Lending Effects of the ECB's Asset Purchases[☆]

Michael Koetter[a,b]

[a]*Halle Institute for Economic Research (IWH) and Otto-von-Guericke University*
Kleine Märkerstraße 8, G-06108 Halle (Saale)
[b]*Deutsche Bundesbank, Wilhelm-Eppstein-Straße 14, G-60431 Frankfurt am Main*

Abstract

Between 2010 and 2012, the European Central Bank absorbed €218 billion worth of government securities from five EMU countries under the Securities Markets Programme (SMP). Detailed security holdings data at the bank level affirms an effective lending stimulus due to the SMP. Exposed banks contract household lending, but increase commercial lending substantially. Holding non-SMP securities from stressed EMU countries amplifies the commercial lending response. The SMP also improved liquidity buffers and profitability without compromising credit quality.

Keywords: Unconventional monetary policy, SMP, bank lending
JEL: C30, C78, G21, G28, L51

1. Motivation

Do asset purchase programs (APP) conducted by central banks affect bank lending? Since the financial crisis of 2008, APPs are pivotal policy instruments (Kuttner, 2018). The effects on asset prices are well documented (Gilchrist and Leahy, 2002; Eser and Schwaab, 2016; Krishnamurthy et al., 2018). But the role of unconventional policy in macroeconomic models has only recently been studied (e.g., Ferrante, 2019) and leaves several issues unresolved (such as the forward guidance puzzle, see e.g. McKay et al., 2016). Especially micro-founded empirical evidence if and how APPs cause aggregate lending and economic activity is scarce. This void reflects severe endogeneity challenges that plague the identification of causal APP effects.

We tackle this issue by exploiting granular transaction data of a specific APP, the Securities Markets Programme (SMP), in a non-stressed economy, Germany. This set-up has three distinct advantages. First, the combination of security-by-security SMP transaction data with security-level holding information for all banks permits the precise classification of banks affected by the policy. Whereas actual security holdings prior to APPs are usually unobserved (Rodnyansky and Darmouni, 2017), we can identify banks that held SMP securities just before the first transactions of the European Central Bank (ECB) on 05/10/2010. The comparison of treated and untreated banks' lending responses five years before and after the SMP permits comprehensive and causal inference on lending effects.

Second, the SMP was the first outright APP by the ECB in secondary security markets, representing an unexpected policy regime shift.

Third, stressed sovereign debt is mostly held by stressed banks domiciled in stressed markets. Any correlation between APP transactions, banks' refinancing costs, and lending patterns may thus be spurious due to simultaneity and reverse causality (Manganelli, 2012). The SMP was triggered by yields of *stressed* European Monetary Union (EMU) economies' debt, not by financial stability concerns about German banks. Holding a French or an Italian bond prior to the SMP was fairly random given identical regulatory treatment (Buch et al., 2016). Yet 17% of all regional German banks held SMP securities in q1:2010. Thus, the SMP is a relevant policy shock in an ideal quasi-experimental setting to assess if APPs cause lending.

To restore monetary policy transmission and to calm sovereign debt markets, the ECB purchased sovereign bonds from Italy, Ireland, Spain, Portugal, and Greece in secondary markets worth €218 billion between May 10, 2010 and February 29, 2012. Asset purchases aimed to enhance bank health in affected countries and spark commercial and household lending mainly via two channels (European Central Bank, 2015).

The portfolio rebalancing channel entails that banks sell securities with longer maturities to the central bank and substitute them with assets of shorter duration. Reduced duration risk and additional excess reserves enhance the credit-bearing capacity of banks, thereby igniting additional lending.[1] The commitment channel posits that central banks conduct or credibly announce balance sheet-relevant activities, such as purchasing government securities. Consequently, financial market uncertainty declines and financial asset prices stabilize.[2] The SMP stabilized stressed sovereign debt yields and increased bond values indeed (Eser and Schwaab, 2016). Higher collateral value, flanked by the Outright Monetary Transactions (OMT) promise of July 2012, reduced information asymmetries in money markets and thus banks' refinancing costs (Heider et al., 2015). I test explicitly if credit responses are primarily due to selling stressed debt or due to asset valuation gains that enhance banks' credit-bearing capacity.

The results show a statistically significant total customer lending hike in the five years after the SMP compared to the five years before its launch. After saturating the specification with bank- and quarter-by-county fixed effects and bank-specific controls, the average regional bank is estimated to increase customer lending by €2.8 million. The composition of lending changes in response to the SMP, too. Retail lending, comprising mostly mortgage loans, contracts whereas commercial credit expands. The average bank

---

[1] Other instruments can affect banks via a direct pass-through channel, e.g., the (targeted) long-term refinancing operation (TLTRO, see e.g. Ferrando et al., 2019).

[2] The ECB (2015) coins this mechanism also a signaling channel, which is however a term that others use for signaling to investors about future short-term monetary policy rates (e.g. Woodford, 2012; Krishnamurthy and Vissing-Jorgensen, 2013; Bauer and Rudebusch, 2014). To avid confusion, I use here the term commitment channel.

increases the latter by around €13.2. million or 4% of mean commercial lending. The corresponding aggregate commercial lending hike of around €4.7 billion is juxtaposed by an aggregate contraction of retail lending by €3 billion. This direct effect due to holding SMP securities is amplified if banks hold further securities from stressed Eurozone economies that were not purchased by the ECB under the SMP, presumably reflecting positive valuation spillovers from the policy to non-SMP assets. Besides this substantial lending stimulus, the SMP also enhanced bank liquidity buffers and profitability without an observable increase in credit risk or a depletion of equity capital.

Overall, the security- and bank-level evidence in this paper highlights the positive effects of APP's on lending and financial resilience in a non-stressed EMU economy, thereby complementing micro-founded evidence for the large-scale APP in the U.S. (Rodnyansky and Darmouni, 2017).

2. Securities Markets Program: Identification, causality, and channels

The SMP was the first APP in EMU secondary sovereign debt markets. It exemplifies unconventional monetary policy by the ECB to combat soaring sovereign debt spreads of stressed members in 2010. While small compared to U.S. APPs, which accumulated US$ 4.5 trillion until October 2014, the SMP represented a paradigm shift in EMU monetary policy. This shock to selected bond market segments affected banks that held SMP securities in May 2010 via the commitment or the portfolio rebalancing channel.

It is challenging to isolate the effect of any monetary policy shock to credit portfolio choices of (inter)nationally active banks, for which spatial lending patterns and branch locations are unobservable. An institutional feature of the German banking system helps to curb this challenge. Regional savings and cooperative banks are restricted *de jure* and *de facto* to operate in their home county ("Kreis", Koetter et al., 2019), which permits the isolation of SMP lending effects from confounding factors, such as regional business cycles. Yet these banks provide around half of aggregate lending in the German banking system and are thus an important source of credit. Therefore, large commercials, like e.g. Deutsche Bank, large savings (Landesbanken), and central cooperative banks are excluded to enhance the identification of causal lending responses to the SMP.

It may remain a concern if the SMP is a valid policy shock. First, the policy needs to affect sufficiently many banks. The top panel in Figure 1 shows that in each quarter when the SMP was active, around 17% of all banks held at least one SMP security (see also Online appendix A).

– Insert Figure 1 around here –

Second, we assume that German banks did not buy SMP securities in anticipation of asset purchases by the ECB, which is supported by the bottom panel on Figure 1. Box plots of quarterly book values of SMP securities relative to banks' total security portfolios indicate a stable median share of around 1%, which suggests that anticipation effects are unlikely.

– Insert Figure 2 around here –

Third, banks might strategically re-allocate security portfolios after the launch of the SMP. Such a strategy was generally hard to implement because it remained unclear, which specific security would be purchased under the SMP. The detailed security-level data shows that many banks held non-SMP securities from stressed EMU members. This exposure to stressed assets but not to the policy shocks aids the difference-in-difference approach pursued below in Section 6.2.2. The top panel in Figure 2 compares the number of banks with constant exposure to stressed sovereign debt to those that reduced or increased it. "Increasers" are banks that accumulate SMP securities over the course of the policy. "Stayers" maintain their SMP exposure in nominal value. "Reducers" contract their stock of SMP securities.[3] Most banks maintained or increased exposures. The number of banks that sell assets directly is low. "Increasers" depicted in the bottom panel invest relatively large shares in SMP securities. I show below that lending does not differ significantly across these three types.

---

[3]Tables C.1 and C.2 in the online appendix detail transaction dynamics per type.

3. Specification and data

3.1. Specification

The lending effects of asset purchases are identified using bank-quarter panel data that comprise all $i = 1, ..., K$ regional savings and cooperative banks ($K = 1,790$) that operate in Germany five years before and after the SMP, which lasted from q2:2010 until q1:2012. The lending by banks that are exposed to the SMP shock is compared to that of banks that are not five years before (q2:2005–q1:2010) and five years after the program (q2:2012–q2:2017) in a difference-in-differences setting:

$$\ln L_{i,q} = \alpha_i + \alpha_r \times \alpha_q + \beta SMP_i \times POST_q + \gamma X_{i,q-1} + \epsilon_{i,q}. \tag{1}$$

The coefficient of interest is the interaction term β. It gauges the differential lending effect caused by the policy shock. It compares treated and non-treated banks before and after the shock, where SMP treatment is defined as follows. Each German bank i reports all securities $j = 1, ..., J$ held in a given quarter q to the security holdings statistics of Deutsche Bundesbank ("Wertpapierhandelsstatistik"). ISIN codes and purchase dates are provided by the ECB. Transactions are matched by ISIN to banks' security portfolios reported as of q1:2010. These data are then aggregated to the bank-quarter level. The treatment indicator SMP_i equals 1 for banks that held at least one SMP security in the last quarter before the first purchases were conducted on 05/10/2010. Out of 1,760 regional banks, 356 are treated by this SMP shock.[4] *POST* is an indicator equal to 1 in all quarters after the last purchases were conducted (q2:2012–q2:2017).

The dependent variable is the log-level of customer lending or its components $L_{i,q}$. Bank-level financial data are obtained from Deutsche Bundesbank. Regional banks are domiciled in $r = 1, ..., R$ counties ($R = 437$), the median (minimum) number of banks per county is 5 (2). Bank- (α_i) and county-by-quarter ($\alpha_r \times \alpha_q$) fixed effects control for level differences of bank traits and regional business cycles. Lagged time- and bank-variant control variables $X_{i,q-1}$ gauge differences in the size, capitalization, funding structure, security share, credit commitments, and liquidity positions. Equation (1) is estimated with panel OLS and two-way clustered standard errors. Variable are described in online appendix Table C.5.

3.2. Summary statistics and validity

Table 1 describes the main outcome variables in the upper panel and control variables in the bottom panel for the entire sample period q2:2005–q1:2017. Consider first the full sample in columns (1) through (4).

– Insert Table 1 around here –

Customer loans are the most important asset class of regional banks and comprise mostly commercial and retail loans (see also Figures OA.1 and OA.2 in the online appendix). Commercial and retail loans each amount approximately to €325 million for the mean bank. Commercial borrowers are public non-bank firms and sole proprietorships, which are mostly small- and medium-sized enterprises (SME). Mortgage loans dominate retail lending and account on average for €280 million. Government and foreign lending is negligible. Regional banks are overall well-capitalized, are net borrowers in interbank markets, invest around a quarter of their balance sheets in securities, do not rely on capital market funding, bear latent credit risk via credit lines, and hold low liquidity buffers.

Because banks may differ in terms of financial profile traits, we conduct a propensity score matching to estimate how likely a bank was to be treated by the SMP based on the vector of control variables X observed in the quarter before the SMP was launched, i.e. q1:2010. Propensity scores PS are estimated with a probit model for that single cross-section to predict the likelihood that a bank holds a SMP security: $PS(X) = Pr(SMP = 1|X)$ (Leuven and Sianesi, 2003). For each of the 356 treated banks, the predicted propensity scores identify the "nearest untreated neighbor".[5]

---

[4]We test various alternative treatment and post-treatment period definitions below.

[5]Table C.3 in the online appendix provides the probit estimation results. Table C.4 shows that bank traits no longer differ after the one-to-one propensity score matching.

Columns (5) to (8) in Table 1 describe the moments of observed outcome and control variables of the 356 treated and the 356 matched non-treated banks for the entire panel sample period q2:2005–q1:2017. All outcome variables tend to be larger compared to the complete panel in columns (1) to (4), but qualitatively identical. The similarity of matched banks bodes well for the validity of a difference-in-difference comparison.

– Insert Table 2 around here –

Table 2 tests if growth rates of outcome and control variables differ before the SMP during the period q2:2005 until q1:2010, which is neither the case in the full (top panel) nor in the matched sample (bottom panel).[6]

4. Main results

4.1. Differential effects and unobservables

Table 3 shows the main results for the full bank-quarter panel of all regional banks during q2:2005–q2:2017. The dependent variable is total customer lending in logs. The main explanatory variable is an interaction of dummies. The SMP shock thus increases customer lending by $100 \times (e^{\beta} - 1)$ percent relative to a non-treated bank in q1:2010.

– Insert Table 3 around here –

Column (1) omits any fixed effects so as to estimate the direct $POST$ and SMP terms. The significantly positive $POST$ coefficient corroborates the aggregate lending hike in Figure OA.2 after the SMP. The average regional bank increased customer lending according to this estimate by €32 million, corresponding to an aggregate credit hike of around €57 billion.[7]

But inference about economic magnitudes due to the SMP requires the isolation of *differential* lending effects that are *caused* by asset purchases. Hence, the parsimonious model in column (1) is gradually saturated with fixed effects to control for unobservable factors. When including bank fixed effects in column (2), the interaction term remains insignificant. The significant $POST$ coefficient may capture any aggregate customer lending hike. Specifying bank and quarter fixed effects to capture common shocks and to avoid contamination of the differential lending effects due to the SMP in column (3) results in a significantly positive interaction term.

Column (4) even controls for county-by-quarter and bank fixed effects. Entirely muting local dynamics in this way is important because regional banks insure SME against local macro shocks (Koetter et al., 2019). Differential lending effects result from comparing banks with and without SMP exposure within a county in a given quarter. This comparison is particularly powerful because the sampled regional banks only operate within one county. The resulting differential effect is statistically significant and twice as large as in column (3). The SMP caused the average regional bank in Germany to lend €2.8 million more compared to a bank not affected by the unconventional monetary policy shock. Given that 356 out of the 1,790 regional banks were affected, this estimate corresponds to an aggregate customer lending increase in Germany on the order of €991 million.

This finding is insensitive to the choice of the post-treatment period. In the baseline specification, $POST$ equals 1 as of the first SMP purchase in q2:2010. But banks may adapt lending patterns to updated expectations about monetary policy only after the purchases stopped in q1:2012. Column (5) therefore re-defines $POST$ to equal 1 only during the five years after q1:2012. Alternatively, column (6) excludes the entire shock period. Both specifications yield a significantly positive, and slightly larger interaction term, confirming the ability of the SMP to spark lending. Column (7) replaces the SMP indicator with the share of the value of SMP securities relative to banks' total portfolio values. Results remain qualitatively unchanged. Thus, the discrete SMP indicator gauges pretty well that ultimately relatively few banks hold fairly small shares of SMP securities.

---

[6]Quarterly growth rates of controls are winsorized at the 1st and the 99th percentiles.

[7]The product of the sample mean of customer lending in Table 3 and the exponent of the coefficient, i.e. $(e^{0.045} - 1) \times$ €695 million, times the number of banks of 1,790.

4.2. Confounding factors and controlling for observables

The specification in column (6) is henceforth used. Despite the saturation with many fixed effects and the focus on strictly regionally active banks, confounding policy shocks may remain a concern (Krishnamurthy et al., 2018). The first was the introduction of a fixed-rate full allotment policy as of October 2008. Notably 3-year Long-Term Refinancing Operations (LTRO) increased the maturity of central bank facilities substantially in December 2011. This policy affected all German banks and is captured by county-by-quarter fixed effects. The ratio of cash to total assets gauges any remaining quarterly variation in *Liquidity* across banks within counties. It exhibits a significantly negative coefficient. Banks that prefer to hold larger liquidity buffers have lower customer lending capacities.

A second issue is the role of the ECB as a lender-of-last-resort in the interbank market. After Lehman Brothers failed, the (unsecured) interbank market ceased to exist and was de facto replaced by the ECB (Heider et al., 2015). The significantly negative coefficient for quarterly *Net interbank lending* suggests the existence of crowding-out of customer lending, but the *SMP* effect remains intact.

The third policy shock is the OMT ("Outright Monetary Transactions") promise by the ECB in August 2012. The OMT commitment is to absorb sovereign debt in secondary markets without any ex ante limitation on duration or volume. The OMT alleviated capital market funding pressure, especially of banks in stressed EMU economies (see, e.g., Ferrando et al., 2019). Again, county-by-quarter fixed effects gauge the lending variation due to this common policy shock across regions and quarters. *Market Funding* controls for differences of banks' ability and willingness within a county to rely on securitized debt, exhibiting a small, significantly positive effect in the preferred specification in column (6).

The fourth policy change is the widening of the EMU collateral framework since 2007 (Nyborg, 2017). As increasingly many assets qualify as collateral, banks may pledge the most risky ones with the ECB to increase (risky) lending. The *Securities share* captures differences of available collateral across banks and exhibits a negative coefficient. Thus, banks holding relatively more securities seem to lend less to customers.

4.3. Customer lending components

The average customer lending hike of €2.8 million might appear small at first sight. To assess the effectiveness of APP in terms of economic significance, Table 4 decomposes the recipients of more – or less – credit. The dependent variable in each column is the log-level of a different customer lending component. The main result is reproduced in column (1).

– Insert Table 4 around here –

Column (2) shows that the commercial lending effect is around ten times the size of the baseline response. The differential lending expansion estimate is €13.2 million by the average bank, which implies €4.7 billion for the total of 356 banks subject to the policy shock. The magnitude of this lending stimulus due to the SMP to the commercial sector is substantial.

In contrast, column (3) documents that the SMP shock induced banks to contract retail lending. The estimated differential effect corresponds to €8.5 million less retail lending by the average regional bank and an aggregate retail credit contraction by affected banks on the order of €3 billion. Column (4) corroborates the descriptive evidence indicated in Table 1 that most of the retail lending contraction pertains to mortgage loans.

Heterogeneous loan responses to expansionary monetary policy shocks are also documented by Jiménez et al. (2014), who find that Spanish banks increase risky lending after joining EMU. We cannot test for such responses explicitly because neither default expectations nor historical defaults are reported to Bundesbank by loan category. But three pieces of circumstantial evidence suggest that commercial loans benefited relatively more than mortgage loans from the commitment of the ECB to support stressed EMU members, which helps to rationalize the substitution of (mostly) mortgage with commercial lending.

First, mortgage loans need to be secured by domestic real estate that is pledged as collateral. Foreign real estate is generally not eligible as collateral and therefore these loans rarely represent foreign exposures. Yet foreign lending vis-à-vis non-German, non-bank borrowers amounted to roughly €531 billion in May

2010, of which around €65 billion were loans to the five stressed EMU members (Deutsche Bundesbank, 2010). Compared to total domestic lending to non-banks of €2,688 billion, these exposures are substantial and should in contrast to domestic (real estate) lending be sensitive to a reduction of risk premia due to the SMP.

Second, interest rate and lending standard developments indicate that by the time that the SMP was launched, the average interest rate realized on both long-term commercial and mortgage loans was almost identical at around 4.5% (Deutsche Bundesbank, 2014). Whereas neither mortgage credit rates nor lending standards changed since the Great Financial Crisis, commercial loan terms deteriorated steadily until q1:2010. Hence, the relative risk-relief on commercial lending due to the SMP launch was potentially larger, as also suggested by commercial lending standards that stopped tightening after q1:2010 (see p. 45 in Deutsche Bundesbank, 2014).

Third, 93% of retail loans had a maturity of five years or more in q1:2010. With short-term policy rates stuck close to the zero-lower bound, the SMP commitment of the ECB might have induced banks to compress maturity gaps by reducing long-term real estate exposures with somewhat riskier, but also higher yielding commercial credit of shorter maturity.

Columns (5) and (6) show that also government and foreign lending increased due to the SMP. Given the relatively low volumes, see the last line of Table 4, we focus on commercial and retail lending responses.

5. Scrutinizing commercial and retail lending effects of the SMP

Table 5 addresses four concerns that may remain. First, the difference-in-difference setting hinges on comparing banks that differ solely in terms of their exposure to the SMP shock. Therefore, we re-estimate the main specification using the sample obtained from the propensity score matching described in Section 3.2. Columns (1) and (2) confirm the differential effects of the SMP on commercial and retail lending.

– Insert Table 5 around here –

Second, difference-in-differences regressions generate biased results if outcome variables are auto-correlated. Whereas the specification of county-by-quarter fixed effects assuages this concern, we follow Bertrand et al. (2004) and de-mean the dependent and explanatory variables. Thereby, the time-series component is eliminated both prior to the launch of the SMP and after it stopped. Columns (3) and (4) confirm the headline results, thus suggesting that these are not biased by auto-correlation.

Third, if the documented commercial lending hike is indeed attributable to the asset purchases of the SMP, no such responses should be detectable for a randomly generated pseudo-shock. Columns (5) and (6) present the according falsification test. Replicating the moments of the observed SMP shock distribution in q1:2010, placebo treatments are randomly assigned to banks. The estimated differential lending responses are statistically insignificant, which corroborates that the SMP stimulates lending.

Fourth, Figure 1 illustrated that the nominal portfolio share of SMP securities is generally low amongst the sampled regional banks. However, for a few banks these assets account for up to 75% of their entire bond portfolio. To ensure that it is not these very few banks with extreme holdings that drive the main results, we re-define the *SMP* variable. Columns (7) and (8) present results where the continuous portfolio share of SMP securities observed in q1:2010 is specified and interacted with the *POST* indicator. Again, the main result remains intact and qualitatively identical.

6. Further results: Alternative outcomes and channels

6.1. Lending growth, market shares, and performance

Besides restoring monetary policy transmission, the SMP aimed to stabilize financial markets and banking systems. Table 6 shows results for outcomes related to these objectives for the matched sample.

– Insert Table 6 around here –

6

Columns (1) and (2) show that asset purchases during the SMP did not cause significantly higher growth rates of commercial and retail lending, mitigating concerns about persistent crowding-out of lending by non-SMP banks. Note that the coefficients for interbank lending, security shares, and cash holdings exhibit reversed signs compared to the results in Table 4. Thus, these variables may be persistent and revert to the mean. If above-average holdings of cash, securities, or interbank loans revert to the mean, commercial and retail lending may be low, but exhibit above-average growth since those variables are also regressing to the mean.

Policy shocks may benefit some banks, but disadvantage others. Columns (3) and (4) specify market shares of commercial and retail lending per county as dependent variables.[8] The estimates indicate that affected banks participated more in the aggregate lending hike shown in Figure OA.2.

The specific objective of the SMP aside, any APP aims to strengthen financial system resilience in times of stress (Krishnamurthy et al., 2018). Two key indicators to this end are capital and liquidity buffers, which are specified in log-levels as dependent variables in columns (5) and (6).[9] The differential SMP effect on equity capital is insignificant. But the SMP caused a differential increase in cash levels and thus liquidity buffers.

Columns (7) and (8) show results for bank performance in terms of operating returns relative to risk-weighted assets and risk gauged by the ratio of non-performing loans to total customer lending. Treated banks improved their profitability without compromising credit quality in this non-stressed economy.

6.2. Mechanisms and channels

6.2.1. Portfolio rebalancing channel: valuation or sales effects?

This channel entails two ways how banks can benefit from APPs. First, they can realize windfall gains due to hiking asset prices by selling APP securities directly in secondary markets. Alternatively, banks either hold or even increase their exposure to APP securities and benefit from additional excess reserves due to to unrealized asset valuation gains. To test if holding, shedding, or loading up on SMP securities yields significantly different lending responses, we infer security transactions from quarterly changes in the number of securities held. Table 7 specifies three different interaction terms to classify banks as in Figure 2.

– Insert Table 7 around here –

Column (1) shows that all three trading responses to the SMP confirm the positive differential commercial lending effect. Wald tests confirm that this credit stimulus of the SMP is not significantly different across banks that either increase, reduce, or maintain their levels of "supported" securities. Column (2) presents results for the matched panel of 27,629 bank-quarter observations. These results suggest that the SMP exerted lending effects in Germany in particular via the large number of banks that did not change their exposures. Thus, valuation effects seem to be the more relevant channel of unconventional monetary policy transmission compared to outright unloading of securities in non-stressed economies.

Columns (3) and (4) present the three different transaction effects for the full and the matched sample on retail lending. Also here directions and magnitudes do neither differ significantly from another nor the joint effect reported before in the headline results. Banks with an exposure to the SMP reduce their retail lending between 2.4 and 4.2 percentage points.

In sum, outright unloading of SMP securities by German banks seems an unlikely cause of additional commercial lending. Instead, unrealized valuation gains of SMP securities appear to be the dominant driver.

---

[8]Market shares equal a regional bank's lending volume relative to aggregate lending by all regional banks per county. Large, (inter)nationally active banks are excluded because their regional lending distribution is unobservable

[9]Results are qualitatively identical for capital and liquidity ratios instead of log-levels.

6.2.2. Commitment channel: non-SMP periphery holdings

This second channel entails that asset purchases of selected securities convey a credible commitment of the ECB that also increased the value of non-purchased assets from stressed economies. Such indirect effects can be very important. Figure OA.7 in the online appendix shows that German regional banks held around ten times the volume of SMP securities in the form of non-purchased securities from stressed EMU countries. Whereas 17% of regional banks hold SMP securities, 66% of regional banks are exposed to stressed EMU economies via non-SMP securities. This puts the median portfolio share of around 1% (Figure 2) into perspective.

– Insert Table 8 around here –

Table 8 tests for indirect lending effects via the commitment channel. Columns (1) to (3) specify the log-level of commercial lending as dependent variable for the matched sample whereas columns (4) to (6) feature retail lending.

First, we specify a *Periphery* indicator equal to 1 if a bank held a security from the five stressed SMP countries in q1:2010, of which none was actually purchased by the ECB. In the matched sample, 135 banks are subject to this indirect effect in addition to the 356 banks that hold also SMP securities. The estimated differential commercial lending effect is almost twice as large as the response estimated in column (1) of Table 5. It corresponds to an average commercial lending hike of €10.6 million and an aggregate supply of €1.4 billion by these 135 indirect SMP beneficiaries.

Column (2) specifies next to the indirect commitment channel effect the direct portfolio rebalancing channel effects. Both coefficients are statistically significant, positive, and large. The average bank expands lending by €11 million due to an increased valuation of SMP securities plus an additional €18 million attributable to indirect SMP effects via holding non-SMP securities from stressed EMU economies. Average responses translate into an increase of aggregate commercial credit supply by €6.3 billion via the total of 491 affected banks, an economically substantial effect.

Column (3) adds the continuous variable *Coverage* and the associated interaction terms. This variable is defined as the share of all periphery securities held per bank and quarter, relative to the banks' total security holdings in that quarter. Thus, it is a time-variant, bank-specific measure of how intensively a bank is exposed to stressed EMU countries. All three interactions of *Periphery*, *SMP*, and *Coverage* with the *POST* term are significantly positive. Hence, banks that benefit directly and indirectly from the SMP increased commercial lending. This effect is amplified for banks with larger security exposure towards stressed economies.

The remaining columns provide the respective specifications for retail lending. Contrary to the negative direct effect of holding SMP securities on retail lending, column (4) indicates an expansion due to the indirect benefits of the SMP exerted by the commitment channel. But once both direct and indirect SMP effects on retail lending are accounted for in column (5) the total response remains significantly negative. This result corroborates earlier inference that banks reallocated credit from (primarily mortgage) household lending to productive firms. The specification of the relative importance of SMP securities in column (6) strengthens this result further as the interaction of the *Periphery* indicator is insignificant.

7. Conclusion

By combining granular security holding and transaction data of the ECB's first asset purchase program, the Securities Market Program (SMP), we isolate causal effects on the bank lending patterns of all German banks. Detailed prudential data for an entire non-stressed banking market, in which regional banks were quasi-randomly exposed to the SMP shock, permit the clean isolation of causal lending effects with a difference-in-differences approach. This approach mitigates the notorious challenge of endogenous relationships between bank responses and sovereign stress that plague analyses to explain bank behavior in stressed economies.

Customer lending increases in the five years after the spell of the SMP from q2:2010 until q1:2012 by €57 billion. To isolate how much of this lending hike can be attributed to the SMP, we focus on differential

8

lending effects. Banks that held SMP securities just before the first transaction on May 10, 2010 are compared to those that were not exposed. The SMP caused the average exposed bank to increase total customer lending by more than unexposed banks. The differential aggregate lending hike is on the order of €991 million. Regional banks contracted retail, mostly mortgage lending, but expanded commercial lending to firms and entrepreneurs substantially in response to the SMP shock. The aggregate commercial credit increase amounts to €4.7 billion compared to a contraction of aggregate retail lending of around €3 billion.

Differential lending effects are insensitive to the specification of bank- and quarter-by-county fixed effects, confounding policy shocks, a matched sample of non-treated banks, alternative sample periods, placebo SMP shocks, and cross-sectional tests to account for autocorrelation.

Regarding the aim of APPs to strengthen financial resilience, the results point to improved liquidity buffers, as well as a higher profitability of treated banks without an increase in credit risk.

SMP effects are transmitted via positive valuation effects of securities due to price increases in response to the policy. We find no evidence that banks directly shed SMP assets purchased by the ECB on a large scale. Importantly, valuation effects are also indirectly effective because they increase the value of non-SMP security holdings from stressed EMU economies. This indirect amplification effect is substantial and increases, for example, the direct aggregate commercial credit hike from €4.7 billion to a total effect of €6.3 billion. This amplification effect increases for larger indirect exposures. Overall, the evidence points to the existence of an effective commitment channel of APPs that helps to spark commercial lending.

References

Bauer, M. D., Rudebusch, G. D., 2014. The Signaling Channel for Federal Reserve Bond Purchases. International Journal of Central Banking 10 (3), 233–290.

Bertrand, M., Duflo, E., Mullainathan, S., 2004. How much should we trust differences-in-differences estimates? Quarterly Journal of Economics 119, 249–275.

Buch, C. M., Koetter, M., Ohls, J., 2016. Banks and sovereign risk: A granular view. Journal of Financial Stability 25 (1–15).

Deutsche Bundesbank, Juni 2010. Statistical supplement 3. Balance of payments statistics.

Deutsche Bundesbank, 2014. Monetary policy and banking business. Monthly Report November 66 (11), 27–46.

Eser, F., Schwaab, B., 2016. Assessing asset purchases by the ECB's Securities Markets Programme. Journal of Financial Economics 119 (1), 147–167.

European Central Bank, 2015. The transmission of the ECB's recent non-standard monetary policy measures. ECB Economic Bulletin 7, 32–51.

Ferrando, A., Popov, A., Udell, G. F., 2019. Do SMEs benefit from unconventional monetary policy and how? Micro-evidence from the eurozone. Journal of Money, Credit and Banking 51 (4), 895–928.

Ferrante, F., 2019. Risky lending, bank leverage and unconventional monetary policy. Journal of Monetary Economics 101, 100–127.

Gilchrist, S., Leahy, J. V., 2002. Monetary policy and asset prices. Journal of Monetary Economics 49 (1), 75–97.

Heider, F., Hoerova, M., Holthausen, C., 2015. Liquidity hoarding and interbank market spreads: the role of counterparty risk. Journal of Financial Economics (118), 336–354.

Jiménez, G., Ongena, S., Saurina, J., Peydró, J.-L., 2014. Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk? Econometrica 82, 463–505.

Koetter, M., Noth, F., Rehbein, O., 2019. Borrowers under water! Rare disasters, regional banks, and recovery lending. Journal of Financial Intermediation, forthcoming.

Krishnamurthy, A., Nagel, S., Vissing-Jorgensen, A., 2018. ECB policies involving government bond purchases: Impact and channels. Review of Finance 22 (1), 1–44.

Krishnamurthy, A., Vissing-Jorgensen, A., 2013. The Ins and Outs of LSAPs. Jackson Hole Proceedings, 57–111.

Kuttner, K. N., 2018. Outside the box: Unconventional monetary policy in the great recession and beyond. The Journal of Economic Perspectives 32 (4), 121–146.

Leuven, E., Sianesi, B., 2003. PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing. Statistical Software Components Boston College, ver 4.0.12 30jan2016.

Manganelli, S., Winter 2012. The impact of the Securities Market Programme. In: Research Bulletin. European Central Bank, pp. 2–5.

McKay, A., Nakamura, E., Steinsson, J., 2016. The power of forward guidance revisited. American Economic Review 106 (10), 3133–3158.

Nyborg, K. G., 2017. Central bank collateral frameworks. Journal of Banking and Finance 76, 198–214.

Rodnyansky, A., Darmouni, O. M., 2017. The effects of quantitative easing on bank lending behavior. Review of Financial Studies 30 (11), 3858–3887.

Woodford, M., 2012. Methods of policy accommodation at the interest-rate lower bound. Jackson Hole Proceedings, 185–288.

Figures

Figure 1: **Number of regional savings and cooperative banks that hold SMP securities and portfolio shares**

This Figure shows in the upper panel the number of regional savings and cooperative banks that held and did not hold securities purchased by the European Central Bank under the Securities Purchase Program (SMP) between Q2:2010 and Q1:2012. Figure OA.3 in the online appendix provides further details on the group of nationally active banks not covered in the analysis. The bottom panel shows box plots for the share of SMP securities relative to the entire portfolio value during the spell of the program for regional savings and cooperative banks. These shares are based on book values reported to the security holdings statistics of Deutsche Bundesbank. Further information on portfolio shares of nationally active banks and shares based on nominal values of securities are shown in Figure OA.4 in the online appendix.
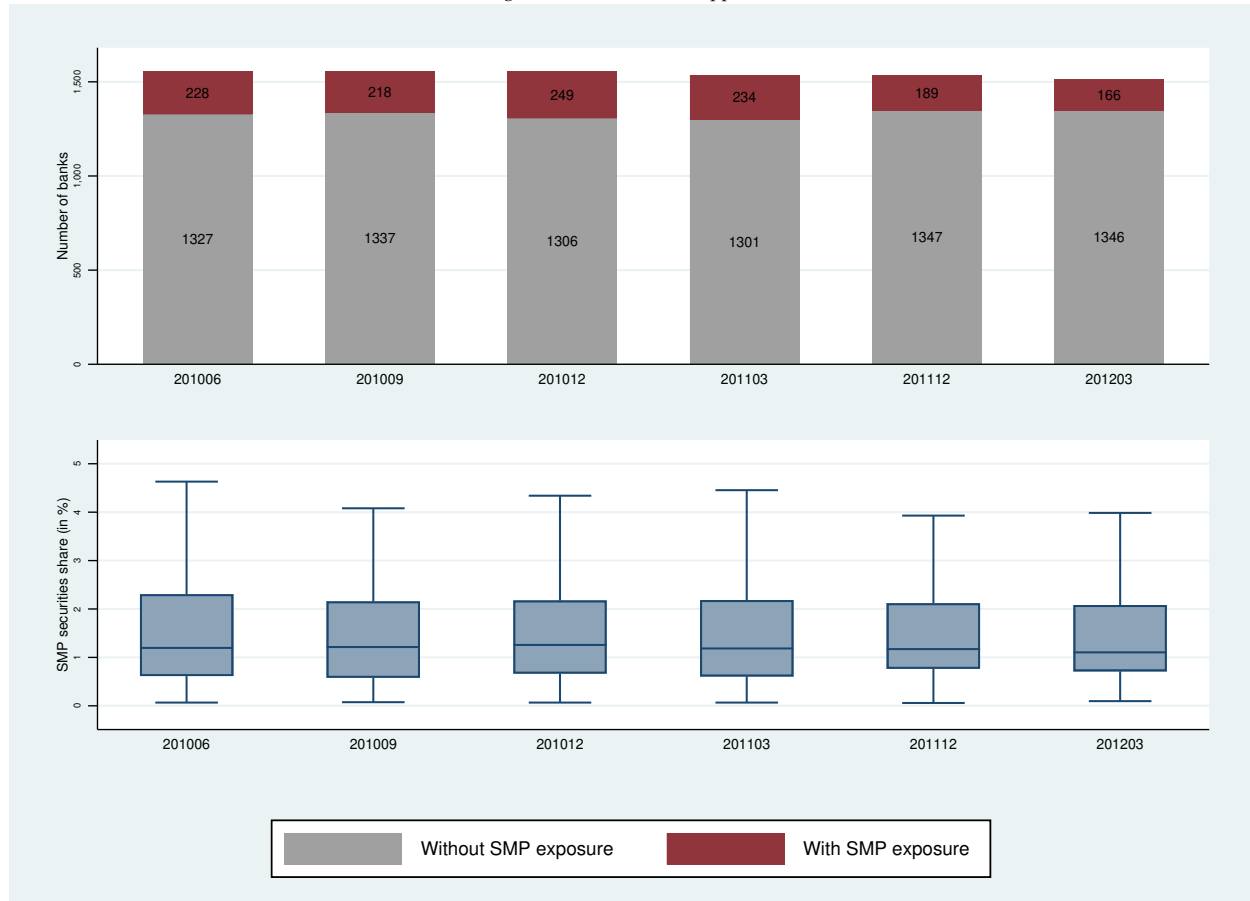
Figure 2: **Direction and magnitude of SMP security trading during the program**
This Figure distinguishes in the upper panel the number of regional savings and cooperative banks that increased, held, or reduced the number of SMP securities between Q2:2010 and Q1:2012. Transactions are derived from the change in the reported number of SMP securities between quarters. Reductions are calculated as the quarter-on-quarter change of observed SMP security holdings. Increases are positive quarter-on-quarter differences in banks' holdings of SMP securities. "Increasers" are banks that expanded the number of securities bought by the ECB over the entire purchase period (q2:2010–q1:2012). "Stayers" maintain their respective positions in SMP securities, and "Reducers" are banks exhibiting declining numbers of SMP securities. Figure OA.5 in the online appendix provides further details on the group of nationally active banks. The bottom panel shows mean shares of sell and buy trades of SMP securities, which are measured during the quarter, relative to the nominal value of SMP security holdings in percentages. Transactions are derived from the change in reported holdings per security between quarters. Reductions are calculated as the quarter-on-quarter change of reported nominal values of SMP security holdings. Increases are measured likewise as the quarter-on-quarter positive differences in banks' nominal holdings of SMP securities. Further information on the SMP security trade shares by nationally active banks are shown in Figure OA.6 in the online appendix.

12

1 Tables

Table 1: Summary statistics bank lending and control variables

This Table shows in the upper panel the descriptive statistics of dependent variables. Customer lending and its components are measured in thousands of euros. All summary statistics pertain either to all regional banks in columns (1)–(4) or a sample of matched banks in columns (5)–(8) during the period q2:2005 – q1:2017. Variables are defined in Table C.5. All ratios are measured as percentages.

	Full sample				*Matched sample*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean	**Std dev**	**p1**	**p99**	**Mean**	**Std dev**	**p1**	**p99**
Observations		62,661					27,629	
Banks		1,790					712	
Dependent variables								
Customer	696,669	1,551,913	15,223	5,999,140	877,300	2,034,818	15,068	7,853,281
Commercial	323,675	910,720	3,829	2,891,878	417,427	1,254,205	3,138	4,169,917
Retail	332,126	656,468	8,203	2,877,680	398,663	746,148	8,717	3,123,514
Mortgage	280,259	560,994	5,731	2,421,754	336,571	637,483	6,417	2,778,843
Government	28,170	100,167	0	415,844	42,571	139,106	0	693,123
Foreign	6,974	28,928	0	99,057	9,590	38,938	0	162,082
Explanatory variables								
logTA	13.051	1.329	10.302	16.1	13.333	1.334	10.372	16.372
Equity ratio	5.847	1.598	3.097	10.595	5.63	1.423	2.869	10.378
Interbank	-4.084	11.981	-33.788	28.451	-4.985	10.932	-32.946	22.804
Securities	24.278	11.928	1.275	58.992	27.52	12.26	6.359	63.062
Market funding	1.881	3.377	0	14.77	2.157	3.614	0	15.888
Credit lines	5.933	3.673	0.965	17.7	6.126	4.002	1.117	17.708
Liquidity	1.821	0.832	0.397	4.39	1.788	0.837	0.401	4.483

Table 2: Pre-SMP trends: validity of difference-in-difference specification

This Table compares quarterly growth rates of the three main dependent and all control variables prior to the the SMP period, i.e. during q2:2005 – q1:2010. The last pair of columns shows the differences in growth rates together with the p-value for a test whether this difference is equal to zero. The upper panel describes trends for the entire sample of regional banks whereas the lower panel shows trends for the matched sample. Control variables are winsorized at the 1st and the 99th percentiles to reduce the influence of outliers on the difference-in-trends test. Variables are defined in Table C.5. All growth rates are measured as percentages.

	Control group		**Treatment group**		**Trend delta**	**p-value**
	Mean	Std dev	Mean	Std dev		
			Full sample			
Observations		26,388	7,120			
Banks		1,790	356			
Customer loans	0.752	5.973	0.815	8.634	-0.064	0.471
Commercial loans	1.288	26.956	1.212	10.885	0.076	0.816
Retail loans	0.592	5.695	0.626	8.457	-0.034	0.693
logTA	0.063	0.242	0.061	0.244	0.001	0.643
Equityratio	0.324	3.522	0.297	3.525	0.026	0.577
Interbank	-3.694	154.625	-3.048	153.248	-0.646	0.754
Securities	1.225	11.745	1.126	10.407	0.099	0.520
Market funding	-1.958	18.658	-2.455	18.100	0.497	0.107
Credit lines	5.848	35.611	6.021	35.751	-0.173	0.716
Liquidity	6.684	250.257	6.082	59.508	0.602	0.840
			Matched sample			
Observations		7,120	7,120			
Banks		356	356			
Customer loans	0.800	5.625	0.815	8.634	-0.015	0.899
Commercial loans	2.041	47.093	1.212	10.885	0.830	0.148
Retail loans	0.578	4.960	0.626	8.457	-0.048	0.680
logTA	0.067	0.245	0.061	0.244	0.005	0.188
Equityratio	0.264	3.521	0.297	3.525	-0.033	0.571
Interbank	-3.370	155.999	-3.048	153.248	-0.322	0.901
Securities	1.366	10.855	1.126	10.407	0.240	0.178
Market funding	-1.880	17.684	-2.455	18.100	0.575	0.121
Credit lines	5.447	34.237	6.021	35.751	-0.575	0.327
Liquidity	14.066	472.523	6.082	59.508	7.985	0.157

Table 3: Difference-in-difference regressions of SMP exposure on customer lending

This Table provides the regression results from difference-in-differences specifications to explain log-levels of customer lending per bank and quarter. The sample is a bank-quarter panel of regional savings and cooperative banks during the period q2:2005 – q2:2017. *POST* is an indicator variable equal to 1 as of the start of the SMP program in q2:2010, unless noted otherwise. *SMP* is an indicator variable equal to 1 if the bank held at least one security in its portfolio that was among the ones purchased by the ECB under the SMP in the quarter prior to the launch of the SMP, i.e. in q1:2010. Column (1) provides estimates without fixed effects (FE). Column (2) introduces bank FE. Column (3) specifies both bank and quarter FE. Column (4) saturates the specification with county-by-quarter and bank FE. In column (5), the *POST* indicator is re-defined to equal 1 only after the suspension of further security purchases under the SMP, i.e. after q1:2012. In column (6), the purchase period of the SMP q2:2010 up and until q1:2012 is excluded from the regression. In column (7) we specify the continuous SMP share instead of the discrete indicator whether a bank held a SMP security as treatment variable. All explanatory variables are lagged by one quarter and are defined in Table C.5. Standard errors are two-way clustered by county and quarter and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1) OLS	(2) Bank FE	(3) Bank and qtr FE	(4) County-by-qtr and bank FE	(5) Post q1:2012	(6) No SMP period	(7) cont. SMP
SMP	0.001						
	(0.001)						
POST	0.045***	0.032***					
	(0.001)	(0.001)					
SMP × POST	-0.002	0.002	0.002*	0.004***	0.005***	0.005***	0.004***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln total assets$_{q-1}$	1.006***	0.933***	0.869***	0.866***	0.866***	0.868***	0.869***
	(0.000)	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Equity ratio$_{q-1}$	0.010***	0.020***	0.010***	0.010***	0.010***	0.009***	0.009***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Interbank lending$_{q-1}$	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Security share$_{q-1}$	-0.016***	-0.013***	-0.013***	-0.013***	-0.013***	-0.013***	-0.013***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market funding$_{q-1}$	0.002***	-0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Credit lines$_{q-1}$	-0.001***	0.002***	0.001***	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Liquidity$_{q-1}$	-0.009***	-0.013***	-0.006***	-0.007***	-0.007***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	75,106	75,106	75,106	75,106	75,106	62,661	62,661
Bank FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	No	No	Yes	Absorbed	Absorbed	Absorbed	Absorbed
County-by-quarter FE	No	No	No	Yes	Yes	Yes	Yes
2-way clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted within R^2	0.994	0.892	0.809	0.804	0.804	0.811	0.803
Banks	1,790	1,790	1,790	1,790	1,790	1,790	1,790
SMP observations	16,528	16,528	16,528	16,528	16,528	13,693	13,693
SMP Banks	356	356	356	356	356	356	356
Average LHS	695,084	695,084	695,084	695,084	695,084	695,084	695,084

Table 4: Customer lending components

This Table provides regression results from difference-in-differences specifications to explain log-levels of customer lending components per bank and quarter. The sample is a bank-quarter panel of regional savings and cooperative banks during the period q2:2005 – q2:2017. *POST* is an indicator variable equal to 1 after the suspension of the SMP program. The purchase period of the SMP q2:2010 up and until q1:2012 is excluded from the regressions. *SMP* is an indicator variable equal to 1 if the bank held at least one security in its portfolio that was among the ones purchased by the ECB under the SMP in the quarter prior to the launch of the SMP, i.e. in q1:2010. All regressions feature county-by-quarter and bank FE. Column (1) reproduces the baseline specification from column (6) in Table 3. Column (2) features commercial loans as the dependent variable. In column (3) we specify retail lending to households. Column (4) details the share of mortgage lending from this category. In column (5), the dependent variable are loans to domestic counties, states, or the federal government. Column (6) shows results to explain lending to foreign non-bank borrowers. All explanatory variables are lagged by one quarter and are defined in Table C.5. Standard errors are two-way clustered by county and quarter and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1) Customer	(2) Commercial	(3) Retail	(4) of which: Mortgage	(5) Government	(6) Foreign
$SMP \times POST$	0.005***	0.040***	-0.026***	-0.022***	0.147***	0.055**
	(0.001)	(0.003)	(0.002)	(0.003)	(0.041)	(0.026)
ln total assets$_{q-1}$	0.868***	0.890***	0.838***	0.777***	1.625***	1.571***
	(0.006)	(0.007)	(0.007)	(0.008)	(0.089)	(0.044)
Equity ratio$_{q-1}$	0.009***	0.011***	0.013***	0.015***	0.052***	-0.006
	(0.001)	(0.001)	(0.003)	(0.004)	(0.012)	(0.008)
Interbank lending$_{q-1}$	-0.009***	-0.012***	-0.007***	-0.007***	0.007***	-0.015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)
Security share$_{q-1}$	-0.013***	-0.016***	-0.010***	-0.010***	-0.010***	-0.024***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)
Market funding$_{q-1}$	0.001***	0.005***	0.000	0.001*	-0.021***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.003)
Credit lines$_{q-1}$	0.002***	0.005***	0.002***	0.002***	0.007**	0.012***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.003)	(0.002)
Liquidity$_{q-1}$	-0.006***	-0.009***	0.000	0.004	0.068***	-0.006
	(0.001)	(0.001)	(0.003)	(0.004)	(0.015)	(0.009)
Observations	62,661	62,661	62,661	62,661	62,661	62,661
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
County-by-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
2-way clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted within R^2	0.811	0.514	0.550	0.401	0.0139	0.0416
Banks	1,790	1,790	1,790	1,790	1,790	1,790
SMP observations	13,693	13,693	13,693	13,693	13,693	13,693
SMP Banks	356	356	356	356	356	356
Average LHS	696,669	323,675	332,126	280,259	28,170	6,974

Table 5: Scrutiny on main results: Sampling and shock definitions

This Table provides scrutiny checks of the main results of commercial and retail lending responses. The first pair of columns shows regressions after a 1:1 propensity score matching procedure based on explanatory lagged covariates from the quarter preceding the start of the SMP, i.e. q1:2010. The second pair of columns shows results for a collapsed pre- and post-SMP period into one cross-section, respectively, to account for potentially auto-correlated error terms (Bertrand et al., 2004). The third pair of results presents differential estimates of a randomly generated placebo shock. The last pair of results replaces the *SMP* indicator variable equal to 1 by the average portfolio share of SMP securities in q1:2010. All variables are lagged by one quarter and are defined in Table C.5. Clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Test	(1) (2) Propensity score matching		(3) (4) Collapsed cross-sections		(5) (6) Placebo shock		(7) (8) Continuous SMP share	
Loan category	Commercial	Retail	Commercial	Retail	Commercial	Retail	Commercial	Retail
$SMP \times POST$	0.013**	-0.029***	0.041***	-0.021**	-0.003	0.002	0.029***	-0.022***
	(0.005)	(0.003)	(0.012)	(0.009)	(0.003)	(0.003)	(0.002)	(0.002)
ln total assets$_{q-1}$	0.895***	0.858***	0.956***	0.882***	0.892***	0.836***	0.893***	0.836***
	(0.012)	(0.010)	(0.023)	(0.025)	(0.007)	(0.007)	(0.007)	(0.007)
Equity ratio$_{q-1}$	0.015***	0.007***	0.006	0.010	0.011***	0.013***	0.011***	0.013***
	(0.003)	(0.002)	(0.004)	(0.017)	(0.001)	(0.003)	(0.001)	(0.003)
Interbank lending$_{q-1}$	-0.012***	-0.007***	-0.013***	-0.007***	-0.012***	-0.007***	-0.012***	-0.007***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Security share$_{q-1}$	-0.017***	-0.010***	-0.018***	-0.009***	-0.016***	-0.009***	-0.016***	-0.010***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Market funding$_{q-1}$	0.008***	0.000	0.006***	-0.001	0.005***	0.000	0.005***	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Credit lines$_{q-1}$	0.003***	0.001**	0.003**	0.001	0.005***	0.002***	0.005***	0.002***
	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Liquidity$_{q-1}$	-0.012***	-0.001	0.018*	0.028	-0.009***	0.000	-0.009***	0.001
	(0.002)	(0.002)	(0.010)	(0.027)	(0.001)	(0.003)	(0.001)	(0.003)
Observations	27,629	27,629	3,078	3,078	62,661	62,661	62,661	62,661
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Absorbed	Absorbed	Yes	Yes	Absorbed	Absorbed	Absorbed	Absorbed
County-by-quarter FE	Yes	Yes	No	No	Yes	Yes	Yes	Yes
2-way clustered SE	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Adjusted within R^2	0.443	0.645	0.671	0.620	0.506	0.540	0.513	0.550
Banks	712	712	1,539	1,539	1,790	1,790	1,790	1,790
SMP banks	356	356	351	351	356	356	356	356

Table 6: Effects on bank performance: Alternative dependent variables

This Table shows results of the baseline specification in column (6) of Table 3 with alternative dependent variables to gauge bank performance. Column (1) and (2) show results for quarterly growth rates of commercial and retail lending, respectively. Columns (3) and (4) present estimations for county markets shares, measured relative to aggregate commercial and retail lending by regional banks, i.e. excluding the lending by commercial and nationally active banks. Columns (5) and (6) show results for the log levels of equity capital and liquidity as potential sources of funding differential lending compared to SMP-induced excess reserves. Columns (7) and (8) present responses of bank return and risk proxies – return on risk-weighted assets and the ratio of non-performing loans – to the SMP shock. All variables are lagged by one quarter and are defined in Table C.5. Clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Dependent variable	(1) q-on-q growth commercial	(2) q-on-q growth retail	(3) Market share commercial	(4) Market share retail	(5) Log-level equity	(6) Log-level liquidity	(7) Return on RWA	(8) Non-performing loan ratio
$SMP \times POST$	0.180	-0.043	0.544***	-0.705***	0.003	0.035***	0.078***	-0.067
	(0.120)	(0.076)	(0.079)	(0.089)	(0.003)	(0.012)	(0.024)	(0.088)
ln total assets$_{q-1}$	-1.415***	-1.676***	16.898***	17.604***	-0.143***	-0.271***	-0.202***	0.491***
	(0.347)	(0.251)	(0.325)	(0.356)	(0.007)	(0.027)	(0.053)	(0.145)
Equity ratio$_{q-1}$	-0.039	-0.129***	0.795***	0.650***		0.056***	-0.087***	0.237***
	(0.067)	(0.043)	(0.060)	(0.054)		(0.007)	(0.015)	(0.056)
Interbank lending$_{q-1}$	0.026***	-0.008*	-0.086***	-0.062***	0.003***	0.002**	0.005***	0.009*
	(0.008)	(0.005)	(0.006)	(0.006)	(0.000)	(0.001)	(0.002)	(0.005)
Security share$_{q-1}$	0.056***	0.005	-0.180***	-0.116***	-0.000	-0.008***	0.016***	-0.053***
	(0.008)	(0.005)	(0.007)	(0.007)	(0.000)	(0.001)	(0.002)	(0.005)
Market funding$_{q-1}$	-0.031*	0.002	-0.104***	-0.082***	-0.005***	-0.010***	0.002	0.020*
	(0.018)	(0.012)	(0.015)	(0.014)	(0.000)	(0.002)	(0.003)	(0.011)
Credit lines$_{q-1}$	0.122***	0.111***	0.017	-0.005	-0.001***	0.009***	-0.009**	-0.034***
	(0.016)	(0.011)	(0.012)	(0.010)	(0.000)	(0.001)	(0.004)	(0.009)
Liquidity$_{q-1}$	0.049	0.075**	0.212***	0.239***	0.015***		0.017	0.037
	(0.054)	(0.036)	(0.054)	(0.062)	(0.002)		(0.013)	(0.047)
Observations	27,628	27,629	27,629	27,629	26,962	27,629	21,716	21,480
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2-way clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted within R^2	0.0121	0.0231	0.398	0.412	0.107	0.0524	0.0153	0.0135
Banks	712	712	712	712	712	712	712	712
SMP observations	13,693	13,693	13,693	13,693	13,366	13,693	10,804	10,701
SMP Banks	356	356	356	356	356	356	356	356
Average LHS	1.091	0.741	30.21	29.82	5.630	1.788	1.538	3.412

Table 7: Channels of SMP effects: the direction of trades

This Table shows results of the baseline specification in column (6) of Table 3 with the main variable *SMP* separated into three indicators for different types of banks as in Figure 2. "Increaser" is a variable equal to 1 if the bank expanded the number of securities bought by the ECB over the entire purchase period (q2:2010–q1:2012). "Stayer" equals 1 if banks maintain their respective positions in SMP securities. "Reducer" equals 1 if banks reduced the number of SMP securities. This classification is based on security-level data described in Table C.1. The sample is a bank-quarter panel of regional savings and cooperative banks during the period q2:2005 – q2:2017. *POST* is an indicator variable equal to 1 after the suspension of the SMP program. The purchase period of the SMP q2:2010 up and until q1:2012 is excluded from the regressions. Columns (1) and (2) specify commercial lending as the dependent variable for the complete and the matched sample, respectively. Columns (3) and (4) specify retail lending as the dependent variable. All regressions feature county-by-quarter and bank FE. All variables are lagged by one quarter and are defined in Table C.5. Clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)
Dependent	Commercial		Retail	
Sample	full	matched	full	matched
Increaser $\times POST$	0.037***	-0.007	-0.027***	-0.035***
	(0.005)	(0.009)	(0.003)	(0.004)
Reducer $\times POST$	0.043***	0.053***	-0.042***	-0.035***
	(0.008)	(0.009)	(0.006)	(0.007)
Stayer $\times POST$	0.042***	0.017***	-0.023***	-0.024***
	(0.004)	(0.005)	(0.003)	(0.003)
ln total assets$_{q-1}$	0.890***	0.895***	0.838***	0.858***
	(0.007)	(0.012)	(0.007)	(0.010)
Equity ratio$_{q-1}$	0.011***	0.015***	0.013***	0.007***
	(0.001)	(0.003)	(0.003)	(0.002)
Interbank lending$_{q-1}$	-0.012***	-0.012***	-0.007***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
Security share$_{q-1}$	-0.016***	-0.017***	-0.010***	-0.010***
	(0.000)	(0.000)	(0.000)	(0.000)
Market funding$_{q-1}$	0.005***	0.008***	-0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)
Credit lines$_{q-1}$	0.005***	0.003***	0.002***	0.001**
	(0.000)	(0.001)	(0.000)	(0.000)
Liquidity$_{q-1}$	-0.009***	-0.012***	0.000	-0.000
	(0.001)	(0.002)	(0.003)	(0.002)
Observations	62,661	27,629	62,661	27,629
Bank FE	Yes	Yes	Yes	Yes
County-by-quarter FE	Yes	Yes	Yes	Yes
2-way clustered SE	Yes	Yes	Yes	Yes
Adjusted within R^2	0.514	0.444	0.550	0.645
Banks	1,790	712	1,790	712
SMP observations	13,693	13,693	13,693	13,693
SMP Banks	356	356	356	356
Average LHS	323,675	417,427	332,126	398,663

Table 8: Signaling versus portfolio rebalancing channel

This Table augments the baseline effect of holding SMP securities in the pre-policy period with the lending responses from holding non-SMP securities from the supported *Periphery* countries as well as the interaction with the intensive margin of these non-SMP exposures, referred to as *Coverage*. Columns (1) through (3) feature the log level of commercial lending as the dependent variable. Columns (4) through (6) show results for the log-level of retail lending. The sample is a matched bank and quarter panel of all regional savings and cooperative banks during the period q2:2005 – q2:2017. *POST* is an indicator variable equal to 1 at the start of the SMP program in q2:2010. *SMP* is an indicator variable equal to 1 if the bank held at least one security in its portfolio that was among the ones purchased by the ECB under the SMP during the quarter prior to the launch of the SMP, i.e. in q1:2010. The specification contains county-by-quarter and bank FE. The purchase period of the SMP q2:2010 up and until q1:2012 is excluded from the regression. All explanatory variables are lagged by one quarter and are defined in Table C.5. Standard errors are two-way clustered by county and quarter and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Dependent	(1)	(2)	(3)	(4)	(5)	(6)
	Commercial all banks			Retail		
	Periphery	plus SMP	Coverage	Periphery	plus SMP	Coverage
Periphery $\times POST$	0.025**	0.042***	0.026**	0.028***	0.011***	0.006
	(0.010)	(0.010)	(0.011)	(0.003)	(0.004)	(0.005)
SMP $\times POST$		0.026***	0.026***		-0.025***	-0.022***
		(0.005)	(0.006)		(0.003)	(0.004)
Coverage			0.002*			-0.003***
			(0.001)			(0.001)
Coverage $\times POST$			0.012***			0.000
			(0.003)			(0.001)
Periphery $\times$ Coverage			-0.015***			0.000
			(0.004)			(0.001)
Periphery $\times$ Coverage $\times POST$			0.012***			0.004***
			(0.004)			(0.001)
ln total assets$_{q-1}$	0.896***	0.893***	0.892***	0.855***	0.858***	0.856***
	(0.012)	(0.012)	(0.011)	(0.010)	(0.010)	(0.010)
Equity ratio$_{q-1}$	0.015***	0.015***	0.015***	0.007***	0.007***	0.007***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Interbank lending$_{q-1}$	-0.012***	-0.012***	-0.012***	-0.007***	-0.007***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Security share$_{q-1}$	-0.017***	-0.017***	-0.017***	-0.010***	-0.010***	-0.010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market funding$_{q-1}$	0.008***	0.008***	0.009***	0.001	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Credit lines$_{q-1}$	0.003***	0.003***	0.003***	0.001**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Liquidity$_{q-1}$	-0.012***	-0.012***	-0.012***	-0.000	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	27,629	27,629	27,629	27,629	27,629	27,629
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
County-by-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
2-way clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted within R^2	0.443	0.444	0.447	0.664	0.645	0.646
Banks	712	712	712	712	712	712
SMP observations	5,294	5,294	5,294	5,294	5,294	5,294
SMP Banks	135	135	135	135	135	135
Average LHS	417,427	417,427	417,427	398,663	398,663	398,663

19

Online appendix A. Further details on SMP holdings in Germany

Figures OA.1 and OA.2 visualize the monthly evolution of banks' total earning assets by asset class and the components of customer lending, respectively. The left panels show treated banks whereas the left panel illustrate developments of the control group.

The analysis in the main body of the paper uses regional cooperative and savings banks because these are most suited to isolate causal lending effects due to the SMP. This online appendix provides further data for regional banks including also small commercial banks. The group of large banks comprises large commercial banks,[10] head institutions of the savings bank sector, so-called Landesbanken, and central cooperative banks.

Figure OA.3 shows that large, multinational German banks with sizeable capital markets operations held even more SMP securities compared to the regional cooperative and savings banks shown in Figure 1 in the main body of the paper. The median share of SMP securities is now slightly larger as shown in Figure OA.4. Large banks are much more active in re-allocating their SMP security portfolios compared to regional banks as illustrated in Figure OA.5. Figure OA.6 shows the share of buy-side and sell-side trades involving SMP securities during a quarter relative to the stock of SMP securities at the end of the quarter. Figure OA.7 contrasts direct and indirect exposures of German banks to the stressed EMU member economies over the lifetime of the SMP. The left panel shows the quarterly stock of SMP securities' book value. The right panel depicts the aggregate book value of all other securities, stocks and bonds, from the five SMP countries that were, however, not part of the asset purchases of the ECB.

---

[10]Commerzbank, Deutsche Bank, Dresdner Bank, Hypo Vereinsbank, and Postbank.

Online appendix B. Additional Figures

Figure OA.1: **Evolution of asset components of SMP and non-SMP banks**
This Figure shows the evolution of assets and their composition for savings and cooperative banks. The left panel depicts asset compositions for banks that held SMP securities whereas the left panel shows the same for non-SMP banks. All variables are measured in millions of euro. The quarters during which the ECB bought sovereign debt securities from Greece, Italy, Ireland, Portugal, and Spain are q2:2010 until q1:2012.
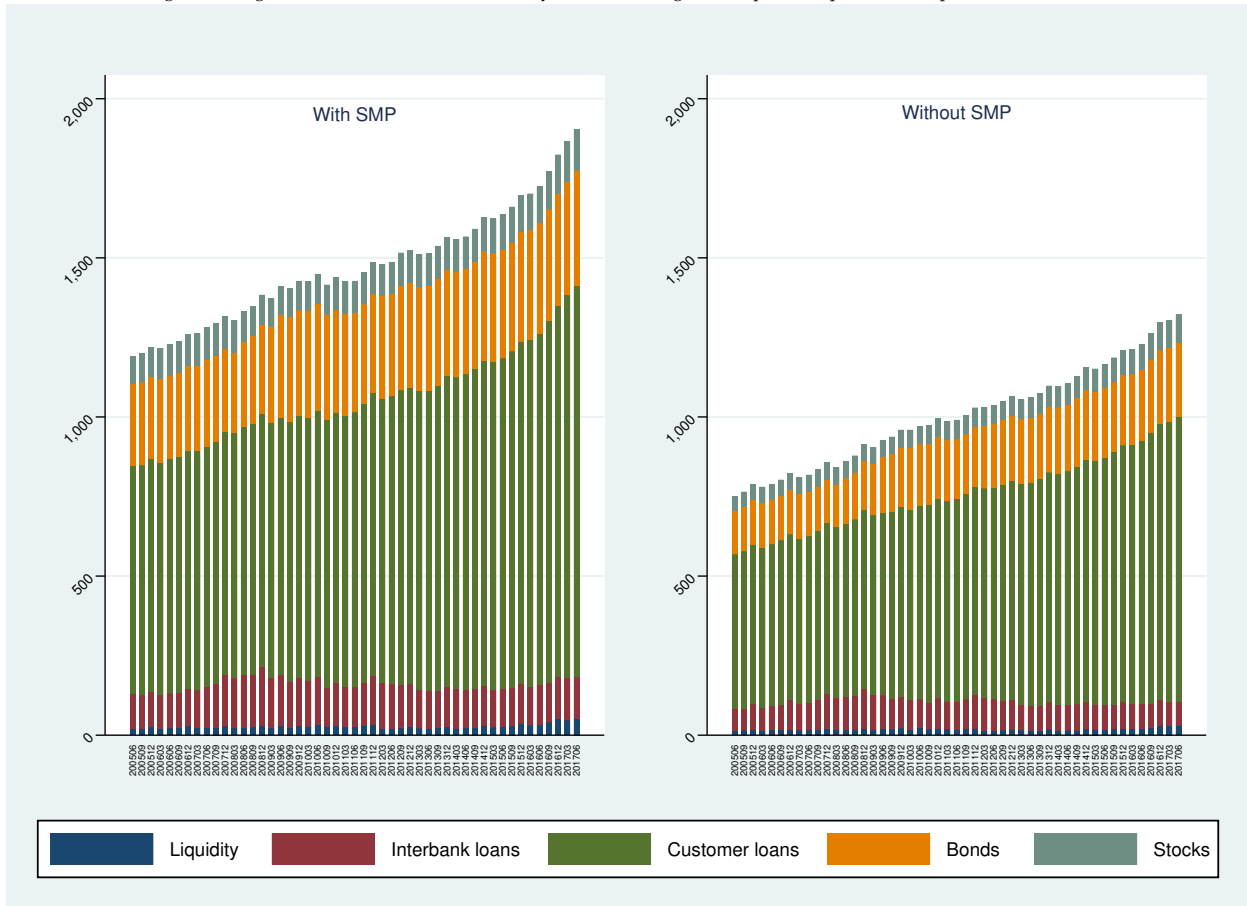
Figure OA.2: **Customer lending components over time by SMP and non-SMP savings and cooperative banks**
This Figure shows the evolution of customer lending components for banks that held SMP securities (left panel) and banks that did not hold SMP securities (right panel). Commercial lending are loans extended to both publicly listed as well as privately incorporated non-bank firms. Retail loans comprise credit to households and consist for a large part of mortgage loans. Government loans consist of lending to county, state, and federal government authorities. Foreign lending includes credit to any non-German, non-financial firm. All variables are measured in millions of euro. The quarters during which the ECB bought sovereign debt securities from Greece, Italy, Ireland, Portugal, and Spain are q2:2010 until q1:2012, which are indicated on the horizontal axis.
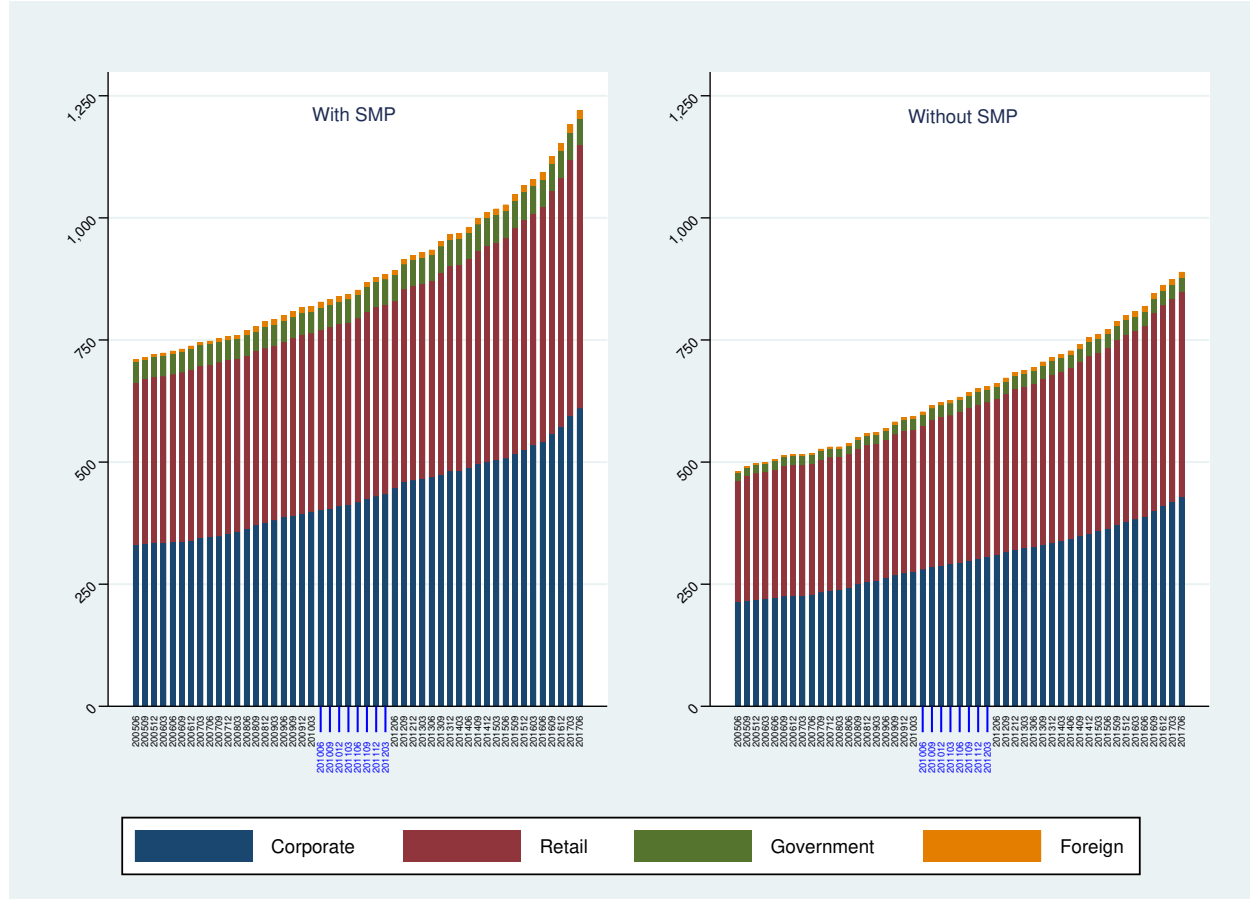
Figure OA.3: **Number of banks holding SMP securities**
This Figure shows the number of banks that held and did not hold securities purchased by the European Central Bank under the Securities Purchase Program (SMP) between q2:2010 and q1:2012. The distinguished banking groups follow the three-pillar taxonomy of Deutsche Bundesbank. Small regional banks include savings, cooperative, and commercial banks. Large banks comprise the five largest commercial banks, head institutions of the savings banks ("Landesbanken"), and central institutions of cooperatives.

Note: Large banks include commercial banks, central savings institutions, central cooperative banks, and mortgage banks.
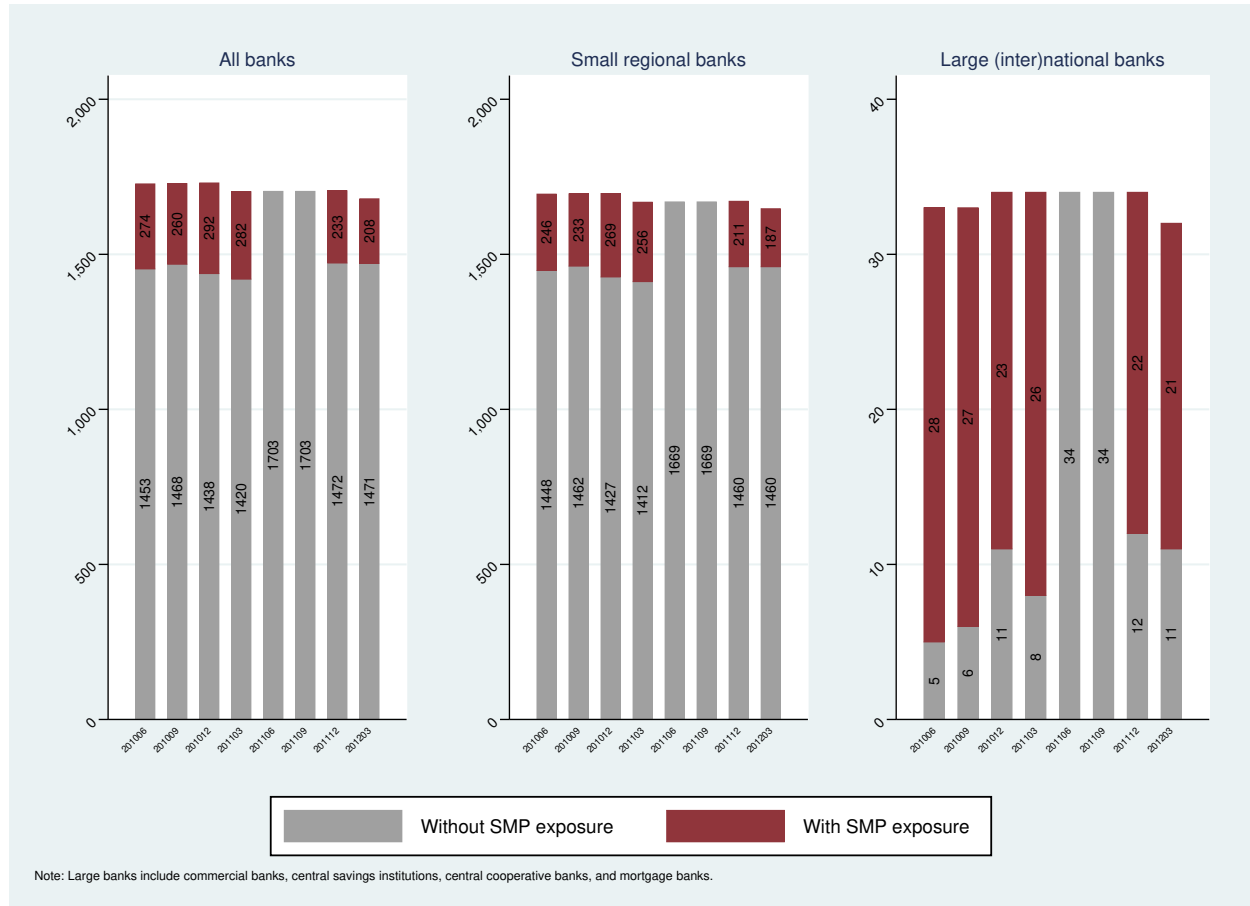
Figure OA.4: **Share of SMP securities in banks' portfolios**

This Figure shows box plots for the percentage share of SMP securities relative to the total portfolio of banks. Security portfolios and SMP securities are measured in nominal value and book values, respectively. The distinguished banking groups follow the three-pillar taxonomy of Deutsche Bundesbank. Small regional banks include savings, cooperative, and commercial banks. Large banks comprise the five largest commercial banks, head institutions of the savings banks ("Landesbanken"), and central institutions of cooperatives.

Note: Large banks include commercial banks, central savings institutions, central cooperative banks, and mortgage banks. Outside values excluded.

Figure OA.5: **Number of banks reducing, holding, or increasing SMP securities**
This Figure shows the number of banks reducing, holding, or increasing the number of SMP securities between Q2:2010 and Q2:2012. Transactions are derived from the change in the reported number of SMP securities between quarters. Reductions are calculated as the quarter-on-quarter change of observed SMP security holdings. Increases are measured likewise as the quarter-on-quarter positive differences in banks' holdings of SMP securities. The distinguished banking groups follow the three-pillar taxonomy of Deutsche Bundesbank. Small regional banks include savings, cooperative, and commercial banks. Large banks comprise the five largest commercial banks, head institutions of the savings banks ("Landesbanken"), and central institutions of cooperatives.

6

Figure OA.6: **Mean shares of sell and buy trades of SMP securities**
This Figure shows the mean shares of sell and buy trades of SMP securities during the quarter, relative to the nominal value of SMP security holdings in percentages. Transactions are derived from the change in reported security holdings per security between quarters. Reductions are calculated as the quarter-on-quarter change of reported nominal values of SMP security holdings. Increases are measured likewise as the quarter-on-quarter positive differences in banks' nominal holdings of SMP securities. The distinguished banking groups follow the three-pillar taxonomy of Deutsche Bundesbank. Small regional banks include savings, cooperative, and commercial banks. Large banks comprise the five largest commercial banks, head institutions of the savings banks ("Landesbanken"), and central institutions of cooperatives.

Note: Large banks include commercial banks, central savings institutions, central cooperative banks, and mortgage banks.

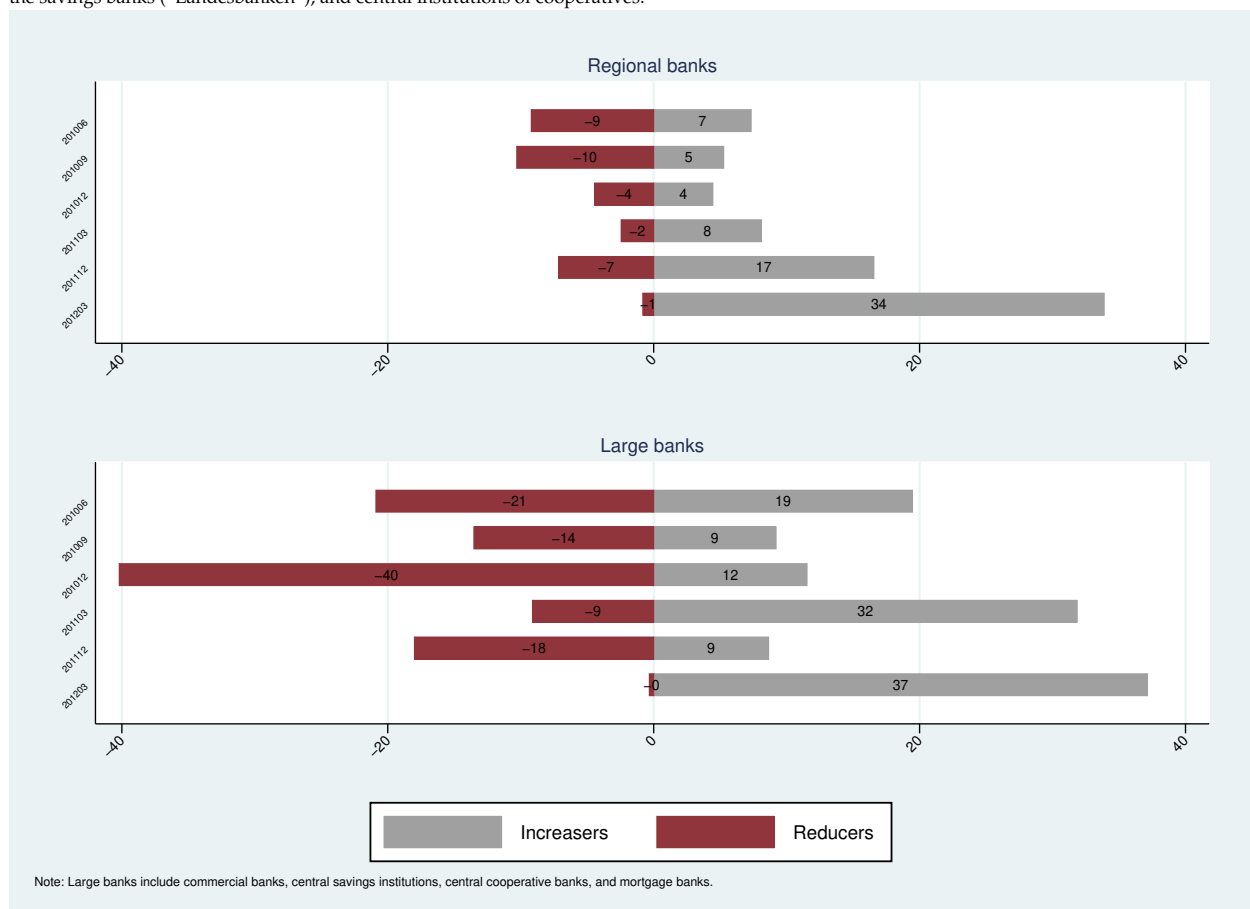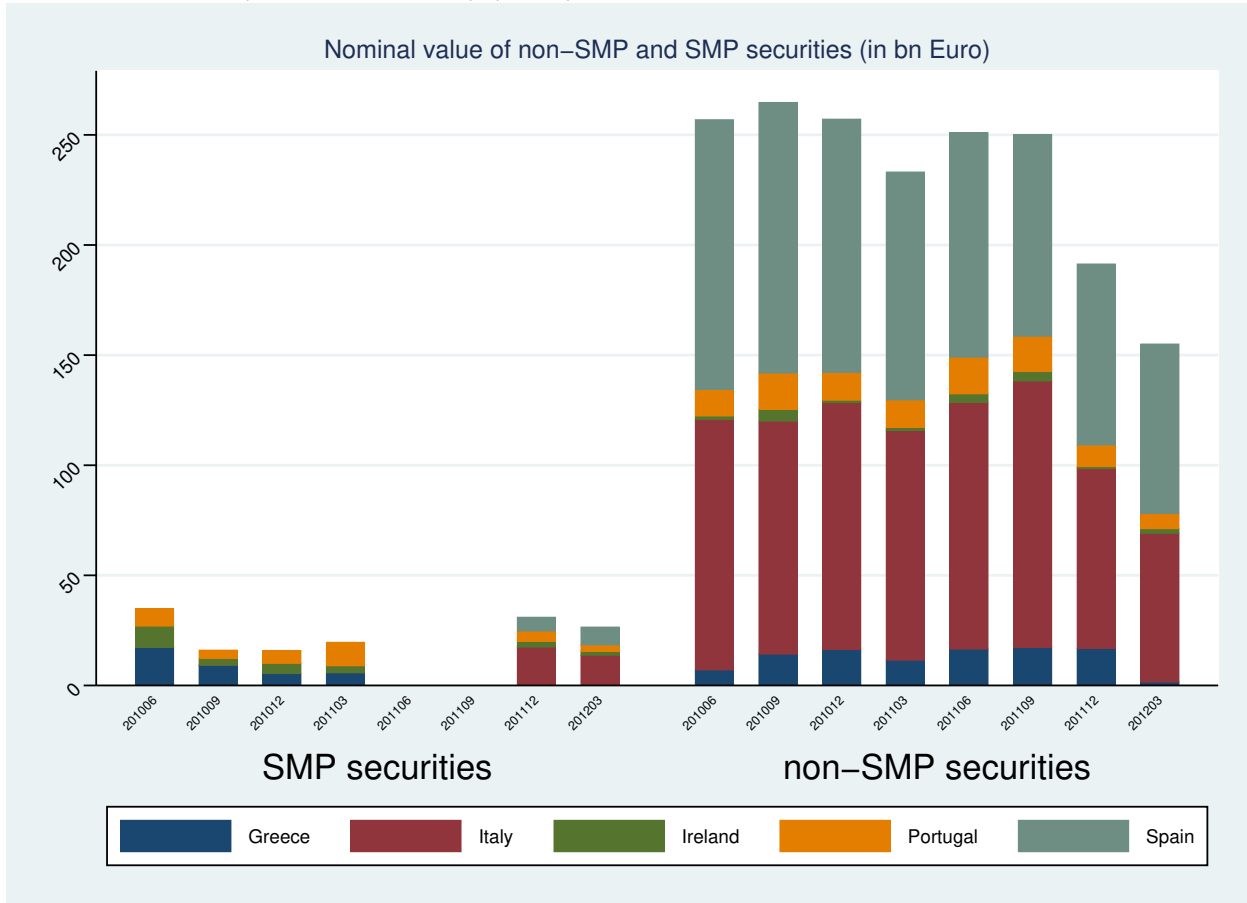Figure OA.7: **Quarterly stock of SMP securities per country**
This Figure shows the stock of SMP securities purchased by the European Central Bank under the Securities Market Program (SMP) between Q2:2010 and Q2:2012 that were held by all German banks, country-by-country.

Nominal value of non−SMP and SMP securities (in bn Euro)

SMP securities   non−SMP securities

Greece   Italy   Ireland   Portugal   Spain

1 Online appendix C. Additional Tables

Table C.1: Frequency and type of SMP transactions at security level

This Table provides the number of transactions per security and the number of individual securities eligible for the SMP that remained unchanged in banks' portfolios. Frequencies are calculated on the basis of the bank-security-quarter sample. "Equal" indicates the number of securities held by all banks at the time that were purchased during the quarter by the ECB. "Increase" indicates the number of securities, which increased relative to the preceding quarter. "Initial" denotes the number of securities that were purchased by banks in the indicated quarter for the first time since the start of the securities holding statistics, q5:2005. "Previous" shows the number of securities purchased by banks during the quarter earlier than the preceding quarter. "Reduction" indicates the number of securities reduced from one quarter to the other. Regional banks include local savings and cooperatives as well as small commercial banks. Large banks comprise the five largest commercial banks, central banks of the savings bank sector ("Landesbanken"), and the cooperative banking sector.

Date	Number of transactions					Total
	Equal	Increase	Initial	Previous	Reduction	
All banks						
201006	476	108	60	26	158	828
201009	419	73	45	33	83	653
201012	563	89	35	16	110	813
201103	516	92	43	25	92	768
201112	457	143	56	36	195	887
201203	313	156	104	32	110	715
Regional banks						
201006	393	17	32	1	31	474
201009	342	5	39	3	17	406
201012	466	3	27		16	512
201103	425	17	34	5	3	484
201112	364	3	33	1	15	416
201203	262	16	88	4	9	379
Large banks						
201006	83	91	28	25	127	354
201009	77	68	6	30	66	247
201012	97	86	8	16	94	301
201103	91	75	9	20	89	284
201112	93	140	23	35	180	471
201203	51	140	16	28	101	336

Table C.2: Number and volume of periphery and non-SMP periphery securities

This Table provides the number and the volume of periphery securities in billions of Euro per quarter that German banks held and that were either excluded from the SMP (left panel) or part of the program at some time (right panel). The data are differentiated by issuer country based on the ISIN code. Securities include both fixed income and stocks. The ISIN codes XS are excluded.

Date	Non-SMP securities					SMP-securities				
Country	ES	GR	IE	IT	PT	ES	GR	IE	IT	PT
					Number of securities					
201006	4,211	207	825	2,081	799		459	183	3	235
201009	4,286	243	1,027	2,121	880		416	89	2	170
201012	4,172	270	896	2,284	770		369	218		271
201103	4,183	274	1,125	2,401	749		349	182		293
201106	4,149	570	1,351	2,416	929					
201109	3,903	519	1,333	2,365	924					
201112	3,503	481	1,047	1,894	655	211		184	372	202
					Aggregate book value of securities in billions of Euro					
201006	120.3	3.5	2.6	120.5	10.7		12.07	9.45	0.05	7.60
201009	123.7	8.2	6.1	115.2	14.3		7.53	2.82	0.04	3.56
201012	108.8	8.8	2.1	117.3	10.3		4.22	3.73		5.34
201103	98.3	6.4	2.2	110.3	9.9		4.22	2.42		9.33
201106	96.2	8.3	3.7	114.7	12.1					
201109	88.3	6.1	4.9	112.7	11.1					
201112	77.2	3.9	1.6	72.0	6.7	6.22		2.28	16.30	3.04
					Aggregate nominal (face) value of securities in billions of Euro					
201006	122.4	7.1	1.6	113.7	12.1		17.2	9.7	0.1	7.9
201009	122.8	14.2	5.4	105.8	16.5		9.1	3.1	0.1	3.8
201012	114.9	16.3	1.1	112.1	12.7		5.4	4.6		5.9
201103	103.5	11.5	1.4	104.4	12.4		5.8	3.2		10.7
201106	101.9	16.5	3.9	112.0	16.7					
201109	91.6	17.4	4.3	120.8	16.1					
201112	82.1	16.8	0.9	81.6	9.9	6.3		2.7	17.4	4.6

Table C.3: Probit estimation results propensity score matching

This Table provides the estimation results of a propensity score matching procedure based on a probit model to conduct a one-to-one nearest neighbor matching according to the routine of Leuven and Sianesi (2003). Propensity scores of SMP treatment are estimated using all covariates that are described in Table 1 in the quarter before the SM program was launched, i.e. in q1:2010. All observations in this cross-section are on the common support and the average propensity score of treated banks is 24%.

	Coefficient	SE	p-value
logTA	0.093	0.032	0.003
Equityratio	0.004	0.028	0.875
Interbank	-0.003	0.003	0.342
Securities	0.021	0.003	0.000
Market funding	0.021	0.012	0.069
Credit lines	0.005	0.011	0.664
Liquidity	-0.080	0.051	0.119
Constant	-2.474	0.500	0.000
Diagnostics			
Pseudo R2	0.042		
Log likelihood	-807.3		
Observations	1,580		
Untreated	1,224		
Treated	356		

Table C.4: Descriptive statistics of covariates used for propensity score matching

This Table describes outcome and control variables for the quarter preceding the launch of the SMP that are used to conduct the propensity score matching. The last two columns depict the difference of each variable between the control group and the treatment group together with the p-value from a test if the difference is equal to zero. The upper panel describes the data of the complete cross-section in q1:2010. The lower panel depicts the one-to-one matched sample based on propensity scores obtained from the probit model shown in Table C.3.

Variable	Control group		Treatment group		Difference	p-value
	Mean	SD	Mean	SD	Difference	p-value
Unmatched sample						
Banks	**1224**		**356**			
Customer loans	598665	1232916	827812	2187957	-229147	0.011
Corporate loans	275236	639375	398423	1393132	-123187	0.019
Retail loans	291613	595908	365335	713747	-73723	0.050
Mortgage loans	240781	496849	300660	593602	-59879	0.056
Government loans	21902	73561	44223	145720	-22322	0.000
Foreign loans	5670	21436	11281	62180	-5612	0.008
logTA	12.947	1.313	13.307	1.336	-0.360	0.000
Equityratio	5.637	1.425	5.391	1.491	0.246	0.005
Interbank	-3.562	12.267	-4.940	11.125	1.378	0.057
Securities	24.031	11.130	28.728	11.434	-4.697	0.000
Market funding	1.999	2.939	2.494	3.595	-0.495	0.008
Credit lines	4.921	2.974	5.342	3.739	-0.421	0.027
Liquidity	2.175	0.755	2.124	0.707	0.051	0.252
One-to-one matched nearest neighbor sample						
Banks	**356**		**356**			
Customer loans	789737	1738747	827812	2187957	-38075	0.797
Corporate loans	370511	943154	398423	1393132	-27913	0.754
Retail loans	366325	719308	365335	713747	990	0.985
Mortgage loans	301124	602204	300660	593602	464	0.992
Government loans	36650	117048	44223	145720	-7573	0.445
Foreign loans	8339	32146	11281	62180	-2942	0.428
logTA	13.273	1.349	13.307	1.336	-0.033	0.739
Equityratio	5.352	1.227	5.391	1.491	-0.040	0.697
Interbank	-5.189	10.843	-4.940	11.125	-0.249	0.762
Securities	28.674	11.738	28.728	11.434	-0.054	0.950
Market funding	2.397	3.281	2.494	3.595	-0.096	0.709
Credit lines	5.070	2.701	5.342	3.739	-0.272	0.266
Liquidity	2.089	0.652	2.124	0.707	-0.035	0.496

Table C.5: Variable definition

This Table provides the variable definitions. BBK abbreviates Deutsche Bundesbank.

Variable name	Source	Unit	Description
Dependent variables: customer lending and components			
Customer lending	BBK	ln T€	The sum of all lending to non-financial firms
Commercial lending	BBK	ln T€	Loans to non-financial firms and sole proprietorships
Retail lending	BBK	ln T€	Loans to domestic households
Mortgage lending	BBK	ln T€	Real estate loans to domestic households
Government lending	BBK	ln T€	Loans to federal, state, and county government
Foreign lending	BBK	ln T€	Loans to non-domestic, non-financial counterparties
Alternative dependent variables			
Market shares	BBK	%	commercial and retail lending per bank relative to the county aggregate
Growth rates	BBK	%	Quarter on quarter growth rates of commercial and retail loans
Equity buffers	BBK	ln T€	Log-level of gross equity levels
Liquidity buffers	BBK	ln T€	Log-level of cash and short-term assets
Return on RWA	BBK	%	Operating profit relative to risk-weighted assets
NPL shares	BBK	%	Non-performing loans relative to total loans
Quarterly control variables lagged by one quarter			
log Total assets	BBK	log	Natural logarithm of monthly gross total assets (TA) in million Euros
Equity ratio	BBK	%	Total balance sheet equity to gross total assets
Net interbank lending	BBK	%	Interbank assets minus interbank liabilities relative to TA
Security share	BBK	%	Stocks and bonds relative to TA
Market funding	BBK	%	Issued bonds and money market instruments to total liabilities
Credit lines	BBK	%	Sum of irrevocable credit and other commitments to TA
Liquidity	BBK	%	Cash and net balances with central banks to TA