the post period due to the favorable financing conditions of these firms. More lending to real estate asset managers can thus be a reflection of a higher growth of affected regions, as opposed to reflecting credit supply shocks from treated banks. Columns (2) and (5) add bank NUTS 1 x quarter fixed effects to the baseline specification reported in Table 2. NUTS 1 corresponds to the 16 *Länder* in Germany and is assigned to a bank based

[21] 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.

[22] Note that the sample size slightly increases as i) some banks that are not always in the sample never serve as control banks or/and ii) some banks that are always in the sample serve as a match multiple times.

on where the majority of its borrowers is located. As there are 3 *Länder* that consist of only one city (Berlin, Hamburg, Bremen), these are dropped in this specification. Columns (3) and (6) add NUTS 2 x quarter fixed effects. NUTS 2 corresponds to the 31 *Bezirke* (or *Länder*, in case a *Land* is not subdivided into *Bezirke*) in Germany and is assigned to a bank based on where the majority of its borrowers are located. As for matching, the estimated coefficients remain highly statistically significant and even slightly increase in magnitude.

5 Impact of the CSPP on real estate prices

In the preceding section, we demonstrated that the CSPP led to a notable increase in loan supply directed towards real estate asset managers. We will now investigate whether this specific increase in credit supply impacts real estate prices. It is crucial to note that this unconventional monetary policy is likely to exert a more pronounced influence on real estate prices compared to the credit supply shocks discussed in prior literature. There are two main reasons why we expect this outcome. First, due to saturation in credit markets, the CSPP had a highly varied impact on loan supply, predominantly favoring the real estate sector. Secondly, considering the construction sector was operating at maximum capacity when the CSPP was implemented, the supply of real estate is largely inelastic in response to the policy. The combination of these two factors is anticipated to result in a particularly substantial increase in real estate prices.

5.1 Geographic dispersion of the loan supply shock to real estate firms

Our empirical approach aims to exploit geographic dispersion in real estate prices due to differences in the availability of credit to real estate asset managers which, in turn, is driven by the location of banks that have been most impacted by the CSPP. A large literature has shown that due to frictions, geographic proximity between banks and their borrowers is a key determinant to explain existing lending relationships (see e.g. Degryse and Ongena (2005)). For this reason, real estate asset managers located in proximity of CSPP-affected banks are likely to be most exposed to the credit supply shock identified in the previous section.

To begin, we test whether the increase of loan supply to real estate firms by treated banks had a divergent impact on real estate firms situated in their respective counties compared to those in other counties. To conduct this analysis, we aggregate the total debt of all real estate firms per county-year and perform a parallel aggregation for non-real estate firms. We use these aggregated total debt per county-year measure as a dependent variable regressed on the interaction of the $After$ dummy (as before equal to one for years after 2015) and a $Treated$ dummy. The $Treated$ dummy is equal to one for counties whose firms' weighted CSPP affectedness (measured by the affectedness of its lenders) is above-median.[23] Consider the specification:

$$y_{dt} = \beta \times Treat_d \times After_t + Controls_{dt-1} + \gamma_d + \gamma_t + \varepsilon_{dt} \quad (2)$$

where d indicates county and t year. y_{dt} is a measure on the county level total debt of all real estate firms or of all non-real estate firms. γ_d and γ_t are county 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.

Table 4 Panel A shows the resulting county-year regressions. Following the implementation of the CSPP, there is an observable increase in total debt among real estate firms in treated counties, ranging between 6.05% to 6.70% relative to non-treated counties, contingent upon the specification (Columns (1) and (2)). This suggests a spatial concentration of loan supply to real estate asset managers located in counties where treated banks are situated.

Notably, this observation is not attributable to a trend of increased funding in counties where treated banks are located. Upon substituting the dependent variable from debt to real estate firms to debt to non-real estate firms, we fail to observe a statistically significant effect (Columns (3) and (4)). The dynamics of this effect can be visually illustrated in Figure IA.7.

5.2 Credit Supply and the Pricing of Real Estate

We now investigate the impact of credit reallocation to real estate asset managers on real estate prices. In Table 4, Panel B, we present the results. Column (1) features the dependent variable as the natural logarithm of prices for apartment buildings and existing apartments. Our analysis reveals that in counties affected by the CSPP, real estate prices witness an increase post-CSPP relative to control counties compared to pre-CSPP levels. This effect is highly statistical significance and amounts to 3.13%.[24] We visualize the dynamics of this regression, which are in line with the gradual implementation of the CSPP, in the upper graph in Figure 4. While the average increase in real estate prices is 3.13% across the post-

[23] E.g. suppose in some county there is only one firm. In 2015, the firm borrows €3m 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%.

[24] We do not observe a comparable increase in prices for residential stand-alone houses. This finding aligns with the characteristics of houses, which are typically less liquid, indivisible, and associated with higher transaction costs compared to apartment buildings and existing apartments, rendering them less attractive to investors to buy and sell with the aim to achieve capital gains (Himmelberg et al., 2005).

period, the cumulative price growth by the end of our sample period in 2019 stands at 5.1%. As over the same period (2015 to 2019), the growth rate in the price of apartment buildings and existing apartments registers at 28.7% (see German Federal Statistical Office (2023)), the CSPP contributes approximately 17.8% (=5.1%/28.7%) to the overall increase of these real estate prices.[25]

Column (2) indicates that apartment rents in highly CSPP-affected counties also increase post-CSPP, albeit at a slower rate compared to prices (1.66% vs. 3.13%). Consequently, Column (3) demonstrates an increase in the price-to-rent ratio, a common indicator for real estate overvaluation (Case and Shiller, 2003), due to the CSPP. The increase in the price-to-rent ratio by 0.4370 represents a rise of 2.1% relative to the pre-CSPP average of 20.45. This indicates that, due to the CSPP, it takes about half a year longer in treated counties for earned rents to offset the purchase price. The lower graph in Figure 4 confirms that the reported outcomes regarding the price-to-rent ratio manifest only after the initiation of the CSPP, and do so consistently, aligning with the gradual increase in CSPP holdings and banks' rebalancing towards the real estate sector.

An alternative metric for assessing potential overvaluation in real estate prices is the price-to-income ratio. In contrast to our initial indicator, which captures the comparative cost of ownership versus renting, the price-to-income ratio evaluates the affordability of purchasing real estate in relation to the local income levels. Column (4) demonstrates a significant increase in the price-to-income ratio, approximately by 3.0% (=0.1480/4.99) compared to the pre-CSPP sample mean. Consequently, given an average apartment size of about 92m^2 in Germany (German Federal Statistical Office, 2022), purchasers in highly CSPP-affected counties need to allocate an additional amount equivalent to (0.1480*92=)13.6% of a year's income compared to less CSPP-affected counties.

The resulting elasticity estimates significantly exceed those derived from credit supply shocks unrelated to unconventional monetary policy. Our calculated cumulative growth in real estate prices attributable to the CSPP stands at 5.1% by the end of our sample period in 2019, derived from a 6.05% increase in debt of real estate firms (as indicated in Column (2) of Table 4 Panel A). This translates to an elasticity estimate of 0.84, indicating that a 1 percent increase in debt of real estate firms results in a 0.84 percent increase in the growth rate of real estate prices. Notably, this elasticity is approximately seven times higher

[25]Alternatively, one can calculate this more formally. Under the simplifying assumption that all counties would have experienced a similar growth rate in the absence of the CSPP, and with the findings indicating that price growth due to the CSPP was 5.1% higher in treated counties, and the average price growth in the presence of the CSPP being 28.7%, this implies that price growth must have been 28.7%-5.1%/2=26.2% in control counties and 28.7%+5.1%/2=31.3% in treated counties. Hence, (5.1%/31.3%=)16.3% of the price growth in treated counties can be attributed to the CSPP.

than the estimate derived from a loan supply shock due to US branch deregulation on real estate prices by Favara and Imbs (2015). Similarly, Di Maggio and Kermani (2017) find, for the US, that an increase in annual lending during the 2004–2006 period led to an annual house price growth rate with an elasticity of 0.3.[26] We attribute our high elasticity to the inelastic supply of housing and the exclusive absorption of excess loan supply by real estate asset managers due to the CSPP policy in a saturated credit market. Further, the same change in interest rates at very low levels should all else equal result in a higher elasticity compared to a similar change at a higher level of the interest rate. Therefore, the impact of unconventional monetary policy measures which are generally conducted when interest rates are close to the lower bound likely result into higher elasticities compared to measures that increase loan supply at higher rates.

We present a graphical summary of the findings of this Section in Figure 5. The upper figure illustrates the relationship between the change (from pre- vs. post-CSPP) in prices of apartments and apartment buildings and the debt of real estate firms per county (NUTS 1 level).[27] Next, we aggregate data at the next larger geographical unit, i.e., Bezirk, in the middle figure (NUTS 2 level). Finally, we present averages at the state level (NUTS 3 level) in the bottom figure. All subfigures indicate that geographical units with larger increases in real estate firm debt also experience larger increases in real estate prices. Specifically, the correlation coefficient amounts to 0.28, 0.53, and 0.56 at the NUTS 1, NUTS 2, and NUTS 3 levels, respectively.

6 Impact of the CSPP on financial stability

6.1 Bank risk taking and diversification

CSPP eligible firms must have an investment grade rating and are therefore by definition low risk borrowers. Columns (1)-(2) of Table 5 Panel A suggest that treated banks substituted lending from eligible firms with lending to higher-risk ineligible firms (defined as having a PD-implied rating of BB+ or worse). The share of high-yield firms increases by about 1.5 percentage points relative to control group firms after the CSPP. Before the CSPP, treated banks had lower loan portfolio PDs than control banks (almost by construction, as they are

[26]Estimating the elasticity via an instrumental variable approach as in Favara and Imbs (2015) does not alter our results materially.

[27]The former is calculated as the 2019 average existing apartment price divided by the 2015 average existing apartment price. The change in debt of real estate firms is calculated as the instrumented debt of real estate firms in a geographical unit (i.e., the predicted values of a regression of the debt of real estate firms in a geographical unit on treat × after) in 2019 divided by the instrumented debt of real estate firms in a geographical unit in 2015.

defined as lending a lot to eligible, and thus low-risk, firms). Columns (3) and (4) documents a significant increase in loan portfolio PDs for treated banks relative to control banks post CSPP (Figure IA.6 reports dynamic effects). The effects are quantitatively meaningful, implying that the gap in loan portfolio PDs between treated and control banks narrowed by 1/3 due to the CSPP.

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. Table 5 Panel A Columns (5)-(6) show the empirical results (Figure IA.6 depicts the dynamics). The HHI increases by about 3%, implying 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.

Lastly, we examine the impact the CSPP had on affected banks' reliance on real estate collateral in Table 5 Panel A Columns (7)-(8). 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 2.29% in the strictest specification. The estimate is statistically significant as well as economically significant as it represents about 4.7% of the pre-CSPP sample mean across all banks.

6.2 Impact of the CSPP on bank profitability

We examine whether bank profitability responds to previously documented changes in banks' portfolio composition brought about by the CSPP. Table 5 Panel B 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 4.8-5.0bps of total assets for treated banks after the CSPP relative to control group banks. Thus, the increase in average PD of the loan portfolio of treated banks is accompanied with higher average write-offs. To date, after the ECB has drastically increased policy rates real estate prices dropped significantly and insolvencies in the commercial real estate sector have increased in Germany. Therefore, loan write-offs are likely to increase further during the following years.

Interestingly, we do not observe any effect on net interest income, as Columns (3) and (4) of Table 5 Panel B suggest. 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 slightly more than one third of the effect documented on loan write-offs in Columns (1)-(2). Our result is line with the ECB compressing bond spreads via the CSPP, dampening loan demand by eligible firms, which in turn, dampens loan spreads in affected markets.

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

Figure IA.8 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 PDs (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.[28]

7 Conclusion

In this paper, we have explored how central bank corporate bond purchases, namely the ECB's CSPP, unfold in markets that do not suffer from credit supply frictions – what we label credit saturated economies. A drop in lending to eligible firms is fully substituted by an increase in lending to (ineligible) real estate asset managers. Real estate prices increase and measures such as the price-to-rent or price-to-income ratio indicate overvaluation. Finally, financial stability is negatively affected, with a rise in banks' portfolio concentration, a lower profitability, and a higher reliance on real estate collateral.

[28]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.

Overall, our finding suggests that unconventional monetary policy in credit-saturated markets comes with substantial unintended consequences. 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.

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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	13.59	9.86	9.32	120	1.69	1.28	1.52
			Quarterly measures on bank corporate loan portfolio composition							
Share Eligible	%	Bank x Quarter	3,567	13.05	9.85	9.79	3,539	2.23	2.22	1.80
Lending to Eligibles	€m	Bank x Quarter	3,567	372	1,459	75	3,539	35	98	13
Lending to Ineligibles	€m	Bank x Quarter	3,567	2,642	8,783	539	3,539	1,787	4,795	698
Total Corp. Lending	€m	Bank x Quarter	3,567	3,013	9,993	624	3,539	1,821	4,871	714
PD	%	Bank x Quarter	3,567	2.18	2.15	1.57	3,539	3.62	5.17	2.30
Share HY	%	Bank x Quarter	3,567	19.52	9.75	17.92	3,539	24.71	15.54	20.82
Share REAM	%	Bank x Quarter	3,567	17.43	9.16	17.09	3,539	22.86	11.74	21.70
RE Collateral	%	Bank x Quarter	3,528	51.27	18.89	53.84	3,524	52.88	21.05	56.12
			Yearly measures on bank profitability							
NII / Toas	%	Bank x Year	910	1.82	0.45	1.90	910	1.91	0.44	1.90
Loan write-offs / Toas	%	Bank x Year	910	0.19	0.16	0.16	910	0.27	0.24	0.21
Rest / Toas	%	Bank x Year	910	-0.84	0.36	-0.88	910	-0.85	0.34	-0.86
RoA	%	Bank x Year	910	0.79	0.36	0.80	910	0.79	0.40	0.78
			Yearly lagged control variables							
Capital Ratio	%	Bank x Year	910	17.14	3.81	16.65	910	16.14	3.68	15.51
Deposit Ratio	%	Bank x Year	910	48.89	12.53	48.75	910	49.88	12.44	48.79
Off-BS Ratio	%	Bank x Year	910	3.11	3.00	2.18	910	2.48	1.86	2.12
Share of Fee income	%	Bank x Year	910	18.70	9.89	17.32	910	18.37	8.65	17.58
			Quarterly lagged control variables							
Total Assets	€bn	Bank x Quarter	3,567	13.38	39.55	3.38	3,539	7.41	13.16	3.67

Panel B: Descriptive Statistics on the Industry 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	563	99.29	7.88	1991	18,531	171	1,440	19,454	1.31	0.70
RE – Asset Management	21,387	7.20	20.25	2004	29	5	10	23	0.27	0.83
RE - Development	15,210	9.48	13.92	2005	35	5	10	21	0.24	0.86
RE – Construction	6,397	5.04	4.94	1998	18	4	7	15	1.56	0.85
Transport	5,974	12.34	3.78	2002	40	5	10	20	2.43	0.81
Electricity	9,580	8.10	8.29	2009	38	4	7	17	0.40	0.82
Manufacturing	14,707	5.99	10.99	1989	74	6	12	30	7.91	0.67
Professional Activities	7,737	16.68	11.61	2001	237	7	21	95	1.64	0.68
Administrative Activities	4,375	8.38	2.95	2001	76	5	10	26	1.94	0.76
Wholesale and Retail Trade	12,460	4.81	8.24	1991	48	4	8	17	5.86	0.76
Health	3,415	5.35	4.38	1997	54	7	17	55	11.50	0.60
Water	972	8.02	1.39	1995	44	7	14	33	2.86	0.70
Accomodation	1,316	4.75	1.20	2003	12	3	6	11	8.52	0.84
Other Industries	4,232	4.91	2.42	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							
Debt RE	€bn	County x Year	1,594	0.86	3.90	0.20	1,545	0.87	3.92	0.29
Debt Non-RE	€bn	County x Year	1,594	8.13	19.91	2.51	1,545	6.11	20.03	2.07
Total Debt	€bn	County x Year	1,594	8.99	22.06	2.79	1,545	6.97	23.36	2.46
			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	21.70	4.46	21.16	1,545	20.28	4.27	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. Treated banks are banks whose share of lending to CSPP eligible firms in the two years before the CSPP is above-median. 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. Treated counties are counties whose firms' weighted CSPP affectedness (measured by the affectedness of its lenders) is above-median. 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)	
	(1)	(2)	(3)	(4)
Treat x After	-1.5608***	-1.6420***	0.0075	0.0014
	(-3.00)	(-3.24)	(0.27)	(0.06)
Controls	no	yes	no	yes
Quarter FE	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes
Observations	7,106	7,106	7,106	7,106

Panel B: Capital Allocation across Industries

Dependent variable:	Portfolio Share per Industry			Portfolio Share per Real Estate Subindustry		
	Eligibles	Real Estate	Other	Construction	Development	Asset Man.
Treat x After	-1.6420***	1.4822**	0.1597	-0.2381	0.2748	1.4455***
	(-3.24)	(2.21)	(0.24)	(-0.93)	(0.68)	(2.97)
Controls	yes	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes	yes
Quarter FE	yes	yes	yes	yes	yes	yes
Observations	7,106	7,106	7,106	7,106	7,106	7,106
Sample Mean in %	7.63	36.66	55.72	4.72	12.78	19.16

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. In any Panel, the dataset is on the bank x quarter level with $After = 1$ for quarters from 2016q1 on and $Treat = 1$ for banks whose share of lending to CSPP eligible firms in the two years before the CSPP is above-median. The dependent variable in Panel A Columns (1)-(2) and Panel B is the portfolio share in %. Variable definitions are provided in the Variable Appendix. Control variables are the lags of the following 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).

Table 3: CSPP Induced Capital Reallocation: Robustness

Dependent variable:	Portfolio Share per Industry					
	Eligibles			Real Estate Asset Managers		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat x After	-1.6620***	-1.9775***	-1.8904***	1.9943***	2.0511***	2.0853***
	(-3.20)	(-3.75)	(-3.15)	(3.44)	(4.26)	(3.91)
Controls	yes	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes	yes
Quarter FE	yes	-	-	yes	-	-
Bank NUTS 1 x Quarter FE	no	yes	-	no	yes	-
Bank NUTS 2 x Quarter FE	no	no	yes	no	no	yes
Matched Sample	yes	no	no	yes	no	no
Observations	7,186	7,009	6,947	7,186	7,009	6,947

This table provides robustness checks for the results on banks' portfolio share of CSPP eligible firms and Real Estate Asset Managers reported in Table 2. The dataset is on the bank x quarter level with $After = 1$ for quarters from 2016q1 on and $Treat = 1$ for banks whose share of lending to CSPP eligible firms in the two years before the CSPP is above-median. The dependent variable is the portfolio share in %. 'Eligibles' comprises all CSPP eligible firms, independent of their industry classification. Columns (1) and (4) apply Mahalanobis distance matching based on banks' pre-CSPP size and profitability. Columns (2) and (5) add bank NUTS 1 x quarter fixed effects to the baseline specification reported in Table 2. NUTS 1 corresponds to the 16 *Länder* in Germany and is assigned to a bank based on where the majority of its borrowers is located. Columns (3) and (6) add bank NUTS 2 x quarter fixed effects to the baseline specification reported in Table 2. NUTS 2 corresponds to the 31 Bezirke (or *Länder*, in case a land is not subdivided into Bezirke) in Germany and is assigned to a bank based on where the majority of its borrowers is located. Variable definitions are provided in the Variable Appendix. Control variables are the lags of the following 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 4: Impact of the CSPP on Real Estate Prices

Panel A: Total Debt by County

	Ln(Debt RE)		Ln(Debt Non-RE)	
	(1)	(2)	(3)	(4)
Treat x After	0.0670**	0.0605**	0.0009	-0.0039
	(2.49)	(2.33)	(0.04)	(-0.20)
Controls	no	yes	no	yes
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Observations	3,139	3,139	3,139	3,139

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

	Ln(Price Exist. Apartments) (1)	Ln(Rent Exist. Apartments) (2)	Price to Rent Ratio (3)	Price to Income Ratio (4)
Treat x After	0.0313***	0.0166***	0.4370**	0.1480**
	(2.74)	(3.29)	(2.09)	(2.02)
Controls	yes	yes	yes	yes
County FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Observations	3,139	3,139	3,139	3,139

Panel A examines the impact the CSPP had on particularly affected counties' firms. In Columns (1) and (2), we aggregate all debt of real estate firms per county x year, while in Columns (3) and (4) we do the same for non-real estate firms. Panel B examines proxies for real estate overvaluation in (3) and (4). In any Panel, the dataset is on the county x year level with $After = 1$ for years from 2016 on and $Treat = 1$ for banks whose share of lending to CSPP eligible firms in the two years before the CSPP is above-median. Control variables are the lags of the following variables: Log Total Assets, Capital Ratio, Deposit Ratio, Off-Balance-Sheet Ratio and Share of Fee Income. Variable definitions are provided in the Variable Appendix. 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: Financial Stability

Panel A: Bank Portfolio Risk, Concentration, and Collateralization

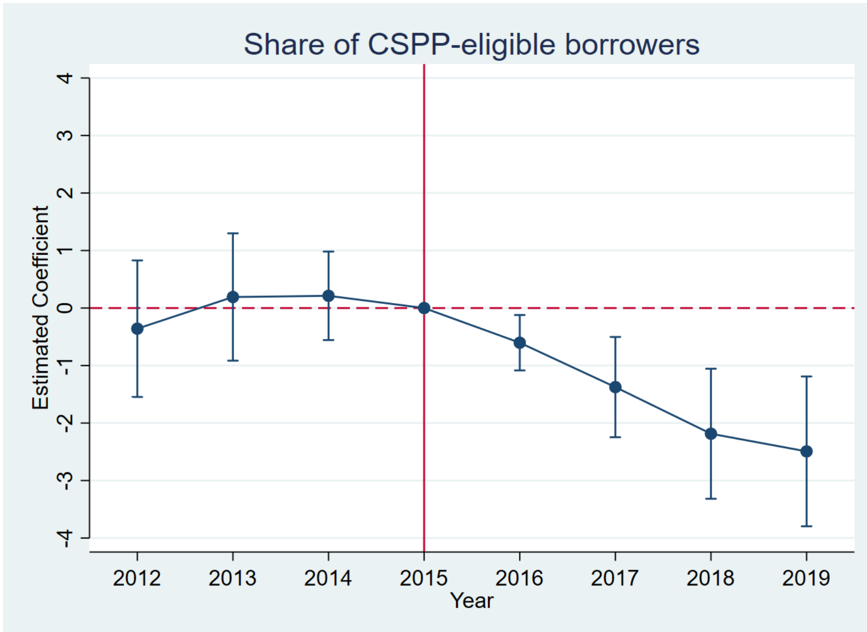
Dep. variable:	Share HY		Ln(PD)		Ln(HHI)		Frac. RE Collateral	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat x After	1.4530***	1.4735***	0.2531***	0.2520***	0.0310	0.0341*	2.1179***	2.2927***
	(2.77)	(2.85)	(4.11)	(4.11)	(1.53)	(1.73)	(2.71)	(3.09)
Controls	no	yes	no	yes	no	yes	no	yes
Quarter FE	yes	yes	yes	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes	yes	yes	yes
Observations	7,106	7,106	7,106	7,106	7,106	7,106	7,052	7,052

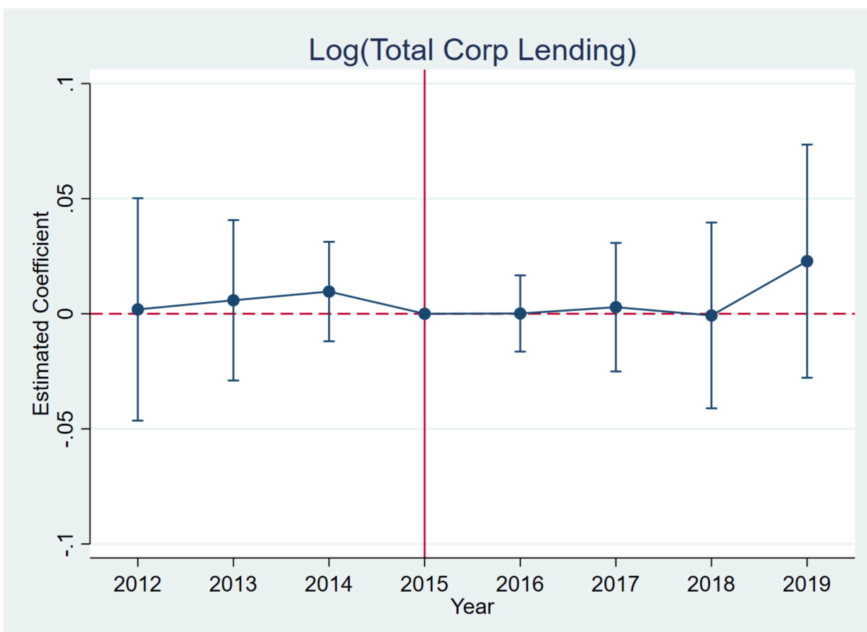
Panel B: Bank Profitability

Dependent variable:	Loan Write-offs / Toas		NII / Toas		Rest / Toas		RoA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat x After	0.0504***	0.0478***	0.0202	0.0172	-0.0190	-0.0224	-0.0492*	-0.0530**
	(3.03)	(2.95)	(0.82)	(0.75)	(-0.79)	(-1.02)	(-1.94)	(-2.12)
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	1,819	1,819	1,819	1,819	1,819	1,819	1,819	1,819

Panel A shows how treated banks' corporate loan portfolio evolves in response to the CSPP in terms of risk, measured by share of High-Yield rated borrowers and 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. Panel B examines how selected return components (Loan Write-offs vs Net interest income vs other components) are affected by the CSPP. In any Panel, the dataset is on the bank x year level with $After = 1$ for years from 2016 on and $Treat = 1$ for counties whose firms' weighted CSPP affectedness is above-median. 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), (6), and (8) in either Panel 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.

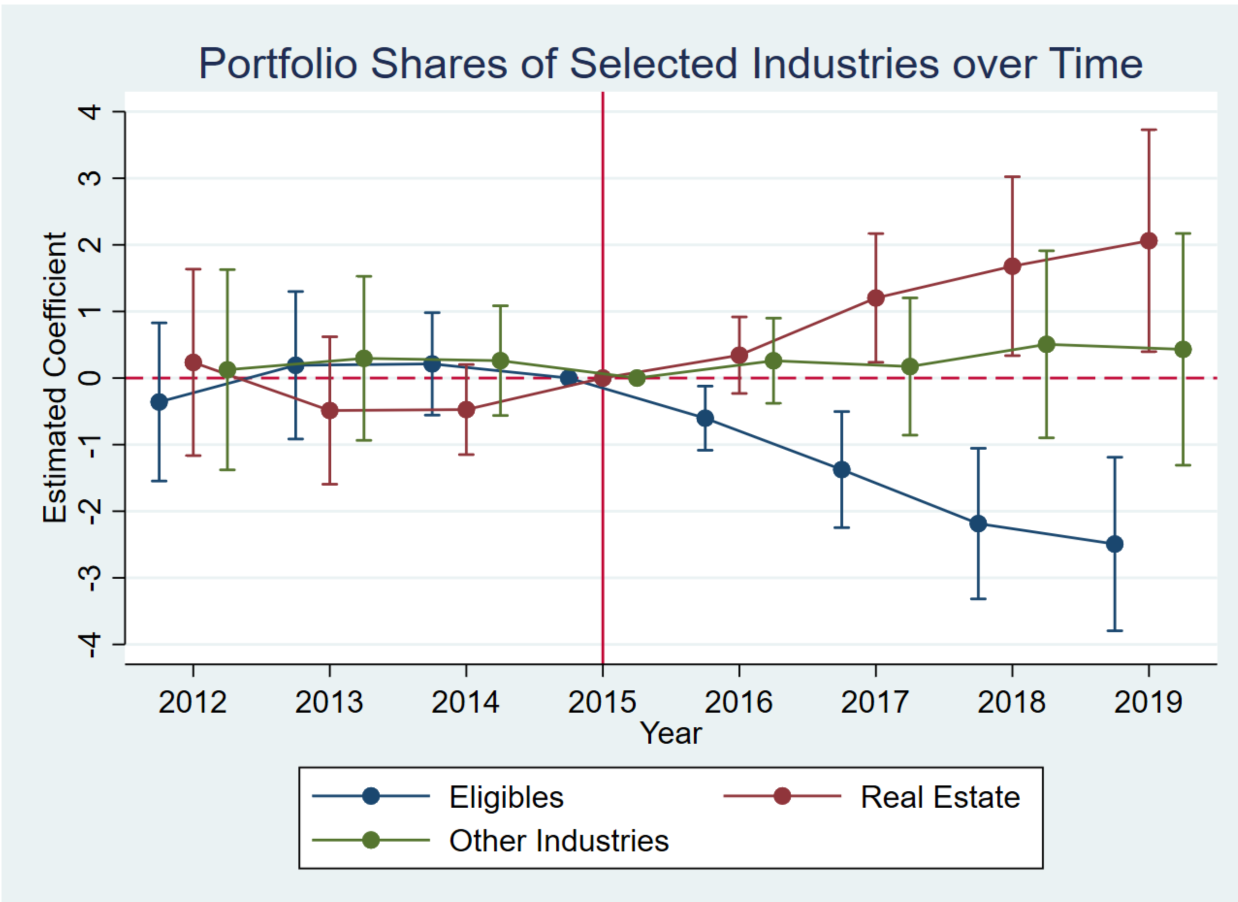
Figure 1: Evolution of the Corporate Loan Portfolio





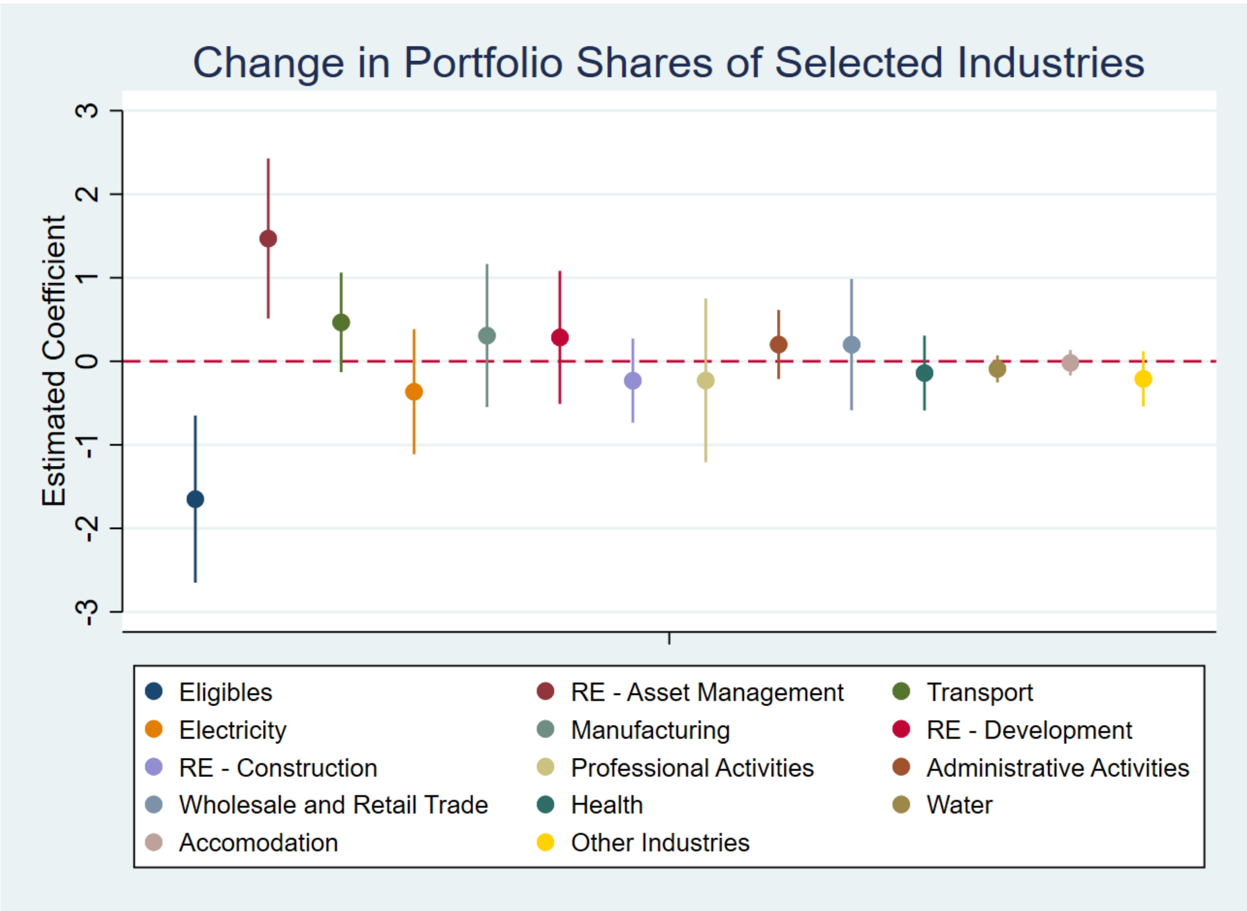
This figure depicts how the loan portfolio of treated vs control banks evolves over time in terms of share of eligible borrowers (upper figure) and total lending (lower figure). The upper (lower) figure depicts estimated coefficients from mapping out Column (2) (Column (4)) in Table 2 Panel A over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

Figure 2: Evolution of Capital Allocation over Time



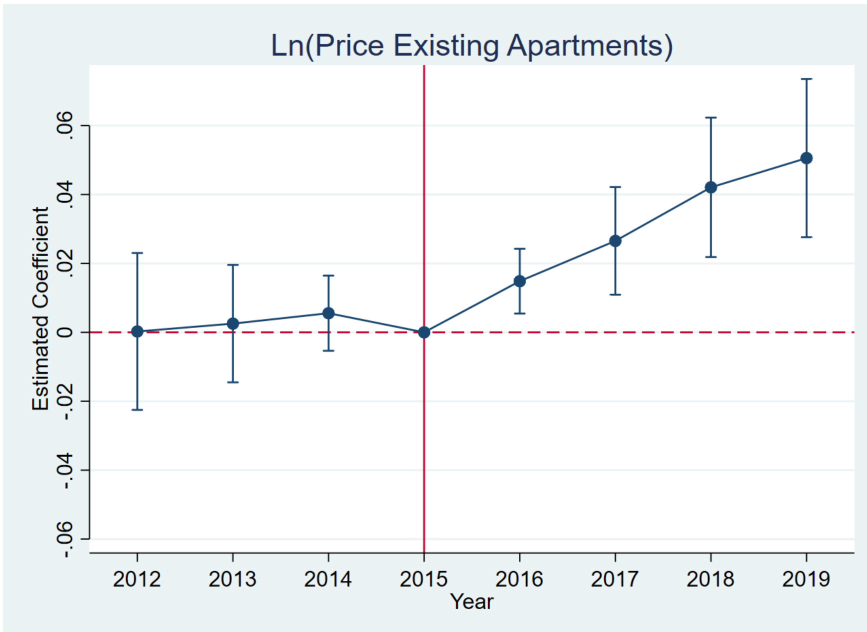
This figure depicts estimated coefficients from mapping out the three industries from Table 2 Panel B Columns (1)-(3) over time with 2015 as base year. The dependent variable is the portfolio share in %. 'Eligibles' corresponds to CSPP eligible firms from any industry. 'Real Estate' and 'Other Industries' therefore only comprise CSPP ineligible firms. The solid lines around coefficients indicate 95% confidence intervals.

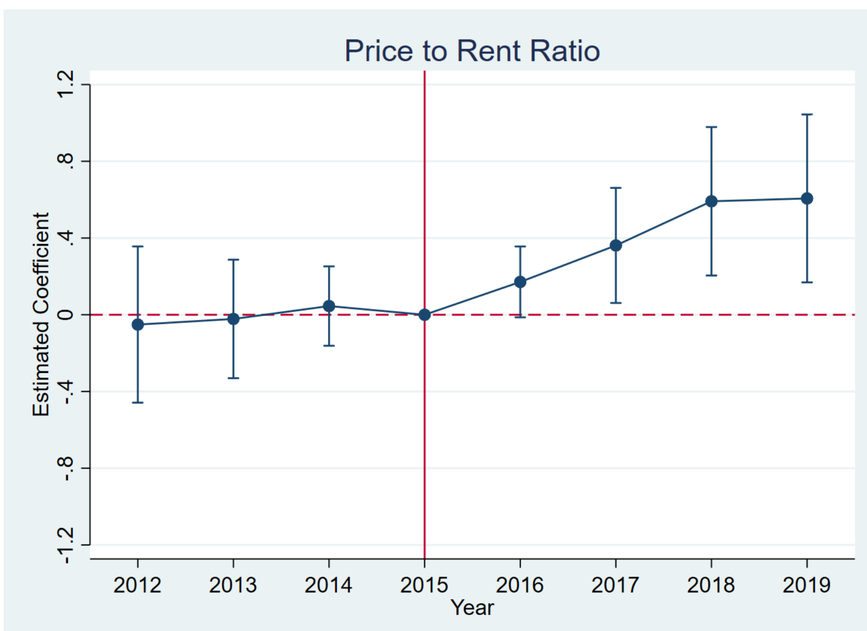
Figure 3: Capital Allocation per NACE Industry



This figure depicts estimated coefficients from Table 2 Panel B for all 21 NACE-industries, with those industries that account for less than 1% pre-CSPP portfolio share summarized under 'Other Industries'. The dependent variable is the portfolio share in %. 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.

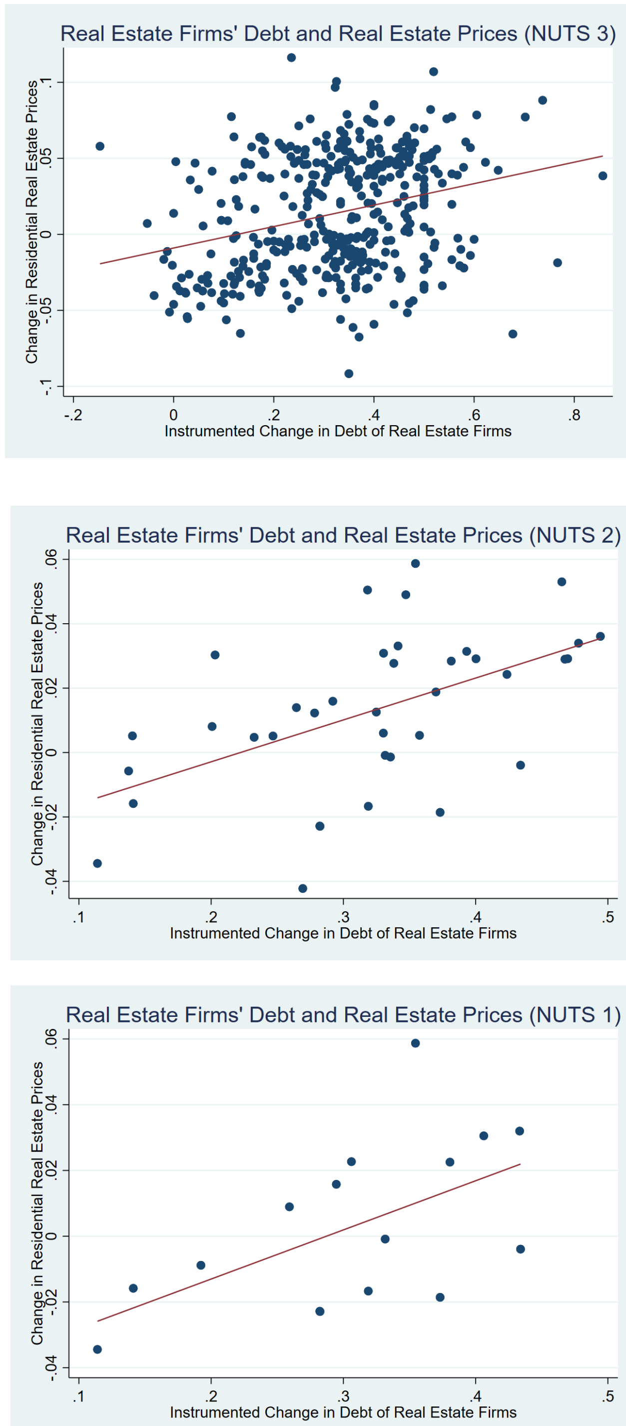
Figure 4: Impact of the CSPP on Real Estate Prices and Rents





This figure depicts how real estate prices (upper figure) and the price to rent ratio (lower figure) in treated vs control counties evolves over time. We depict estimated coefficients from mapping out Table 4 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 5: Relationship between Debt to Real Estate Firms and House Prices



Each figure plots the instrumented change in debt of real estate firms vs the change in residential real estate prices per geographical unit. In the upper (middle) [lower] Figure, each dot represents a geographical unit on NUTS 1 (2) [3]. The instrumented change in debt of real estate firms is the 2015-to-2019 change in the predicted values from Table 4 Panel A Column (2). The change in residential real estate prices is calculated as the 2015-to-2019 change in log price of existing apartments.

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
Share REAM (%)	Fraction of a bank's Eurozone corporate portfolio that is to real estate asset managers	Credit Register
Share HY (%)	(Lending to firms with (internal PD-implied) High-Yield Rating) / (Total Corporate Lending)	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
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
Debt RE (€bn)	Total Debt of all Real Estate Firms per county x Year. We delete those firms that have missing values for total debt in some year.	BvD Amadeus
Debt Non-RE (€bn)	Total Debt of all Non-Real Estate Firms per county x Year. We delete those firms that have missing values for total debt in some year.	BvD Amadeus
Total Debt (€bn)	Total Debt of all Firms per county x Year. We delete those firms that have missing values for total debt in some year.	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	0.0031	-0.0152***	0.0199***	-0.0038	0.0063*	-0.0077	-0.0002	-0.0029	0.0036
	(0.18)	(-4.45)	(2.71)	(-1.64)	(1.90)	(-1.11)	(-0.07)	(-0.64)	(1.06)
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	7,106	7,106	7,106	7,106	7,106	7,106	7,106	7,106	7,106
Sample Mean in %		4.27%	50.88%	3.36%	4.40%	16.82%	6.39%	4.17%	9.72%

This table examines how treated banks adjust their total lending (Column 1) as well as their portfolio shares (in %) w.r.t. certain counterparties (Columns 2-8). We subdivide banks total lending (after discarding interbank lending) into lending to CSPP eligible firms (Column 2), and lending to CSPP ineligible Corporates (Columns 3-5), Governments (Column 6), Households (Column 7), Financials (Colum 8) and other counterparties (Column 9). The dataset is on the bank x quarter level with $After = 1$ for quarters from 2016q1 on and $Treat = 1$ for banks whose share of lending to CSPP eligible firms in the two years before the CSPP is above-median. 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.

Table IA.2: Bank Lending Channel

Panel A: Khwaja-Mian Specification

Dependent variable:	Δ Ln(Loan Amount)			Entry			Exit		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat	0.0854**	0.0679**	0.0994*	0.0599***	0.0646***	0.0532**	-0.0359	-0.0347	-0.0222
	(2.03)	(2.03)	(1.79)	(4.44)	(4.71)	(2.57)	(-1.07)	(-1.20)	(-0.70)
Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Size x Location FE	no	yes	-	no	yes	-	no	yes	-
Firm FE	no	no	yes	no	no	yes	no	no	yes
Observations	7,424	7,395	1,950	22,595	22,548	6,705	20,167	20,126	5,675

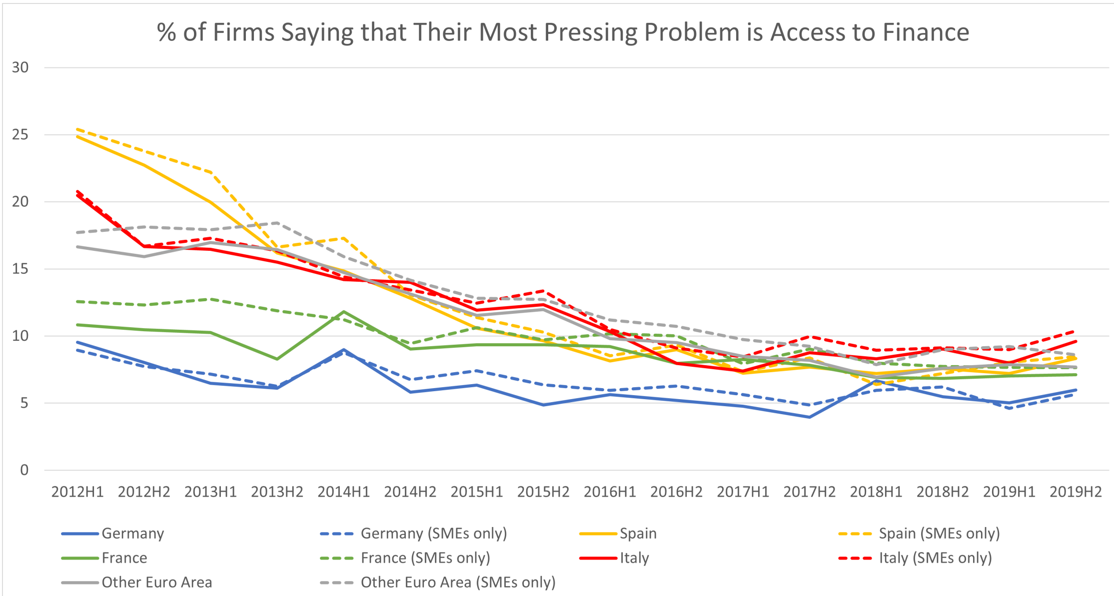
Panel B: Amiti-Weinstein Specification

	Bank Supply Shock (%-Change in Lending)	
	Treated Banks	Control Banks
Mean bank FE	0.0701***	0.0243
	(2.77)	(1.02)
Observations	115	118

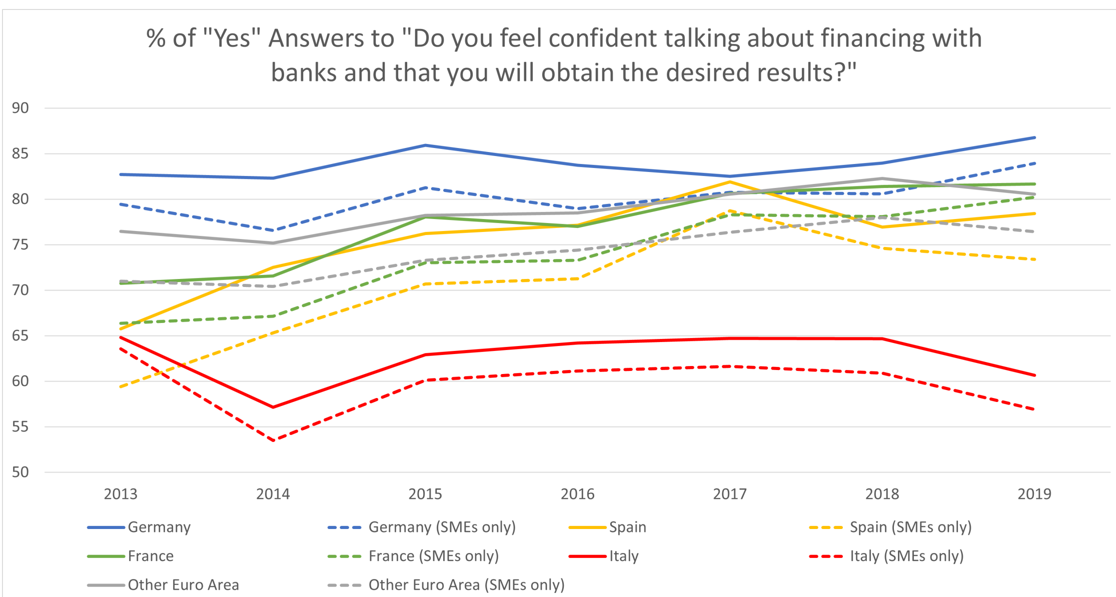
This table explores the role bank supply shocks play in our setting, i.e. how treated banks' loan supply to real estate asset managers changes in response to the CSPP. In Panel A, we employ the methodology by Khwaja and Mian (2008). We start with the credit register on the bank x firm x quarter level, then collapse the time dimension to pre vs post event and then for Columns (1)-(3) calculate the difference in log loan amount between the post and the pre period, for Columns (4)-(6) (Columns (7)-(9)) among all loans outstanding in the post (pre) period we define entry (exit) as one for loans not outstanding in the pre (post) period. The sample consists of all CSPP ineligible Real Estate Asset Managers. 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).
In Panel B, we employ the methodology by Amiti and Weinstein (2018). We start with the credit register on the bank x firm x quarter level and aggregate firms to location x size clusters. We then collapse the time dimension to pre vs post CSPP and then calculate loan growth rates in percentage terms for real estate asset managers (see Amiti and Weinstein (2018) why growth rates need to be specified in percentage terms). The method by Amiti and Weinstein (2018) decomposes loan growth rates into firm fixed effects ("firm borrowing shocks"), bank fixed effects ("bank shocks"), and a common shock and we report the mean of the bank fixed effects in Panel B.
Variable definitions are provided in the Variable Appendix. T-statistics are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1%-level (two-tailed), respectively.

Figure IA.1: Firm Credit Constrainedness

Panel A: Firms' Most Pressing Problem

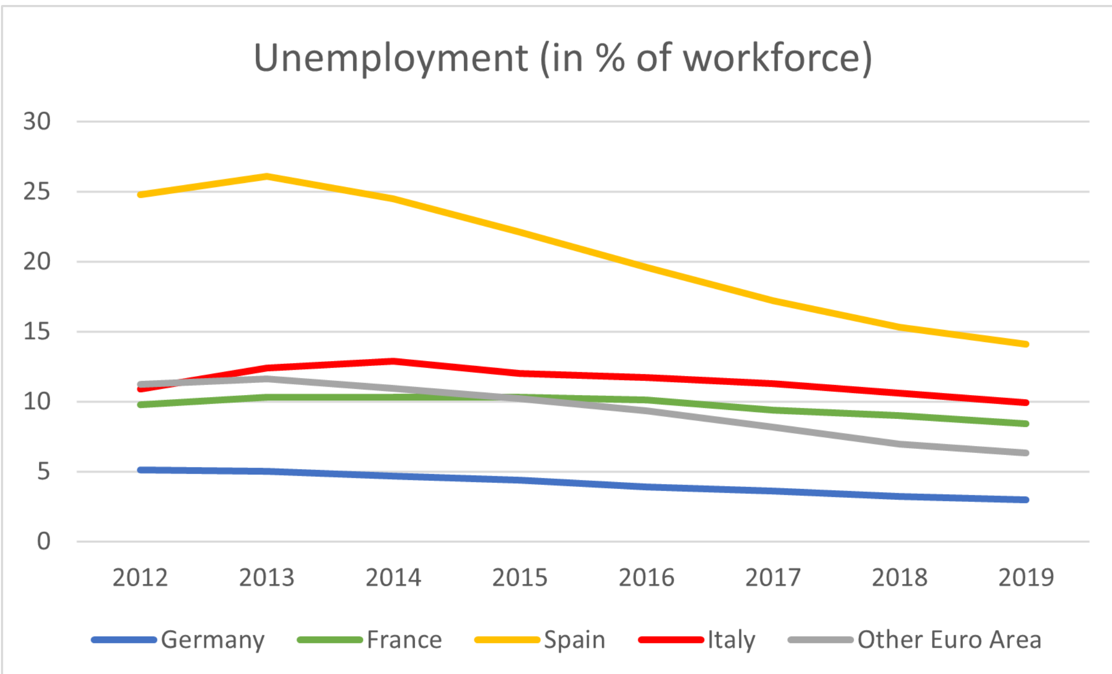


Panel B: Firms' Confidence in Talks with Banks



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).

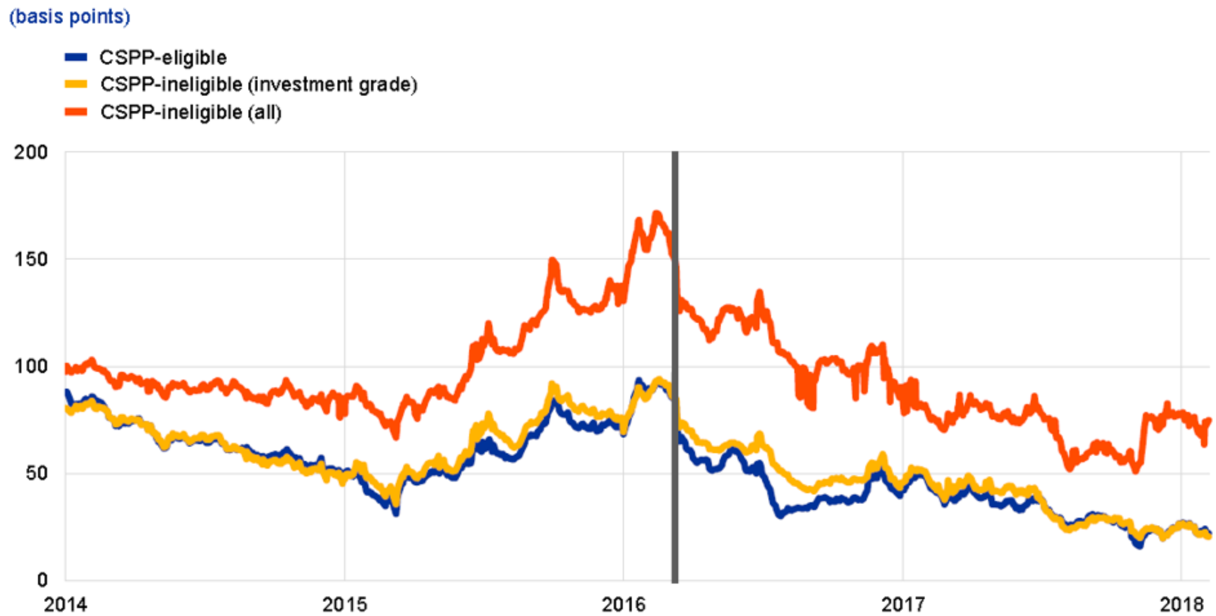
Figure IA.2: Unemployment in the Euro Area



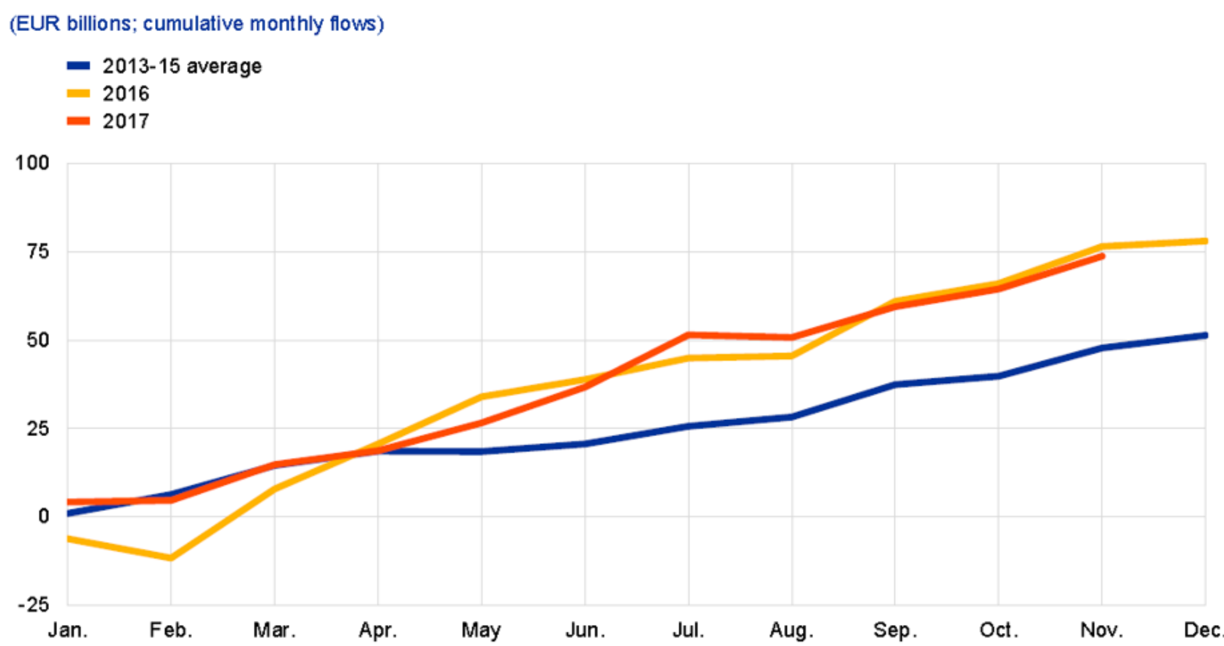
The figure plots the unemployment ratio, measured as unemployed divided by workforce, for selected Euro Area countries. Source: Eurostat.

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

Panel A: Bond Spreads

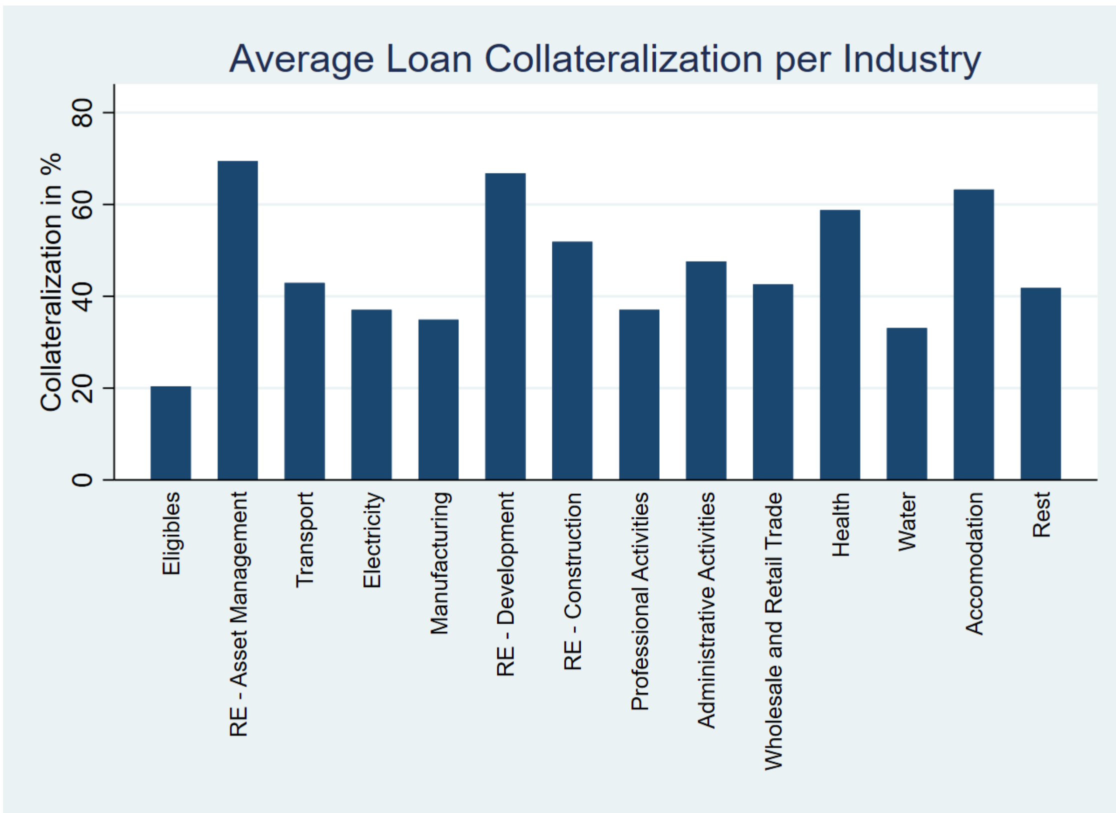


Panel B: Bond Issuances



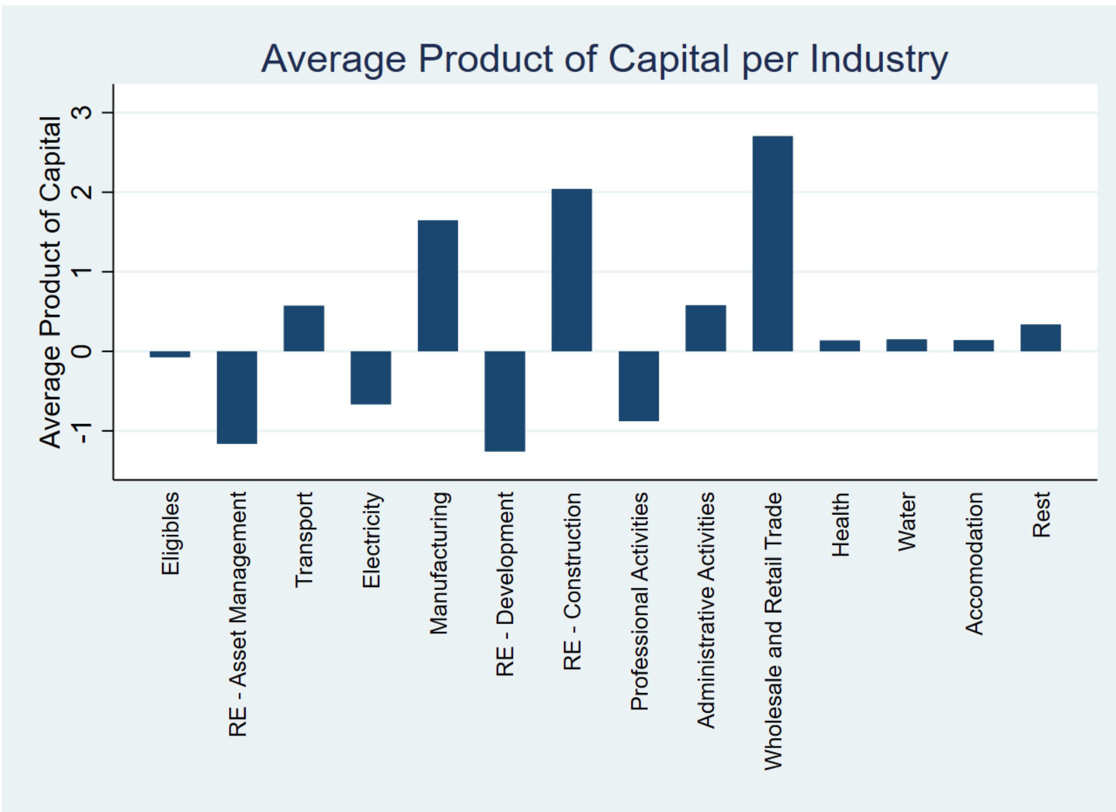
Source: De Santis et al. (2018). Figure 1.A depicts the impact the CSPP announcement had on CSPP eligible/ineligible bonds' spreads. Figure 1.B indicates how the CSPP spurred issuance of euro-dominated NFC long term debt.

Figure IA.4: Collateralization per Industry



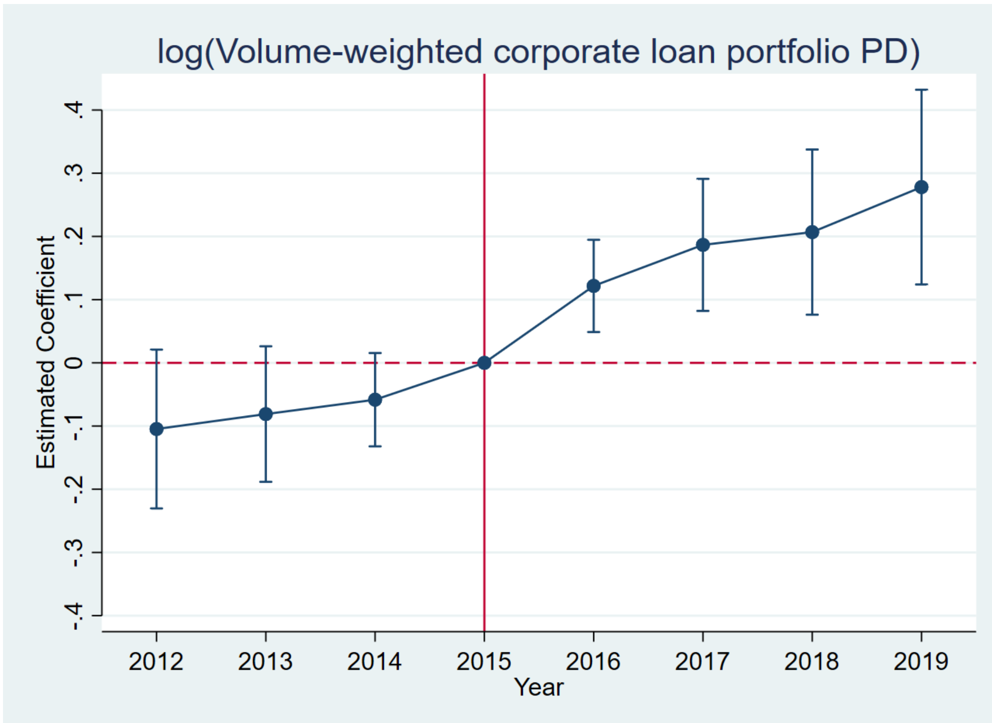
The figure depicts the average pre-CSPP collateralization per NACE-21-industry. Collateralization of an industry is calculated as total collateral pledged divided by total loans outstanding. Industries are ordered and summarized as in Figure 3.

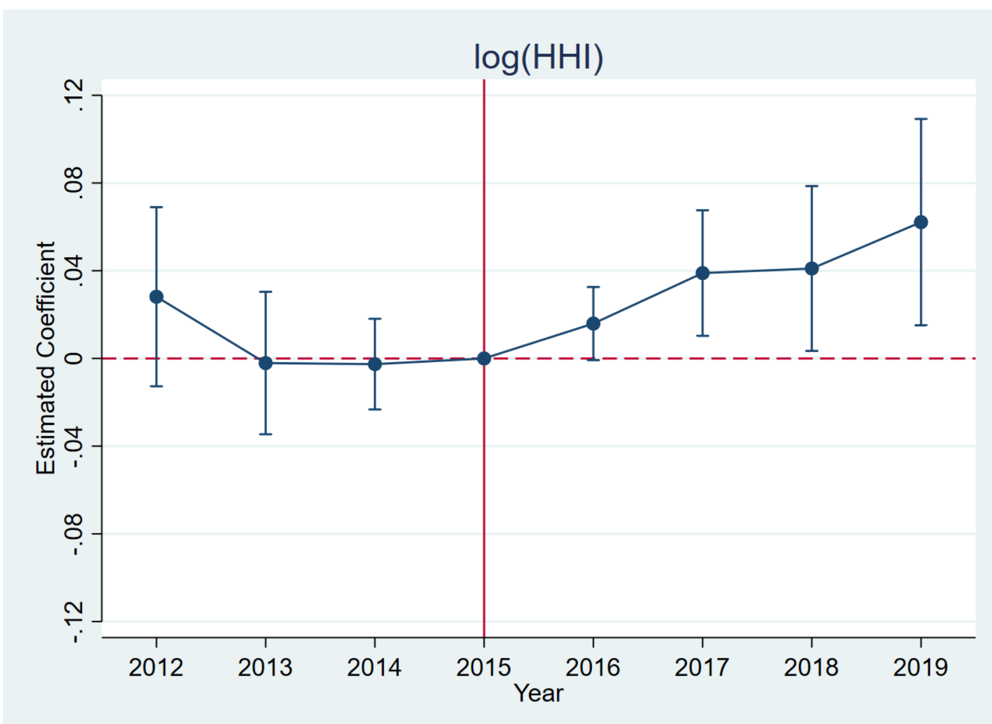
Figure IA.5: Average Product of Capital per Industry



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 3.

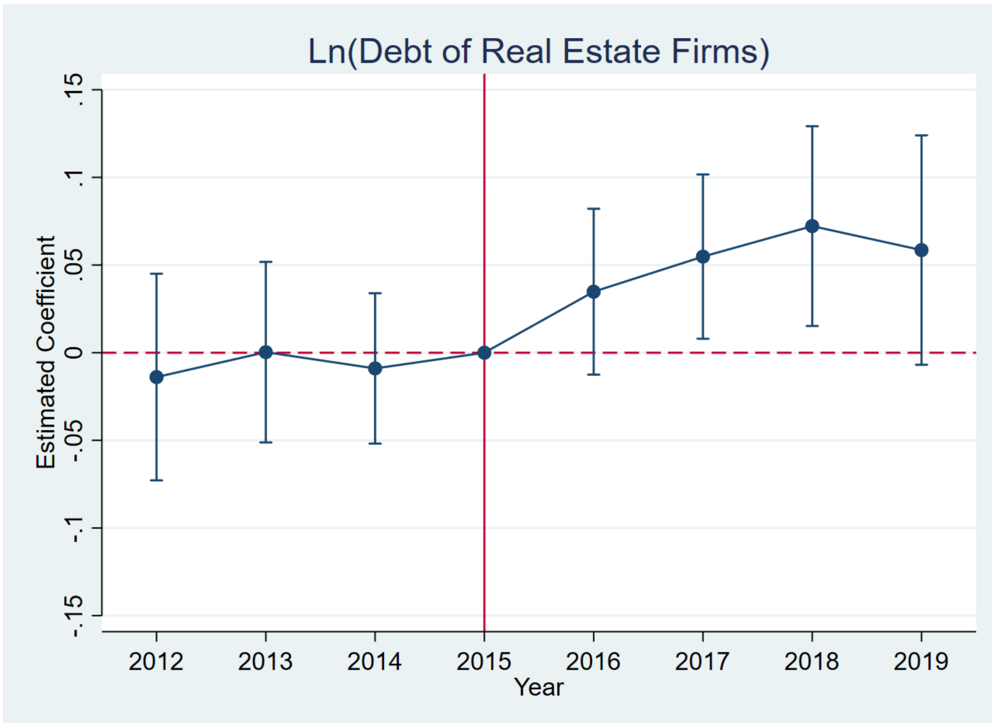
Figure IA.6: Bank Portfolio Risk and Concentration

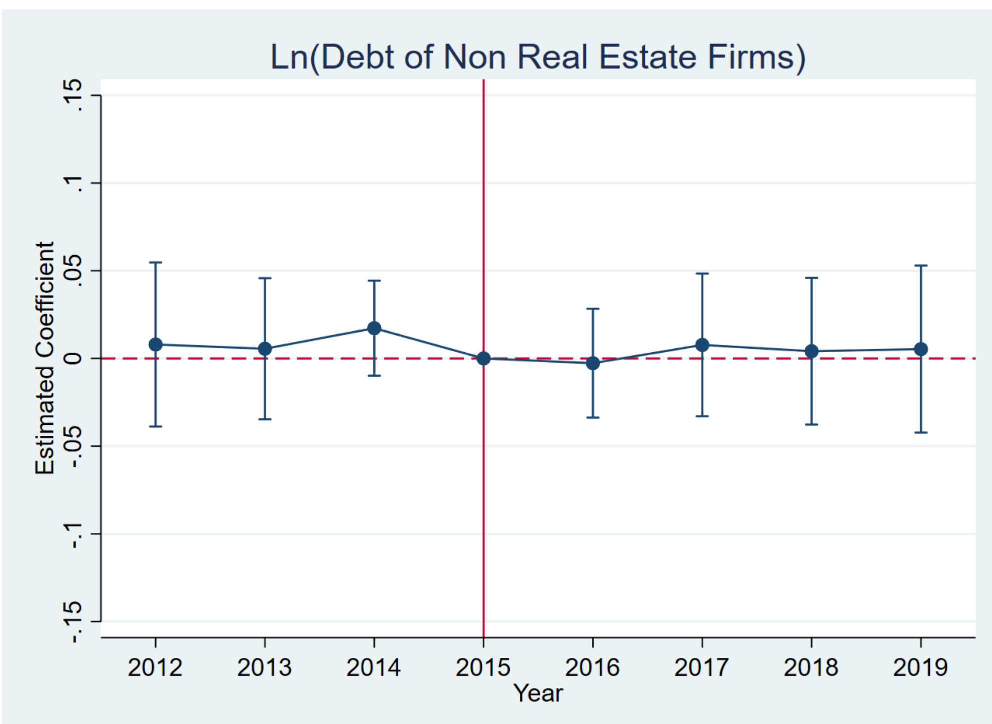




The upper (lower) figure depicts estimated coefficients from mapping out Table 5 Panel A Column (4) (Column (6)) over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.

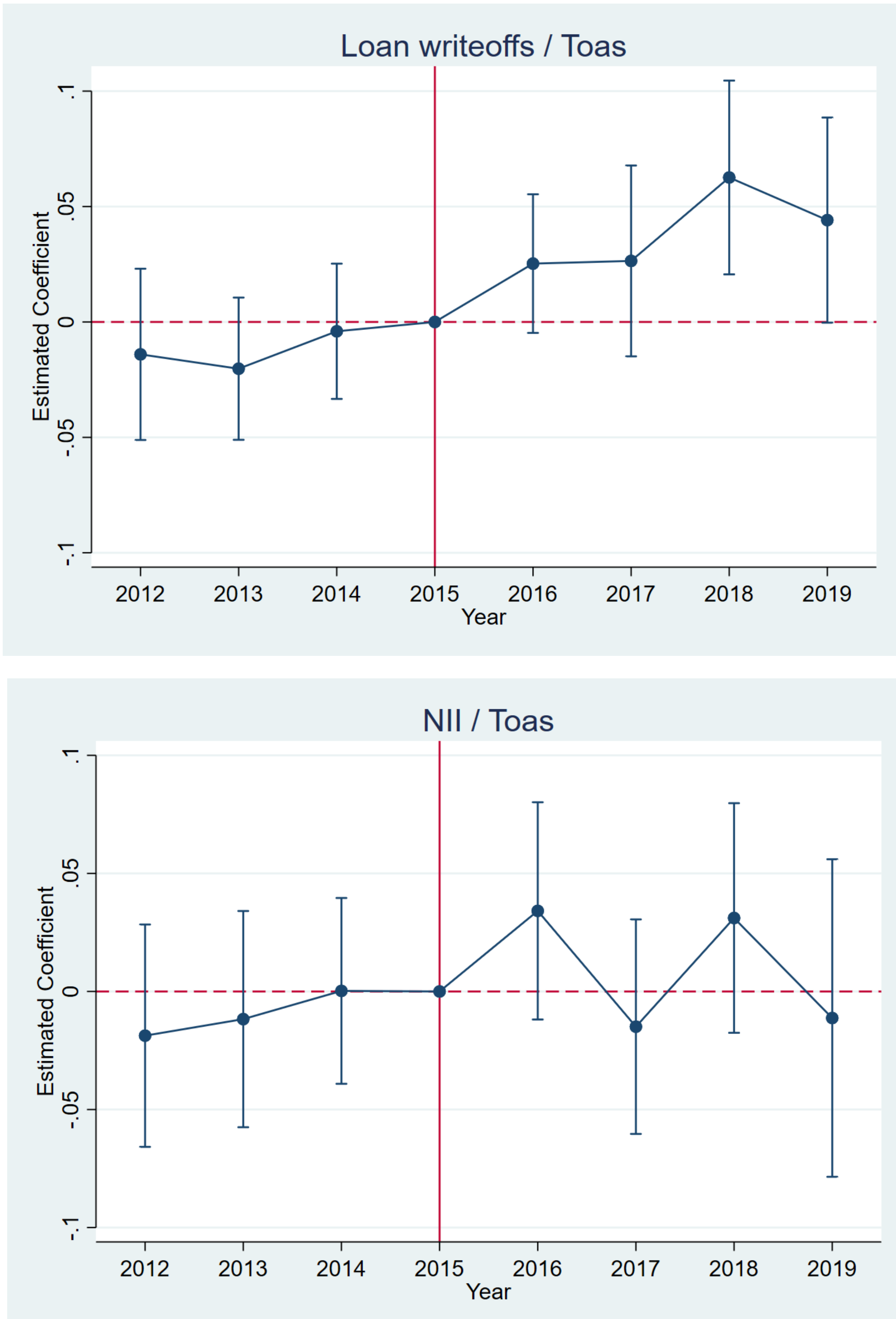
Figure IA.7: Effect of the CSPP on Capital Allocation





This figure depicts estimated coefficients from mapping out Table 4 Panel A 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 IA.8: 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 5 Panel B over time with 2015 as base year. The solid lines around coefficients indicate 95% confidence intervals.