Central Banks and Financial Integration: Evidence from the Eurosystem Collateral Framework*

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Abstract

Can central banks effectively improve financial integration? To shed light on this question, we exploit that the Eurosystem started accepting loans to non-domestic euro area firms as collateral for its lending operations in January 2007, which enhances the liquidity of bank assets. Banks holding a large share of newly eligible loans significantly increase their total credit supply. However, affected banks only supply more cross-border credit when participating in loan syndicates and not when acting as lead arrangers. Since harmonized collateral policy does not mitigate credit frictions between banks and firms, it improves financial integration only indirectly through syndicate participation.

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Keywords: Collateral Framework, Bank Liquidity Shocks, Bank Lending Channel, Cross-Border Lending, Syndicated Loan Market, Financial Integration

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1 Introduction

Increasing financial market integration remains a major policy objective in the euro area (Draghi 2024). Due to the large degree of bank dependence in the euro area, one key objective of an European financial market union is to make firm funding conditions independent of the local banking sector's health.[1] While there is consensus about the desirability of deeper financial market integration, it remains an open question which instruments can contribute to its successful implementation (ECB Committee on Financial Integration 2024) and what role central banks can play in this context (Altavilla et al. 2024).

In this paper, we focus on central bank collateral policy as a potential candidate to foster financial market integration. In 2007, the Eurosystem harmonized its list of eligible collateral, making cross-border bank loans eligible for Eurosystem standing facilities. One stated goal of this policy was to "enhance the level playing field in the euro area, further promoting equal treatment for [...] issuers" of eligible loans (ECB Monthly Bulletin 2006). Whether such a policy successfully increases financial market integration depends crucially on banks' credit supply decision. By expanding the pool of eligible assets, this shock enhances the overall liquidity of bank assets, in particular of cross-border loans. We use loan-level data from the euro area syndicated loan market and exploit heterogeneity in banks' loan portfolios prior

[1]Both the 2008 financial crisis and the 2011 sovereign debt crisis revealed vulnerabilities of the euro area to asymmetric shocks, which can (partly) be attributed to the lack of financial integration (Lane 2012). The banking system's failure to absorb adverse shocks was at the heart of the 2008 and 2011 crises (Martin and Philippon 2017). The 2008 financial crisis manifested itself in Europe through dry-ups for periphery banks funding themselves through the interbank market. In contrast, bank holdings of risky domestic sovereign debt were an important driver of the 2011 debt crisis. It is reasonable to assume that an integrated banking system would have softened the impact of either crisis on the real economy. Theoretically, Martinez, Philippon, and Sihvonen (2022) show that a financial market union that makes private sector funding conditions independent from the local banking system's health improves cross-country risk-sharing, see also the discussion in Constâncio (2014). More recent examples of such vulnerabilities are the asymmetric effects of the Covid19 pandemic and global supply chain disruptions on euro area sovereign bond markets, which prompted the European Commission to release a new Capital Market Union action plan in 2021.

to the collateral framework shock to identify affected and unaffected banks.[2]

Employing a standard difference-in-difference setup, we document that banks with a high exposure to cross-border euro area loans increase their credit supply, compared to a control group of unaffected banks. Building on this reassuringly familiar lending effect of expansionary collateral policy, our key novel result concerns the international dimension. We uncover considerable heterogeneity in the cross-border effects of the collateral framework expansion. Accounting for the structure of syndicates, we find that only banks participating in loan syndicates increase their cross-border lending, i.e. they supply more credit to previously ineligible firms. This is not the case for lead arrangers, which increase their loan supply domestically, i.e. to firms that were already eligible prior to the single collateral list. This finding is in line with the presence of severe credit frictions in direct cross-border lending, which the collateral eligibility of loans cannot overcome. Banks respond by intensifying cross-border lending through syndicate participation, where such credit frictions are arguably less relevant.

In January 2007, the ECB introduced a *single collateral list* specifying which assets euro area banks can use as collateral in refinancing operations with the Eurosystem. After this collateral framework change, banks were able to pledge loans extended to borrowers in the whole euro area. Before 2007, each national central bank specified different collateral eligibility criteria, according to which banks could at most pledge domestic loans. To identify banks that are affected by the collateral framework shock, we use their issuance history of

[2]Our approach is related to, but distinct from the literature on the bank lending channel of monetary policy. This literature typically finds that bank liquidity conditions shape the credit supply response to a monetary policy shock, see Kashyap and Stein (2000), Gambacorta (2005) and Jiménez et al. (2014) among others. In contrast, the collateral framework shock allows us to study the transmission of shocks to bank liquidity conditions themselves.

newly eligible loans. Specifically, we construct a bank-level measure using the loan issuance to newly eligible firms, which mostly consist of *non-domestic euro area* firms, prior to the announcement of the single list in June 2005.[3] We then perform a median split along the *Affected*-measure to classify banks into affected and unaffected banks and compare changes in the lending of affected banks relative to the control group of unaffected banks.

We provide support for our identifying assumption that unaffected banks provide a counterfactual for the lending of affected banks in the absence of the collateral framework shock. A specific concern is the proximity to the financial crisis unfolding after the burst of the US subprime bubble in the third quarter of 2007, which is a possible confounding event of our identifying assumption. While its earlier announcement in 2005 suggests that the collateral framework shock is a crisis-unrelated policy change, we still identify affected banks through their cross-border activity on the euro area syndicated loan market. Affected banks might also be more active on the US market and would then change their credit supply in 2007 and 2008 for reasons unrelated to the collateral framework shock. To address this, we first test for differential pre-trends and, in addition, present two falsification tests. On the one hand, we show that internationally active banks, located in the EU but outside the euro area, do not expand credit supply relative to their unaffected peers, controlling for loan demand. On the other hand, we use an ineligible asset class, revolving credit lines, as placebo treatment indicator and find no credit supply effect by affected banks either.

To tackle endogeneity concerns that typically arise in empirical strategies like ours, we enrich our baseline difference-in-difference specification along several dimensions. The treat-

[3]In Italy, Belgium, Greece and Portugal, domestic bank loans were ineligible prior to the collateral framework shock as well. We take this into account when constructing the *Affected*-measure and show that the expansionary credit supply effects are not driven by banks in these four countries.

ment could lack random assignment, i.e. it might instead be based on a variable that affects treated and control groups differentially and correlates with the shock. For example, large banks could be more active internationally or less profitable banks could depend more on central bank facilities. Therefore, we include a large set of bank level controls. Another concern is that the pool of potential borrowers is not orthogonal to a banks' actual loan portfolio, such that affected and unaffected banks would face different lending opportunities after the collateral framework shock. To address this concern, we add firm × quarter fixed effects, which absorb any time-varying difference in firm-specific factors such as loan demand, along the lines of Khwaja and Mian (2008).[4] Once loan demand is controlled for, we find that affected banks increase their quarterly loan supply by 14% (corresponding to almost 70 million USD each quarter), which is in line with the credit supply effects of liquidity shocks to bank liabilities, originating on the interbank market (see Iyer et al. 2013 or Mitchener and Richardson 2019, among others).

While the literature has identified positive credit supply effects in response to expansionary central bank lending and collateral policies, the introduction of the single collateral list is well suited to test the international transmission of collateral policy, which has not been studied in the literature before. The large importance of syndicated loans for cross-border lending in the euro area prompts us to distinguish between affects banks' credit supply as lead arranger and as participant.[5] Maintaining the distinction between participants and lead arrangers, we re-estimate our baseline specification for three sub-samples, based on the borrower location: domestic, non-domestic euro area, and non-euro area. As expected, we

[4]We also show that the effect estimated size hardly changes when using country × industry × quarter fixed effects in spirit of Degryse et al. (2019) instead of firm × quarter fixed effects.

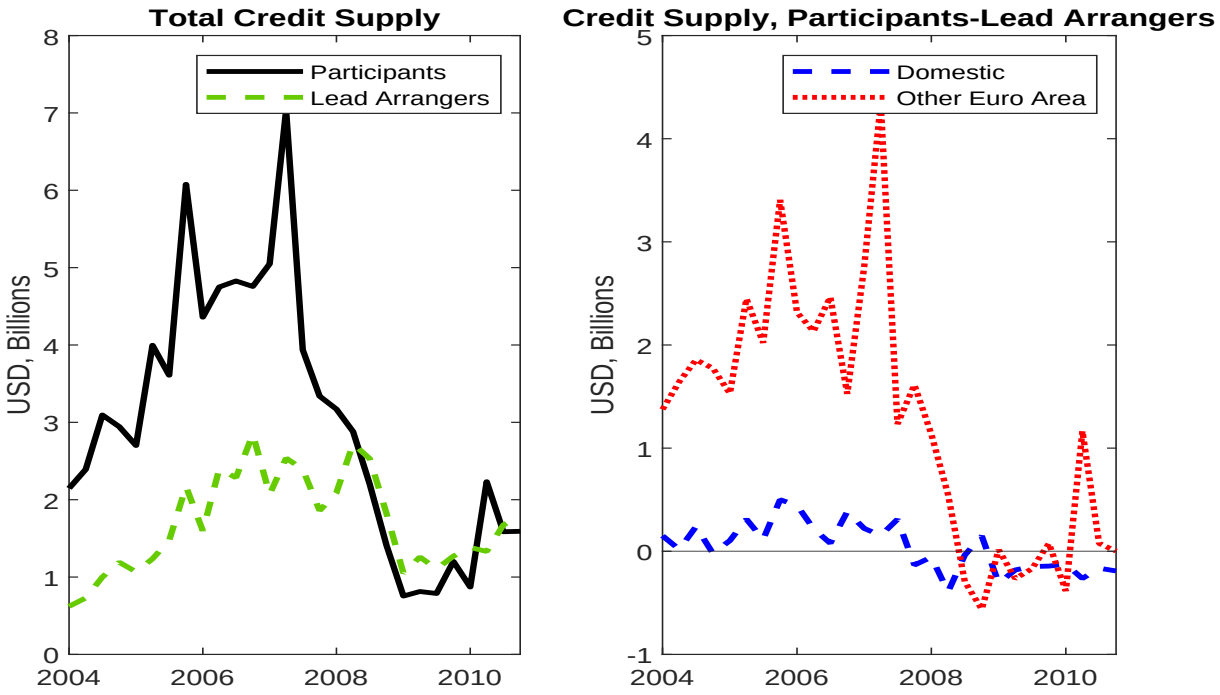
[5]Syndicated bank loans make up 75% of bank-to-firm cross-border lending in the euro area (Doerr and Schaz 2021).

find no evidence of additional credit supply to non-euro area firms, which remained ineligible under the single list. Regarding the euro area, we find stark differences between lead arrangers and participants. Affected banks increased credit supply to (newly eligible) firms in other euro area countries when acting as participants and do not significantly change their domestic credit supply. In contrast, when acting as lead arrangers, affected banks experience a significant but quantitatively small increase in cross-border lending and instead direct most of the additional credit supply to domestic borrowers. These differences are highly significant in a triple difference specification.

Our results suggest that the collateral eligibility of cross-border loans has merely stimulated cross-border lending indirectly through loan syndicate participation and not by strengthening borrower-lender relationships. To the best of our knowledge, the importance of distinguishing *direct* bank-to-firm relationships from syndicate participation is a novel finding in the literature on cross-border lending. Regarding barriers to international bank-to-firm lending, the literature has suggested information asymmetries (Van Nieuwerburgh and Veldkamp 2009), cultural differences (Giannetti and Yafeh 2012), and country-specific bank regulation and corporate bankruptcy laws (Davydenko and Franks 2008) as barriers to international loan market integration. Irrespective its source, barriers to international lending imply a low direct effect of collateral eligibility of loans to direct bank-to-firm lending. These frictions can reasonably assumed to be absent in the interaction between syndicate members, such that we would also expect a larger effect on indirect lending through loan syndicates.

The stark heterogeneity in international lending effects informs the ongoing discussion about the European banking and capital markets union. As documented in Hoffmann, Maslov, and Sørensen (2022), cross-border lending has been largely restricted to the inter-

Figure 1: Credit Supply Decomposition over Time



bank market, which turned out to be a fragile financing source during the European debt crisis. Our loan level analysis allows us to further sharpen this argument by distinguishing between direct bank-firm relationships (lead arrangers) and indirect cross-border lending via syndicates (participations). The left panel of Figure 1 suggests that total credit supply by participating banks collapsed by more than 80% during the financial crisis (solid black line), while lead arrangers provided much more stable funding to the real sector (dotted green line). This retrenchment was driven by cross-border lending, as shown by the right panel of Figure 1 which decomposes the credit supply differential between participants and lead arrangers - i.e. the difference between the black and green lines in the left panel - by borrower location. The dotted red line shows that the level of international credit supply by participants dropped below the level of lead arrangers, after peaking at almost five billion USD in 2007. In contrast, domestic credit supply by participants declined much less and never

exceeded half a billion USD prior to the crisis. In this sense, syndicate participation exhibits a strikingly similar pattern to interbank lending and is arguably a less stable funding source for the real sector. On a conceptual level, our paper shows that central bank instruments - such as collateral frameworks - are likely unable to overcome barriers to stable financial market integration through borrower-lender relationships but merely induce lending in the comparatively unstable form of syndicate participation.

Having discussed the (limited) cross-border effects of harmonized collateral policy, we use this shock to trace the effects of unconventional central bank instruments to bank risk-taking and the firm sector. This serves a dual purpose. First, understanding the real effects of bank liquidity shocks is important for macroeconomic stabilization policies (Bernanke and Gertler 1989), monetary policy (Bernanke and Gertler 1995), and bank regulation (Diamond and Rajan 2001). Second, it demonstrates that the real effects of our collateral framework shock are consistent with prior literature, which mitigates concerns that the limited cross-border effect is a merely consequence of a generally limited pass-through of this shock to the wider economy. At the bank level, we show that banks increase loan supply to riskier borrowers as measured by the loan-volume weighted distance-to-default (Merton 1974). An alternative interpretation of this finding is that banks extend loans to firms with tighter borrowing constraints (Farre-Mensa and Ljungqvist 2015). As a complementary approach, we subset borrowers into firms active in tradable and non-tradable sectors along the lines of Müller and Verner (2021) and only find positive credit supply effects for the non-tradable sector. This is consistent with the risk-taking channel of collateral policy first documented by Van Bekkum, Gabarro, and Irani (2018).[6]

[6]Related to this result, Jasova, Mendicino, and Supera (2021) document risk-taking effects of LOLR

At the firm level, we demonstrate that the collateral framework shock did not merely induce a reallocation of loan financing from unaffected to affected banks, i.e. the policy change had real effects. We show that firms with a large exposure to affected banks increase their employment and tangible assets. Our results are consistent with findings in Paravasini (2008), Chodorow-Reich (2014), Amiti and Weinstein (2018), or Jasova, Mendicino, and Supera (2021) and are in line with standard theories of credit supply and firm borrowing constraints: upon experiencing an increase in liquidity conditions, banks' additional credit supply is directed to riskier and more credit-constrained borrowers, who use the additional credit supply to increase their real activity. Different from essentially all other commonly used shocks to collateral frameworks in the empirical literature, the single list was introduced during a period of low financial stress. Thus, our paper establishes that the transmission channels of unconventional monetary policy through the banking sector are also at play during conventional times. This might bear important implications for future implementation of monetary policy in the euro area: in its recently concluded operational framework review, the ECB announced that it will continue to rely on "fixed-rate tenders with full allotment against broad collateral".[7]

Related Literature Our findings mainly contribute to two strands of literature. First, we add to a series of papers on the relationship between financial market integration and the real economy, which has been studied extensively using bank deregulation in the United States,

policies, Delis and Kouretas (2011) establish risk-taking effects of interest rate policy, Grosse-Rueschkamp, Steffen, and Streitz (2019) document elevated bank risk-taking after the Eurosystem's CSPP, Bruno and Shin (2015) stress the role of bank risk-taking for the international transmission of US monetary policy and Dinger and Kaat (2020) demonstrate that international capital flows increase bank credit supply and risk taking.

[7]The full statement is available under this link.

see Morgan, Rime, and Strahan (2004), Karakaya, Michalski, and Örs (2022) or Goetz and Gozzi (2022) among others. In an euro area context, Buch (2003) shows that the European Union's Banking Directive did not overcome national fragmentation in cross-border lending, which is consistent with our findings at the loan level. Burietz and Ureche-Rangau (2020) and Hoffmann, Maslov, and Sørensen (2022) use country level data to establish a generally low level of *direct* cross-border lending and show that there was sizeable indirect lending through the interbank market. Emter, Schmitz, and Tirpak (2018) document that cross-border lending fell sharply after the global financial crisis in 2008, in particular interbank loans. Bruche and Suarez (2010) propose a model of international lending via interbank markets that exhibits fragility with potentially large negative real implications. Therefore, it has been argued that the absence of a banking and capital markets union was an important driver of the European debt crisis (see for example Lane 2012 and the references therein). We contribute to this literature by showing that central bank collateral policy can affect cross-border lending via participation in loan syndicates, which is arguably less stable than a genuine borrower lender relationship but also less fragile than international bank-to-bank lending (Hoffmann, Maslov, and Sørensen 2022). [8]

Second, by employing a shock to the collateral framework, our paper extends the literature on the effects of central bank operational frameworks.[9] Van Bekkum, Gabarro, and Irani

[8]The positive cross-border effect in response to the collateral framework shock is consistent with studying the role of bank liquidity for cross-border lending. Peek and Rosengren (2000) and Schnabl (2012) study international spillovers of adverse shocks to bank assets. Cetorelli and Goldberg (2011) study the transmission of bank shocks from developed to emerging economies using country-level data. Giannetti and Laeven (2012) demonstrate that banks disproportionately decrease international credit supply when funding conditions in their home market deteriorate. Popov and Udell (2012) provide evidence for downsides of financial integration by exploring how adverse liquidity shocks to international banks decrease SME lending in Eastern Europe through local subsidiaries. Giannetti and Jang (2020) argue that foreign lenders are more likely to extend credit supply prior to banking crises. In contrast, Doerr and Schaz (2021) find that international lenders maintain a higher credit supply during banking crises in borrower countries.

[9]This literature is largely empirical. However, a small literature studies the role of collateral policy as

(2018) document that changes in collateral eligibility concerning residential mortgage backed securities affects bank lending and risk-taking behavior in the mortgage market. Delatte, Garg, and Imbs (2019) find that the Banque de France's Additional Credit Claims program has an positive impact on credit supply to French firms. Using a similar dataset, Harpedanne de Belleville (2023) documents positive effects on credit supply and employment. Mésonnier, O'Donnell, and Toutain (2021) document that such eligibility translates also into a relative reduction in rates for newly eligible bank loans. Cahn, Duquerroy, and Mullins (2022) use the ECB's very long term refinancing operations to study credit supply to single- and multi-bank firms. We show that credit supply effects of collateral policy identified in the literature are also robust to using a period of low financial stress, positive interest rates, and a small central bank balance sheet. Thereby, our results suggest that central bank collateral policy also matters in "conventional" times.[10] Pelizzon et al. (2024) also use properties of the ECB collateral framework in their empirical strategy. Using the collateral eligibility of corporate bonds, they find that eligibility reduces secondary market bond yields and increases bond issuance at the firm level.

The remainder of our paper is organized as follows. Section 2 describes the institutional setting and the collateral framework shock. We introduce our dataset in Section 3. Section 4 presents our empirical strategy and results. Section 5 concludes.

central bank instrument through a theoretical lens, see for example Chapman, Chiu, and Molico (2010), Ashcraft, Garleanu, and Pedersen (2011), Koulischer and Struyven (2014), and Cassola and Koulischer (2019).

[10]Our focus on a non-crisis episode also allows us to cleanly attribute the credit supply and real effects of collateral policy to the demand for eligible assets, rather than to a temporary deviation of credit conditions from borrower fundamentals, see Gilchrist and Zakrajšek (2012).

2 Institutional Setting

On 22 July 2005, the ECB announced the introduction of a *single collateral list*, applicable to the whole euro area, specifying which assets banks can pledge as collateral to obtain central bank funding through main refinancing operations or the marginal lending facility.[11] The single list came into effect on 1 January 2007. Previously, the collateral eligibility of bank assets was determined following a two-tier system. Tier-one assets consisted of marketable debt instruments, mostly government bonds, fulfilling euro area-wide eligibility criteria. The eligibility of tier-two assets was specified by national central banks, allowing them to incorporate idiosyncrasies of the respective domestic banking sector in the collateral framework.[12]

Under the single list regime, the ECB directly specifies eligible assets for all euro area banks. Furthermore, the single list regime established the eligibility of (syndicated) bank loans extended to all borrowers located in the euro area.[13] This modification drastically increased the fungibility of loans as collateral: prior to the single list, only the national central banks of Germany, Austria, Spain, France, Ireland and the Netherlands accepted bank loans to domestic companies as collateral, while cross-border loans were not accepted by any national central bank. Notably, the expansion of the set of eligible assets was not achieved by a relaxation of minimum rating requirements, which is in contrast with the

[11] The official announcement on 22 July 2005 contained details on the inclusion of bank loans, see ECB (2005).

[12] For a detailed review of the Eurosystem Collateral Framework, we refer to Nyborg (2017) and Bindseil et al. (2017). Tabakis and Tamura (2013) discuss the collateral eligibility of credit claims, such as syndicated loans, in the Eurosystem.

[13] In the syndicated loan market, different banks form a syndicate to jointly lend to a single borrower. The syndicate includes one lead bank and a number of participating banks. Lead arrangers are those members of a syndicate typically negotiate credit conditions, conduct due diligence, and monitor firms (Dennis and Mullineaux 2000 and Ivashina and Scharfstein 2010). Participants are usually not in direct contact with the borrower, but merely supply credit via the lead arranger.

ECB's expansionary policy measures undertaken later.[14] The ECB Monthly Bulletin (2006) explicitly states the following objectives of switching to a single list regime:

> *The aims of the single list are to* ***enhance the level playing field in the euro area, further promoting equal treatment for counterparties and issuers****, and to increase the overall transparency of the collateral framework. Moreover, the single list takes into account the fact that, with increasing collateralization in private wholesale markets and relatively high consumption of collateral by the Eurosystem, there are now* ***competing demands on the collateral holdings*** *of banks. More generally, by increasing the liquidity of an entire asset class, such as bank loans, the single list of collateral fosters the* ***smooth functioning of the euro area financial system.***
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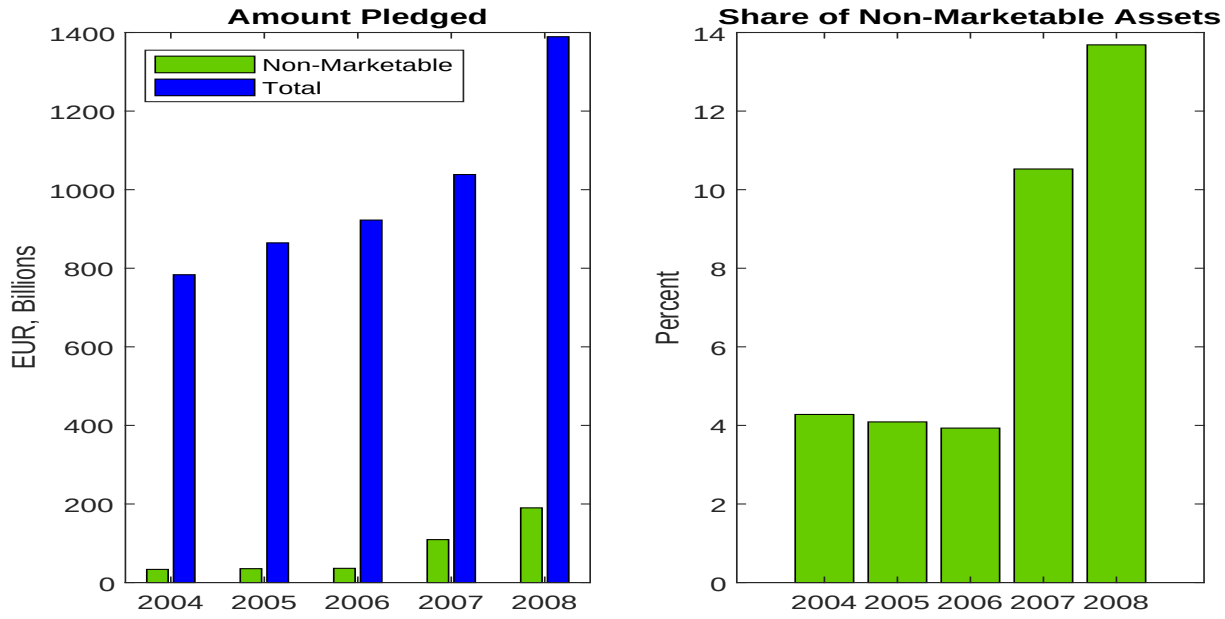
> ECB Monthly Bulletin 2006, page 76.

The ECB Monthly Bulletin (2006) suggests that both the lack of financial market integration and the shortage of high-quality collateral were identified as major issues already prior to the financial crisis unfolding in 2008. Therefore, the single collateral list aimed to increase financial integration within the euro area through direct cross-border lending. Second, reducing collateral scarcity was deemed necessary to ensure an effective pass-through of interest rate policy via the bank lending channel and to facilitate trade among financial institutions.

As a first step, to achieve either objective, collateral policy needs to change banks' pledging behavior which, in turn, might also affect their loan supply. Sauerzopf (2007) provides suggestive evidence along these lines based on collateral pledged by Austrian banks. This

[14]Nyborg (2017) documents the effects of reducing the minimum rating requirement from A to BBB during the financial crisis 2008 and of the temporary suspension of minimum rating requirements during the euro area debt crisis. Furthermore, the ECB suspended minimum rating requirements in April 2020.

Figure 2: Non-Marketable Assets Pledged as Collateral



Notes: *Source*: ECB collateral data. Prior to 2007, collateral data are unavailable at higher frequencies.

is consistent with aggregate usage of non-marketable assets as collateral in ECB refinancing operations over time (Figure 2). Before 2007, both the absolute amount of non-marketable assets and their share of total collateral use was stagnant at around 35 bn EUR, or 4% of total collateral. By the end of 2007, the usage of non-marketable assets more than doubled to 109 bn EUR, and its share of total collateral increased to almost 11%.

While Figure 2 does not provide a bank-specific analysis of pledging behavior, an aggregate increase is indicative of banks' willingness to use non-marketable assets in Eurosystem operations. This has implications for bank behavior on the loan market: *First*, even if banks do not intend to pledge a specific loan, they might still prefer to hold eligible loans for precautionary reasons, for example to self-insure against adverse liquidity shocks. In technical terms, banks submit eligible assets into so called collateral portfolios or collateral accounts, such that these assets can be mobilized quickly if they are needed as collateral.

Put differently, the eligibility into collateral portfolios matters for the pricing of an asset. Consistent with this idea, Barthélemy, Bignon, and Nguyen (2018) show that, even though banks pledged more assets into collateral accounts than required *on aggregate*, around 10% of euro area banks hit their collateral constraints between 2011 and 2016. *Second*, the eligibility of non-marketable assets can have a positive spillover effect on bank holdings of high-quality liquid assets, such as government bonds. As argued in Pelizzon et al. (2024), there is effectively no private wholesale funding market for corporate sector assets in the euro area. If loans can be pledged at the Eurosystem, high-quality liquid assets can be used more effectively on the wholesale funding (repo) market instead.[15] In both cases, the collateral framework shock should have positive effects on banks' net worth. In the next section, we test whether banks that were strongly affected by the shock in fact take advantage of this positive effect by increasing their credit supply.

3 Data

Our analysis is based on syndicated loan market data from DealScan, where we observe the borrowing firm and all participating banks at the loan level. We complement loan level information with bank data from CapitalIQ and firm data from Compustat.

Loan Data As a first step, we restrict the sample to non-financial firms and to commercial, savings, cooperative and investment banks. We decompose syndicated loan deals into loan

[15]Positive spillover effects from "freeing up" high-quality liquid assets are explicitly mentioned in ECB (2006), page 9. Choi, Santos, and Yorulmazer (2021) provide a theoretical analysis of this mechanism. Related "crowding-in" effects have been documented by Arce, Mayordomo, and Gimeno (2020). They show that the ECB's corporate sector purchase programme enabled firms to switch from loan towards bond financing. This switch allowed banks to reallocate funds towards formerly constrained firms without bond market access, who were therefore not directly affected by the CSPP.

portions provided by each lender to obtain loan level data. Whenever DealScan provides information on lending shares of each bank, we use this information to split loan volume accordingly. In other cases, we follow Schwert (2018) to estimate lending shares via a Tobit estimation using information on the facility amount, the number of participants, borrower and lender sales. In addition to each bank's share in the syndicate, we observe the purpose of each loan, Finally, DealScan indicates whether a loan was used to refinance an existing loan, and whether or not it is secured. Transactions with deal status 'canceled', 'suspended', or 'rumor' are removed and all loan nominations transformed into million USD using the spot exchange rate at origination, provided by DealScan. If after this allocation procedure the loan portion is smaller than 10,000 USD, we drop the observation to remove erroneously small loans. We then aggregate all loan issuances between a bank-firm combination to obtain bank i's loan issuance to firm j in quarter t, which we define as a bank-firm-quarter observation.

Total loan volume in a given quarter is the sum of all new loans issued by bank i to firm j. In doing so, we only account for syndicated loan issuances, disregarding the redemption profile. Table 1 presents summary statistics on the bank-firm-quarter level over the sample period Q1 2006 to Q4 2007. The average loan issuance from bank i to firm j in quarter t amounts to 451.13 million, the average spread over LIBOR to 204 basis points, and the average maturity of the loans to around 7 years. All loans in our sample have at least one designated lead arranger. We also observe whether a loan is secured. The share of loans issued to other euro area and domestic firms amounts to 54%, respectively, of which around a third is issued to domestic firms, while 46% of all loans are extended to non-euro area firms. Domestic firms are defined as firms which have their headquarters in the same country as the corresponding bank.

Bank Characteristics To control for bank characteristics, we match the banks included in the DealScan dataset with bank balance sheet data from CapitalIQ. Panel A of Table 2 presents summary statistics for all euro-area banks in the period prior to the framework shock (Q1 2006 - Q4 2006) included in our sample. On average, banks hold 59% loans and 26% securities over total assets. On the funding side, deposits make up 41% and equity 5.0% of total assets on average. The Return on Equity amounts to 15.3% on average across the sample period. Panel B of Table 2 presents evidence on the difference in bank characteristics between affected and unaffected banks using univariate t-tests. Affected banks are banks which have an above median share of euro area loan issuances in their syndicated loan issuances in the period prior to the announcement (Q1 2003 - Q2 2005). Affected banks are similar in terms of size, cash and deposit ratios, and leverage, but have a slightly higher return-on-equity (13.7% vs 17.3%), significant at the 10% level.

Firm Variables We obtain annual firm accounting data for European firms from Compustat. We aggregate the quarterly loan data from DealScan to the firm-year level and match borrowers in DealScan with firms in Compustat. The matching is based on Chava and Roberts (2008), updated in April 2018. Combining those two databases reduces observations, since not all firms have balance sheet data available con Compustat, especially not smaller ones. Eventually, we obtain a sample of 1795 firms. Variables are winsorized at the 1st and 99th percentile. As customary, financials (SIC codes 6000-6999) are dropped. Panel A of Table 3 shows summary statistics for the full sample while Panel B establishes that more and less exposed firms did not differ significantly along the dimensions we use as a control or outcome variable in 2006, the last year prior to the single list's implementation.

4 Empirical Strategy and Results

We use a standard difference-in-differences set-up to compare the lending of banks affected by the collateral framework shock to the lending of unaffected banks. We first describe how we identify banks that are most affected by the shock. Our baseline result in Section 4.2 establishes that banks with a large share of newly eligible loans on their balance sheet increase their credit supply relative to banks with a smaller share of such assets. After providing a number of robustness and falsification tests in Section 4.3, we examine cross-border lending effects in Section 4.4. Lastly, we show that the positive shock to the liquidity of bank assets affects risk-taking at the bank level and real outcomes at the firm level in Section 4.5 and Section 4.6, respectively.

4.1 Identifying Affected Banks

Banks are classified into *affected* and *unaffected* based on their loan issuance histories to newly eligible borrowers prior to the single list's announcement.[16] Assuming that the collateral framework shock has larger effects on banks which were already actively issuing loans that became eligible under the single list, we identify affected banks according to their issuance history from 2003 Q1 until 2005 Q2, the last quarter prior to the announcement. To accurately measure bank-level exposure at the group level, the subsidiary structure of each group i has to be taken into account, since subsidiaries directly interact with the NCB in the country where they are chartered. We denote the set of all subsidiaries of bank groups i by $\mathcal{K}^i$. The set of all subsidiaries is restricted to euro area subsidiary banks.

[16] For banks headquartered in Austria, France, Germany, Ireland, the Netherlands and Spain, all loans to firms in other euro area countries are *newly eligible*. For banks in Belgium, Greece, Italy and Portugal, all loans are *newly eligible*.

From a financial market integration perspective, we are interested in loans where the ultimate owner, i.e. the parent bank, is located in a different country than the borrowing firm. Therefore, we construct an *Affected*-measure at the group level. Specifically, we cumulate subsidiary k's issuance of newly eligible loans over the period prior to the single list's announcement. Let c_j denote the home country of firm j and let $\mathcal{C}_k^{new}$ the set of countries where loans became newly eligible under the single list regime. For a subsidiary located in Germany, the set of newly eligible countries is given by $\mathcal{C}_k^{new} = \mathcal{C}^{ea} \backslash \{DE\}$, since loans to German firms were already eligible under the NCB-regime in Germany. In contrast, for a subsidiary located in Italy, we simply have $\mathcal{C}_k^{new} = \mathcal{C}^{ea}$. The subsidiary-level *Affected*-measure is then given by

$$\text{Affected}_k \equiv \frac{\sum_{t\in\mathcal{T}} \sum_{j\in\mathcal{J}^{ea}} \mathbf{1}\{c_j \in \mathcal{C}_k^{new}\} \cdot L_{kjt}}{\sum_{t\in\mathcal{T}} \sum_{j\in\mathcal{J}^{ea}} L_{kjt}} \,, \tag{1}$$

where L_{kjt} are loan issuances by subsidiary bank k to firm j at time t. The results are robust to using total assets at the bank level, see Appendix B.6. The set of pre-announcement dates is denoted by $\mathcal{T}$ = [Q1 2003, Q2 2005], while $\mathcal{J}^{EA}$ is the set of all euro area firms in our sample. We then aggregate the subsidiary-level *Affected*-measure to the group level, weighted by the subsidiary shares in the group-level loan portfolio:

$$\text{Affected}_i \equiv \frac{\sum_{t\in\mathcal{T}} \sum_{j\in\mathcal{J}^{ea}} L_{kjt}}{\sum_{k\in\mathcal{K}^i} \sum_{t\in\mathcal{T}} \sum_{j\in\mathcal{J}^{ea}} L_{kjt}} \cdot \text{Affected}_k \,. \tag{2}$$

We perform a sample split of banks along the *Affected*-measure (2) and interpret all banks with an above-median share of newly eligible euro area loans in their portfolio as affected.[17]

[17]This identification strategy is common in the literature, see for example Huber (2018), Van Bekkum,

While most of our results use the group level *Affected*-measure, we show in Appendix B.4 that our results also hold when estimating the credit supply effect at the subsidiary level, using the subsidiary level *Affected*-measure. The *Affected*-measures at group and subsidiary level have a correlation of around 90%: internationally active parent banks tend to have internationally active subsidiaries as well. Interestingly, estimating subsidiary-level loan supply using the group level *Affected*-measure yields a larger credit supply effect. This points, first, towards frictions in euro area capital markets and, second, to the existence of bank group-internal capital markets (De Haas and Van Lelyveld 2010) and also provides further justification to using the group level *Affected*-measure in our main analysis.

In total, our sample contains 35 banking groups, all of which are large in the sense that they are at least active at a national level, see the full list in Table A.3. In the following, we focus on syndicated lending to (large) non-financial firms and do not consider crowding-out effects on small local banks that presumably did not benefit from the single list.

4.2 Baseline Specification

We test the effect of the single list's inclusion on credit supply at the bank-firm-quarter level by estimating:

$$ln(L_{ijt}) = \beta_1 \text{Affected}_i(0/1) \times \text{Post07}_t + \beta \text{X}_{i,t-4} + \mu_{ij} + \nu_{jt} + c_{jt} + \epsilon_{ijt} \ , \tag{3}$$

Here, $Post07_t$ indicates the single list regime. $X_{i,t-4}$ is a vector of loan and bank level controls, which are lagged by 4 quarters. μ_{ij} denotes bank $\times$ firm, ν_{jt} denotes firm $\times$

Gabarro, and Irani (2018) or Grosse-Rueschkamp, Steffen, and Streitz (2019).

quarter, and c_{jt} denotes country $\times$ quarter fixed effects. We focus on lead arrangers in the baseline specification. We operationalize this exclusion restriction as follows: if bank i has been a lead arranger in at least one loan extended to firm j, all interactions between this bank-firm pair are included in our sample. We apply some conservatism in truncating the $Post07_t$ in 2007 Q4 in order to exclude the onset of the Great Financial Crisis and additional collateral framework changes as confounders. However, the lending effects are persistently positive until 2009 Q4, as we show in Figure 3.

The coefficient β_1 measures how affected banks respond to the collateral framework shock relative to unaffected banks. We expect $\beta_1 > 0$, as a larger share of eligible loans should stimulate credit supply after the framework shock. Standard errors are clustered at the bank level, the level at which the treatment occurs, to adjust for serial correlation within treated units. Our identifying assumption is that banks less active in cross-border euro area loan syndication provide a valid counterfactual for bank behavior in the absence of a framework shock.

For a causal interpretation of the estimated effect and the coefficient size, several concerns need to be dismissed. *First*, the heterogeneous lending behavior of affected and unaffected banks could be caused by other factors than collateral eligibility of their loan portfolio, for example bank size or funding conditions. To address this concern, we include bank level controls for size, leverage, profitability (return on equity), cash ratio, and deposit ratio. In Panel B of Table 2, we show that banks do not significantly differ along any of these dimensions. *Second*, the treatment could lack random assignment if it were based on a variable that has a differential impact on affected and unaffected banks and correlates with the collateral framework shock, such as a large exposure to international credit markets. We

address this by designing two placebo tests, described below. Furthermore, in Appendix B.7, we also demonstrate that our results are robust to excluding German banks, which are traditionally very active on international credit markets.

Third, the pool of potential borrowers might differ for affected and unaffected banks, and hence banks would face different lending opportunities after the shock. To address this concern, we include bank-firm fixed effects and firm-quarter fixed effects. The former captures lending from the same bank to the same firm. The latter allows identification of loan supply, as we compare the lending of affected and unaffected banks to the same borrower, absorbing loan demand, similar to Khwaja and Mian (2008). In an alternative specification, we replace firm × quarter fixed effects by country × industry × quarter fixed effects, following Degryse et al. (2019).

Table 4 presents the baseline result from estimating equation (3). Each column includes increasingly stringent levels of fixed effects. In column (1), we only use bank × firm fixed effects to compare lending of affected and unaffected banks to the same firm j before and after the collateral framework change in January 2007. Both the coefficient of interest (0.165) and the $Post07_t$ indicator (0.143) are positive but insignificant. In column (2), we control for time-varying country differences by including bank-country × quarter and firm-country × quarter fixed effects. In addition, we add firm × quarter fixed effects to control for loan demand (Khwaja and Mian 2008). We find a positive treatment effect (0.115), which is significant at the 1% level.

Column (3) shows a specification with loan and bank level controls that refine the comparison between treatment and control group. We include the log of assets, return on equity, as well as leverage, cash, securities and deposits ratios over total assets, all lagged by four

quarters. These control variables are standard in the empirical literature on the bank-lending channel (Kashyap and Stein 2000). Banks with a higher securities ratio supply fewer loans on average, which is however not robustly significant across specifications. Other bank level controls are insignificant across specifications. Additional loan supply is significantly larger for secured loans, other loan level controls are at most weakly significant. Including controls even increases the coefficient of interest: affected banks increase their lending by 14.8%, relative to unaffected banks. To put this effect into perspective, we multiply the coefficient by the (full sample) average loan volume from bank i to firm j at time t (see Table 1). Affected banks increase their loan supply by $0.148 \cdot 451 = 67$ mn USD each quarter.

To ensure that our results are not driven by heterogeneity in the treatment of bank loans under the NCB-regime, we define the indicator $DomAff_i(0/1)$ that equals one for banks located in countries where the respective NCB did not accept domestic bank loans before the policy change (BE, GR, IT, PT) and zero for banks in all other euro area countries (AT, DE, ES, FR, IR, NL). Column (4) shows that interacting $DomAff_i(0/1)$ with the treatment indicator yields no significant effect. The estimated coefficient on the *Affected*-measure is slightly smaller than the baseline effect in column (3) but still highly significant.[18] In column (5), we replace firm $\times$ quarter fixed effects by country $\times$ industry $\times$ quarter fixed effects (Degryse et al. 2019), which barely changes the results. In all specifications, the magnitude of the estimated credit supply effect is similar to Van Bekkum, Gabarro, and Irani (2018).

The parallel trend assumption requires that in absence of treatment, the difference between affected and unaffected banks is constant over time. If this was not the case, time-

[18] As Table A.2 shows, banks headquartered in Belgium, Greece, Italy, and Portugal only make up 11% of all loans in our sample.

varying differences across treatment and control would occur and put lending behaviour of affected and unaffected banks on different trends, which could not be differenced out. Figure 3 plots coefficient estimates of the baseline specification for loan supply over a 12-quarter event window, spanning all quarters between announcement and implementation in January 2007. There are no significantly different pre-trends between affected and unaffected banks: Statistically insignificant coefficient estimates hover around zero before the collateral framework change. After the collateral framework shock, the lending activity of affected banks becomes positive and significant relative to the control group of unaffected banks. As long as confounding factors affect both types of banks in the same way, for example an accommodative monetary policy stance in the early 2000s, they are canceled out by the difference-in-differences approach.

4.3 Falsification Tests

Our classification of affected banks is based on their cross-border lending history prior to the collateral framework shock. These banks might also be more active on the international loan market in general and the US market in particular. In the context of the financial crisis unfolding in 2008, affected banks might exhibit a stronger credit supply reaction that is unrelated to the collateral framework shock.[19] While we generally use a relatively short window around the January 2007 event, from January 2006 to December 2007 in our baseline, we additionally conduct two *falsification tests* exploiting that the Eurosystem single list is relevant (i) only for banks headquartered in the euro area and (ii) only applies to fixed-term

[19]Puri, Rocholl, and Steffen (2011) show that European banks exposed to U.S. sub-prime market exhibit a more pronounced decrease of credit supply. In contrast to this narrative, we expect the collateral framework shock to stimulate loan issuance of affected banks. Therefore, the financial crisis would at most bias the results downwards.

loans. For the first test, we build a placebo group of affected banks residing outside the euro area, but inside the EU. Similar to equation (1), we compute the share of euro area loans over total loans for every subsidiary of a non-euro area headquartered bank group and aggregate the subsidiary-level *Affected*-measure using the subsidiary share in the group loan portfolio. As before, we use a median split along the *Affected*-measure to test whether the collateral framework shock has a differential impact on foreign lenders that would be heavily affected by the single list's introduction, relative to their unaffected peers.

For the second falsification test, we make use of the fact that only term loans are pledgeable as collateral under the single list. Reconstructing the *Affected*-measure at subsidiary and bank group level using the issuance history of revolving credit lines thus provides us with another placebo *Affected*-measure that we use to re-estimate equation (3).[20] Table 5 shows that, for both falsification tests, the coefficients on the $Affected_i(0/1) \times Post07_t$ interaction term are insignificant or even negative across all specifications. This suggests that the credit supply effects in our baseline specification indeed reflect the collateral framework shock and are not driven by other factors that affect treatment and control group in heterogeneous ways.

To alleviate concerns that banks simply reduce the frequency of new loan issuances but increase loan size, we also show in Appendix B.1 that credit supply increased significantly at the extensive and total margin. Furthermore, in Appendix B.3, we show that there were no significant announcement effects and that affected banks also lowered the interest rate spreads after the collateral framework expansion (Appendix B.2).

[20] Using an ineligible asset class to conduct a falsification test is in line with Van Bekkum, Gabarro, and Irani (2018).

4.4 International Lending Effects

Building on our baseline specification, we then take a closer look at the borrower headquarter location vis-a-vis bank headquarter location and explicitly distinguish between lead arrangers and participating banks. Due to the heterogeneous treatment of domestic bank loans under the NCB regime, we subset loans into *newly eligible*, which are mostly other euro area loans. Specifically, this sub-sample encompasses loans to other euro area firms for banks headquartered in Austria, Germany, Spain, France, Ireland, and the Netherlands, which makes up the lion's share of our sample and all loans in countries that did not accept loans under the NCB regime (Belgium, Greece, Italy, Portugal). Consequently, *previously eligible* loans are all domestic loans by banks headquartered in countries accepting bank loans already under the NCB regime. To ensure that this classification does not introduce an upward bias into the newly eligible/other euro area sub-sample, we include the $DomAff_i(0/1)$ dummy equal to one for banks headquartered in Belgium, Greece, Italy and Portugal.[21] As in the baseline specification, we expect a positive coefficient β_1 when estimating equation (3) for the sub-samples of domestic and other euro area borrowers. In contrast, firms located outside the euro area should not be affected by the single list and we expect an insignificant coefficient β_1. As an additional placebo test, we perform the same sample split on always ineligible credit lines.

For lead arrangers, a positive coefficient on the $Affected_i(0/1) \times Post07_t$ interaction term in the international sub-sample would indicate a strong direct cross-border lending effect. For participants, a positive coefficient suggests that international lending effects are not

[21] Alternatively, one could use a hard split of the sample based on location, which could introduce an upward bias into the previously eligible/domestic sub-sample. Using the $DomAff_i(0/1)$ in the domestic sub-sample yields almost the same results.

associated with direct bank-to-firm relationships and rather resemble cross-border bank-to-bank lending. To controll for loan demand in the three sub-samples, we use country × industry × time fixed effects (Degryse et al. 2019).

Panel A of Table 6 shows that the effect on direct cross-border lending is positive and significant, but relatively small (0.019) compared to the full sample. Instead, the single list's effect is an order of magnitude larger for lending to firms headquartered in the affected banks' home country (0.296). For participating banks, the opposite picture emerges. Credit supply to domestic firms is not significantly affected, while loan issuance to firms in other euro area countries increases by around 8%. The coefficients are significantly different from each other, as we show in a triple difference specification using the borrower location as additional dummy (Table B.6). Regarding the placebo test, Panel B of Table 6 shows that there is no credit supply effect for (always ineligible) credit lines for lead arrangers or participants. This suggests that the collateral framework shock was driving the international lending effects and that we are not picking up a general retrenchment of cross-border lending by internationally active banks at the onset of the Great Financial Crisis.

The absence of large international lending effects for lead arrangers is consistent with the idea that collateral eligibility does not alleviate frictions in bank-to-firm relationships, such as asymmetric information or country-specific bankruptcy laws. Thus, affected lead arrangers predominately increase their credit supply domestically, where such frictions are less relevant or even absent compared to lending internationally. At the same time, the positive shock to the international liquidity of bank assets induces affected to increase international lending as participants, as the shock still makes it more attractive to extend such loans. However, the additional cross-border lending is not associated with new borrower-lender relationships

but only indirectly through syndicate participation.

4.5 Bank Risk-Taking

Having discussed international lending effects, we now take a closer look at borrower fundamentals and bank risk-taking in response to the collateral framework shock. We provide two complementary approaches to show that in particular high-risk and credit constrained borrowers are subject to funding inflows. First, we estimate equation (3) on two sub-samples split according to firms being classified as tradable or non-tradable. Firms firms active in the non-tradable sector are typically associated with higher credit risk and tighter borrowing constraints (Müller and Verner 2021). We classify firms based on primary SIC codes reported in DealScan (Giannetti and Jang 2020).[22] The coefficient on $Affected_{0i}(0/1) \times \text{Post07}_t$ is positive and significant for non-tradables but insignificant for tradables, see Panel A of Table 7. This result is consistent with Berg et al. (2022), who show that the positive liquidity shock to the banking system induced by the ECB's corporate bond purchase programme had positive credit supply effects almost exclusively in the real estate sector.

We also take a complimentary approach *at the bank level* and use the distance-to-default (Merton 1974) of banks' loan portfolios after the shock as dependent variable. The advantage of this measure is that it can be easily computed from Compustat balance sheet and stock price data. For details on the distance-to-default, its theoretical foundations and practical implementation, we refer to Gilchrist and Zakrajšek (2012), Bharath and Shumway (2008) and the references therein. Specifically, we estimate effect of the single list regime on the

[22] The tradable sector mainly consists of manufacturing firms (SIC code 2000-3999), while the non-tradable sector includes construction (SIC code 1500-1799), wholesale and retail services (SIC code 5000-5999) and accommodation (SIC code 7000-7099).

distance-to-default of bank i's loan portfolio at quarter t:

$$D2D_{it} = \gamma_1 \text{Affected}_i(0/1) \times \text{Post07}_t + \gamma \text{X}_{i,t-4} + c_{jt} + \epsilon_{ijt} \ . \tag{4}$$

Since our analysis is carried out at the bank level, we define country-quarter fixed effects based on the bank headquarter in (4). The results are shown in Panel B of Table 7. The coefficient γ_1 is significantly negative, i.e. the distance-to-default declines after the shock for affected banks and the riskiness of the loan portfolio increases. This result is consistent with risk-taking effects reported in Van Bekkum, Gabarro, and Irani (2018), who show that banks were investing into riskier residential mortgages following a relaxation in eligibility requirements for residential mortgage backed securities.[23]

4.6 Firm Level Results

We study the real effects of the collateral framework shock at the firm level using annual data. To identify firms affected by the collateral framework expansion, we construct a firm level *exposure* measure based on the share of loans obtained from affected banks between January 2005 and December 2006. Formally, the exposure measure is given by

$$\text{Exposed}_j = \frac{\sum_{i \in \mathcal{I}} \sum_{t \in \mathcal{T}} \mathbf{1}\{i \in \mathcal{I}^{Affected}\} L_{ijt}}{\sum_{i \in \mathcal{I}} \sum_{t \in \mathcal{T}} L_{ijt}} \ , \tag{5}$$

where $\mathcal{I}^{Affected}$ is the set of affected banks according to the *Affected*-measure (2) and $\mathcal{T}$ = [Q1 2005, Q4 2006] is the pre-implementation sub-sample. We then perform a sample split

[23] Interpreting the distance-to-default as a measure of borrowing constraints (Farre-Mensa and Ljungqvist 2015), the result can also be read as follows: the transmission of positive shocks to bank liquidity conditions is particularly pronounced for borrowing constrained firms.

of all firms along the *Exposed*-measure (5) and define all firms with an above-median as exposed.

To test whether the collateral framework shock translates into real outcomes at the firm level, we set up the following regression equation at the firm-year level:

$$y_{jt} = \delta_1 \text{Exposed}_j \times \text{Post}_{07,t} + \delta \text{X}_{j,t-1} + \mu_j + \chi_{jt} + \epsilon_{jt} \tag{6}$$

where y_{jt} are real sector outcomes at the firm-level, such as *ln(PPE)*, *ln(Employment)* and *ln(Sales)*. The relative change in property, plants, and equipment (PPE) is a standard proxy for tangible investment. Since tangible investment is typically financed using long-term debt, we expect the most pronounced effect at this margin. $X_{j,t-1}$ is a vector of firm level controls, which consists of ln(total assets), leverage (total debt over total assets), and return on assets (ROA), all lagged by one year. μ_j are firm and χ_{jt} industry $\times$ year fixed effects. Robust standard errors are clustered at the industry level.[24] A positive coefficient δ_1 indicates positive real effects: firms that are highly exposed to the collateral framework shock use the proceeds of higher loan take-up to increase their investment and employment and sales.

In Table 8, we show how the shock to liquidity of bank assets transmits into a positive real effects. Interacting the firm level exposure dummy with the Post07$_t$-indicator variable reveals a positive and significant effect on tangible assets (around 10 percent) and employment (around 4 percent), once firm and industry $\times$ year fixed effects are included. While both effects are robust to including firm controls such as size, leverage, and return on assets, the

[24]We have enough clusters (90 industries) to reliably obtain a cluster-robust variance estimator

liquidity shock had more, pronounced effects on investment. In unreported results, we do not find significant effects on firm's debt maturity profile or their liquid asset holdings. Notably, the increase in real activity is measured in 2007 and 2008, which already contains the first quarters of the financial crisis. This suggests that the real effects of the collateral framework shock were not short-lived or restricted to periods of overall benign credit conditions.

5 Conclusion

Before the global financial crisis, cross-border lending in the euro area was largely restricted to the interbank market, while firms continued to rely on domestic banks. The lack of a banking union has played an important role in amplifying the 2008 Financial Crisis and the 2011 European debt crisis, such that improving financial market integration remains a major policy objective in the euro area. It is however unclear which instruments effectively contribute to financial market integration. This paper focuses on one potential instrument to increase direct cross-border lending. In 2007, the ECB introduced an unified list of collateral, whereby the ECB started accepting all loans granted to firms in the euro area as collateral. This single list of collateral was intended to create "a level playing field" for all issuers of eligible collateral across the euro area. In bank-dependent economies like the euro area, this corresponds to making firm access to credit independent of their local banking sector's health.

Our key novel result suggests that, although the harmonisation of the collateral list has a positive effect on bank lending, it does not have a generally positive effect on cross-border lending. We document positive international lending effects for participation in loan syndi-

cates, while we do not find cross-border lending effects for direct lending from lead arrangers to firms. The lack of an effect on direct cross border lending is consistent with theories on real barriers to cross-border lending, such as country-specific insolvency laws or information frictions due to the lack of geographical proximity. These frictions can reasonably be assumed to be absent between syndicate participants and lead arrangers, which can explain the positive effect of international syndicate participation. Notably, collateral policy does not directly reduce contracting frictions between firms and banks, such that its contribution to a financial market union is small. Policies explicitly targeted at reducing such frictions, for example harmonized corporate bankruptcy legislation, appear to be more promising in improving euro area financial integration.

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6 Tables and Figures

Table 1: **Summary Statistics: Bank-Loan-Quarter Level.** This table presents summary statistics on the bank-loan-quarter level. The sample period is Q1 2006 to Q4 2007. *Loan amount* is the loan issuance granted by euro-area lead arranger i to firm j at quarter t. The *spread* is calculated as the yield minus LIBOR including annual fees, measured in basis points. *Loan Deal Purpose* is a categorical variable with five categories: Other Corporate (1), Working Capital (2), Fixed Investment (3), Debt Repayment (4), M & A (5).

	mean	sd	min	max	count
Loan amount (mn USD)	451.13	711.36	8.96	3,176.25	3,209
Spread (bps)	203.72	129.69	25.00	550.00	3,209
Maturity (months)	85.11	41.66	5.00	515.00	3,167
Share of lead arrangers (%)	1.00	0.00	1.00	1.00	3,209
Loan Deal Purpose $\in 0, 5$	3.33	1.64	1.00	5.00	3,209
Loan Refinancing (0/1)	0.30	0.46	0.00	1.00	3,209
Loan Secured (0/1)	0.97	0.17	0.00	1.00	2,301
Distance to Default	15.23	14.35	4.08	42.56	245
Foreign loans (%)	0.46	0.50	0.00	1.00	3,209
Euro area loans (%)	0.54	0.50	0.00	1.00	3,209
Of which					
Other euro area loans (%)	0.38	0.49	0.00	1.00	1,747
Domestic loans (%)	0.62	0.49	0.00	1.00	1,747

Table 2: **Summary Statistics: Bank Level.** Panel A presents summary statistics for all euro area banks included in the baseline sample from Q1 2006 to Q4 2006. *Loans ratio* refers to gross loans outstanding and is defined - as all other ratios - over total assets and indicated in percent. The *Affected*-measure is defined according to equation (2). Panel B shows univariate t-tests between affected and unaffected banks, based on a median split along the *Affected*-measure (2) in the period prior to the collateral framework shock Q1 2006 - Q4 2006.

Panel A: Full Sample

	Mean	SD	Min	Max	Count
ln(Total Assets)	12.08	1.36	8.83	14.17	35
Loans ratio	58.86	17.77	14.84	85.38	35
Securities ratio	25.74	20.68	6.41	94.08	35
Cash ratio	1.49	2.22	0.02	11.12	35
Deposit ratio	40.53	18.79	5.17	72.87	35
Equity ratio	4.98	2.64	2.21	15.23	35
Return on Equity (%)	15.29	6.21	4.63	29.17	35

Panel B: Univariate t-tests

	Less Affected		More Affected			
	Mean	N	Mean	N	Diff.	t-stat.
ln(Total Assets)	12.00	19	12.17	16	-0.173	-0.370
Loans ratio	62.19	19	54.91	16	7.274	1.215
Securities ratio	31.00	19	19.50	16	11.504	1.683
Cash ratio	1.32	19	1.68	16	-0.364	-0.477
Deposit ratio	38.17	19	43.34	16	-5.180	-0.808
Equity ratio	4.50	19	5.55	16	-1.048	-1.179
Return on Equity (%)	13.63	19	17.25	16	-3.613*	-1.768

Table 3: **Summary Statistics: Firm Level.** This table presents summary statistics for the firm cross-section in 2005-2006, the years prior to the collateral framework shock. *Loan* refers to the sum of issued syndicated loans issued to firm j in year t. *Leverage* is based on firm j's long term debt, *Liquidity* refers to operating net cash flows (Compustat item "ibc"). Both ratios are defined with respect to total assets and indicated in percentage points. The last two columns in Panel B shows the univariate t-statistic for a test of equal means between both groups in 2006, the year prior to the collateral framework shock.

Panel A: Full Sample

	Mean	SD	Min	Max	Count
ln(Loan amount)	2.86	3.47	0.00	12.28	1,121
ln(Total assets)	8.25	1.72	4.40	14.89	1,068
Leverage ratio	37.67	17.87	0.06	79.40	1,070
Liquidity ratio	3.15	6.77	-25.13	19.44	1,074
ln(Tangible assets)	6.86	2.22	1.59	13.51	1,042
ln(No of employees)	2.16	1.23	0.04	5.03	938
Exposed(0/1)	0.50	0.50	0.00	1.00	1,121
Exposed(%)	46.94	36.76	0.00	100.00	1,121

Panel B: Univariate t-tests

	Less Exposed		More Exposed		Diff	t-stat
ln(Loan amount)	2.94	180	3.07	189	-0.132	-0.363
ln(Total assets)	8.30	170	8.13	180	0.170	0.931
Leverage ratio	37.42	172	37.87	178	-0.454	-0.237
Liquidity ratio	2.09	172	3.23	180	-1.142	-1.497
ln(Tangible assets)	6.97	169	6.69	172	0.276	1.160
ln(No of employees)	2.34	150	2.05	151	0.285**	2.054

Table 4: **Loan Supply: Loan-Quarter Level.** This table presents the effect of the single list's introduction on credit supply. *Loan* is the loan issuance from bank i to firm j at quarter t. *Affected$_i$(0/1)* is based on a median split of banks along the *Affected*-measure, see equation (2). *DomAff$_i$*(0/1) equals one for banks located in countries where the respective national banks *did not accept* domestic bank loans as collateral before the policy change (BE, GR, IT, PT). It is equal to zero for banks located in countries where the respective national banks accepted domestic bank loans before the policy change (AT, FR, DE, IE, NL, ES). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

VARIABLES	(1) ln(Loan)	(2) ln(Loan)	(3) ln(Loan)	(4) ln(Loan)	(5) ln(Loan)
Affected$_i$(0/1) × Post07$_t$	0.165	0.115***	0.148***	0.111***	0.149***
	(0.149)	(0.041)	(0.047)	(0.032)	(0.048)
ln(Total Assets)			0.105**	0.053	0.113
			(0.051)	(0.035)	(0.103)
Equity ratio			-0.013	-0.009	-0.011
			(0.016)	(0.011)	(0.025)
Return on Equity			0.000	-0.000	0.000
			(0.001)	(0.000)	(0.001)
Cash ratio			-0.002	-0.005*	-0.001
			(0.009)	(0.003)	(0.011)
Securities ratio			-0.002*	-0.000	-0.002**
			(0.001)	(0.001)	(0.001)
Deposit ratio			0.001	0.001	0.001
			(0.001)	(0.001)	(0.001)
Loan refinancing			0.663*	0.669*	0.671*
			(0.380)	(0.375)	(0.376)
Loan secured			0.468***	0.468***	0.499***
			(0.122)	(0.121)	(0.129)
Loan purpose			0.098	0.098	0.098
			(0.116)	(0.114)	(0.108)
Post07$_t$	0.143				
	(0.102)				
DomAff$_i$(0/1) × Post07$_t$				-0.054	
				(0.046)	
Observations	3,206	3,206	3,206	3,206	3,180
R-squared	0.847	0.865	0.866	0.866	0.867
Bank-level Controls	No	No	Yes	Yes	Yes
Loan-level Controls	No	No	Yes	Yes	Yes
Bank×Firm FE	Yes	Yes	Yes	Yes	Yes
FirmCountry×Time FE	No	Yes	Yes	Yes	Yes
FirmCountry×Ind×Time FE	No	No	No	No	Yes
BankCountry×Time FE	No	Yes	Yes	No	Yes
Firm×Time FE	No	Yes	Yes	Yes	No
Cluster	Bank	Bank	Bank	Bank	Bank

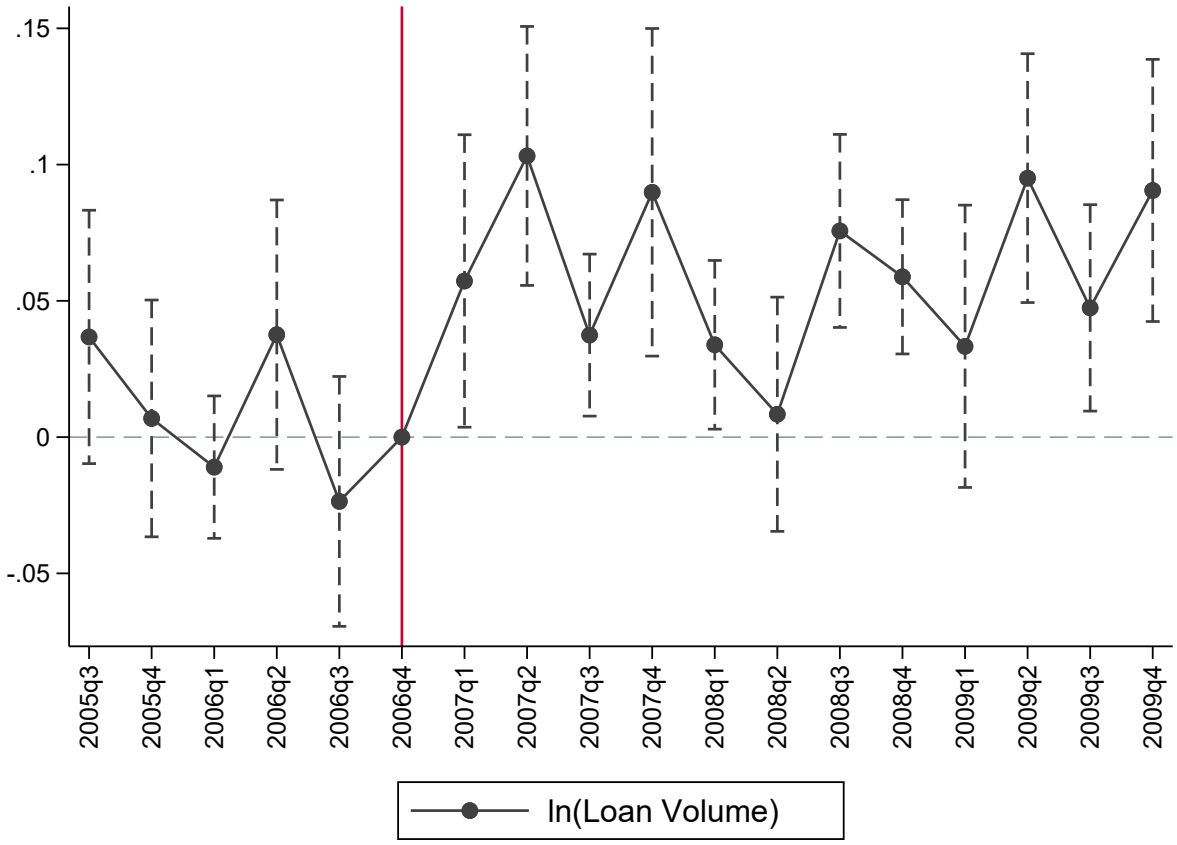

Figure 3: **Parallel Trend Assumption.** The figure is based on the following equation:

$$\log(L_{ijt}) = \sum_{\tau \neq Q4\ 2006} \beta_\tau \text{Affected}_i(0/1) \times \mathbf{1}\{\tau = t\} + \varepsilon_{ijt}\ ,$$

$\mathbf{1}\{\tau = t\}$ is a dummy variable that equals one in quarter t and 0 otherwise. Q4 2006, the quarter before the collateral framework shock, is excluded to estimate the dynamic effect. The dashed lines represent 90% confidence intervals, adjusted for bank level clustering.

Table 5: **Falsification Tests.** Panel A presents the effect of the single list's introduction on credit supply by European banks outside the euro area that are not affected by Eurosystem collateral policy. Panel B presents results for always ineligible credit lines. The analysis is based on data on the bank-loan-quarter level from Q1 2006 to Q4 2007. *Loan* is the loan issuance from bank i to firm j at quarter t. *Affected$_i$(0/1)* is based on a median split of banks along the respective placebo *Affected*-measure, see equation (2). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on firm headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

Panel A: Non-Euro Area Banks

VARIABLES	(1) ln(Loan)	(2) ln(Loan)	(3) ln(Loan)	(4) ln(Loan)
Affected$_i$(0/1) × Post07$_t$	0.070	-0.079***	-0.016	0.009
	(0.076)	(0.023)	(0.088)	(0.074)
Observations	3,492	3,492	3,492	3,434
R-squared	0.857	0.860	0.861	0.862
Bank-level Controls	No	No	Yes	Yes
Loan-level Controls	No	No	Yes	Yes
Bank×Firm FE	Yes	Yes	Yes	Yes
Country×Time FE	No	Yes	Yes	Yes
Country×Ind×Time FE	No	No	No	Yes
Firm ×Time FE	No	Yes	Yes	No
Cluster	Bank	Bank	Bank	Bank

Panel B: Credit Lines

VARIABLES	(1) ln(Loan)	(2) ln(Loan)	(3) ln(Loan)	(4) ln(Loan)
Affected$_i$(0/1) × Post07$_t$	-0.112	-0.030	-0.032*	-0.021
	(0.101)	(0.019)	(0.018)	(0.021)
Post07$_t$	0.144**			
	(0.060)			
Observations	1,826	1,826	1,826	1,818
R-squared	0.893	0.909	0.910	0.912
Bank-level Controls	No	No	Yes	Yes
Loan-level Controls	No	No	Yes	Yes
Bank×Firm FE	Yes	Yes	Yes	Yes
Country×Time FE	No	Yes	Yes	Yes
Country×Ind×Time FE	No	No	No	Yes
Firm×Time FE	No	Yes	Yes	No
Cluster	Bank	Bank	Bank	Bank

Table 6: **Cross-Border Loan Supply.** This table provides sample splits according to borrower location vis-a-vis banks. The analysis is based on data on the bank-loan-quarter level from Q1 2006 to Q4 2007. *Loan* is the loan issuance from lead bank i to firm j at quarter t. *Affected$_i$(0/1)* is based on a median split of banks along the *Affected*-measure, see equation (2). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on firm headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

Panel A: Baseline

	Lead Arrangers			Participants		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Domestic ln(Loan)	Other EA ln(Loan)	Non EA ln(Loan)	Domestic ln(Loan)	Other EA ln(Loan)	Non EA ln(Loan)
Affected$_i$(0/1) × Post07$_t$	0.296***	0.009*	0.018	-0.017	0.079***	-0.029
	(0.030)	(0.005)	(0.018)	(0.013)	(0.014)	(0.045)
DomAff$_i$(0/1) × Post07$_t$		0.020***	-0.136		-0.009	-0.007
		(0.004)	(0.154)		(0.006)	(0.062)
Observations	943	800	1,445	1,224	2,134	3,459
R-squared	0.893	0.867	0.839	0.894	0.885	0.817
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Loan-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank×Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country×Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country×Ind×Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Bank	Bank	Bank	Bank	Bank	Bank

Panel B: Credit Lines

	Lead Arrangers			Participants		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Domestic ln(Loan)	Other EA ln(Loan)	Non EA ln(Loan)	Domestic ln(Loan)	Other EA ln(Loan)	Non EA ln(Loan)
Affected$_i$(0/1) × Post07$_t$	0.031	0.025	-0.057	-0.000	-0.006	-0.016
	(0.031)	(0.022)	(0.090)	(0.000)	(0.006)	(0.022)
DomAff$_i$(0/1) × Post07$_t$		-0.030	-0.002		-0.003	-0.043
		(0.025)	(0.040)		(0.005)	(0.064)
Observations	568	608	654	637	1,061	2,589
R-squared	0.933	0.936	0.854	0.870	0.912	0.871
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Loan-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank×Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country×Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country×Ind×Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Bank	Bank	Bank	Bank	Bank	Bank

Table 7: **Risk-Taking Effects.** Panel A provides a sample split according to borrower sector. The analysis is based on data on the bank-loan-quarter level from Q1 2006 to Q4 2007. *Loan* is the loan issuance from bank i to firm j at quarter t. *Tradable* are firms active in tradable industries (SIC code 2000-3999). *Non-tradable* are firms active in non-tradable industries (SIC code 5000-5999,6500-6599, 7000-7099). Panel B is based on bank-quarter level and uses the distance-to-default of bank i's loan issuance in quarter t as proxy for risk-taking. *Affected$_i$(0/1)* is based on a median split of banks along the *Affected*-measure, see equation (2). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on firm headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

Panel A: Borrower Sector

	Tradable		Non Tradable	
	(1)	(2)	(3)	(4)
VARIABLES	ln(Loan)	ln(Loan)	ln(Loan)	ln(Loan)
Affected$_i$(0/1) × Post07$_t$	0.014	0.014	0.104***	0.132***
	(0.023)	(0.023)	(0.024)	(0.023)
Observations	1,117	1,120	503	506
R-squared	0.881	0.881	0.763	0.765
Bank-level Controls	Yes	Yes	Yes	Yes
Loan-level Controls	Yes	Yes	Yes	Yes
Bank×Firm FE	Yes	Yes	Yes	Yes
Country×Time FE	Yes	Yes	Yes	Yes
Country×Ind×Time FE	No	Yes	No	Yes
Firm×Time FE	Yes	No	Yes	No
Cluster	Bank	Bank	Bank	Bank

Panel B: Bank Risk Taking

	(1)	(2)
VARIABLES	D2D	D2D
Affected$_i$(0/1) × Post07$_t$	-0.016*	-0.007**
	(0.008)	(0.002)
Observations	245	245
R-squared	0.993	0.998
Bank-level Controls	No	Yes
Bank-Country × Time FE	Yes	Yes
Cluster	Bank	Bank

Table 8: **Firm Level: Real Effects.** This table provides results at the firm-year level from 2005 to 2008. The treatment variable *Exposed$_j$(0/1)* equals one for firms in the upper tercile of the *Exposure*-measure (5) and zero for firms in the lower tercile. *Post07$_t$* equals one after the collateral framework shock in January 2007, and zero otherwise. ***, **, *, $^+$ denote significance at the 1, 5, 10, and 15% level, respectively.

VARIABLES	(1) ln(PPE)	(2) ln(Employ)	(3) ln(Sales)
Exposed$_j$(0/1) ×Post07$_t$	0.082*	0.052**	0.062*
	(0.047)	(0.022)	(0.034)
Observations	1,972	1,625	1,970
R-squared	0.980	0.988	0.980
Firm Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes
Cluster	Firm	Firm	Firm

Online Appendix for "Central Banks and Financial Integration: Evidence from the Eurosystem Collateral Framework"

Pia Hüttl (DIW Berlin) and Matthias Kaldorf (Deutsche Bundesbank)

November 12, 2024

A Additional Descriptive Statistics

Table A.1: Variable Definitions

Variable	Source	Description
Loan volume	DealScan	Loan volume to firm j by bank i in quarter t
Spread	DealScan	Spread over LIBOR including annual fees in basis points
Maturity	DealScan	Maturity of syndicated loan in months
Lead arranger	DealScan	Indicator variable equal to one if a bank acts as lead arranger
Ln(volume)	DealScan	Logarithm of (one plus) the loan issuance from bank i to firm j at quarter t
ln(Total Assets)	CapitalIQ	Logarithm of one plus total assets
Loans ratio	CapitalIQ	Share of gross loans over total loans
Equity ratio	CapitalIQ	Share of equity over total assets (leverage ratio)
ROE (%)	CapitalIQ	Return on equity
Cash ratio	CapitalIQ	Share of cash and equivalents over total assets
Securities ratio	CapitalIQ	Share of investment securities over total assets
Deposit ratio	CapitalIQ	Share of deposits over total assets
Tradable	Compustat	Indicator equals one if firm j is active in tradable industries (SIC codes 2000-3999)
Non-tradable	Compustat	Indicator equals one if firm j is active in non-tradable industries (SIC codes 1500-1799, 5000-5999, 7000-7099)
Pr(Loan)	DealScan	Indicator variable that equals one if firm j obtains a bank loan in period t, and zero otherwise
ln(Total assets)	Compustat	Natural logarithm of one plus total assets
Leverage	Compustat	Ratio of long term debt to total assets
Liquidity	Compustat	Ratio of cash equivalents over total assets
Employment	Compustat	Number of employees, in thousands
PPE	Compustat	Plants, Property and Equipment
D2D	Compustat	Distance-to-default, computed over a one-year horizon

Table A.2: **Summary Statistics: Distribution over Countries.** This table splits loan-level observations over the full sample by bank headquarter country.

Country	Number of Loans	Frequency (%)
Austria	15	0.47
Belgium	57	1.78
France	1,373	42.83
Germany	786	24.52
Greece	2	0.06
Ireland	67	2.09
Italy	288	8.98
Netherlands	383	11.95
Portugal	10	0.31
Spain	225	7.02

Table A.3: **List of Banks.**

Bank	Country
Raiffeisen Zentralbank	Austria
Fortis Bank	Belgium
KBC Group	Belgium
Societe Generale	France
BNP Paribas	France
Natixis	France
Credit Agricole	France
Portigon AG	Germany
Landesbank Hessen-Thuringen	Germany
BayernLB	Germany
Landesbank Baden-Wurttemberg	Germany
Deutsche Bank	Germany
DZ Bank	Germany
HSH Nordbank	Germany
IKB Deutsche Industrie Bank	Germany
NordLB	Germany
Commerzbank	Germany
Alpha Bank	Greece
Bank of Ireland Group	Ireland
Allied Irish Banks	Ireland
Unione di Banche Italiane	Italy
Mediobanca	Italy
UniCredit	Italy
Intesa Sanpaolo	Italy
Rabobank	Netherlands
ING Group	Netherlands
Caixa Geral de Depositos	Portugal
Caixabank	Spain
Banco Guipuzcoano	Spain
Banco Pastor	Spain
Banco Bilbao Vizcaya Argentaria	Spain
Bankinter	Spain
Banco de Sabadell	Spain
Banco Santander	Spain

B Additional Results

This section presents several additional empirical results, complementing our baseline specification. Specifically, we vary the outcome variable by considering loan supply at the extensive margin (Appendix B.1 and credit spreads (Appendix B.2). We show that there are no significant announcement effects (Appendix B.3). Furthermore, we use the *Affected*-measure at the subsidiary level (Appendix B.4) and provide further results on the differences between lead arrangers and participants. Lastly, we show that our credit supply results hold when changing the definition of the *Affected*-measure (Appendix B.6) and when excluding German banks (Appendix B.7).

B.1 Extensive and Total Margin

The extensive margin can be relevant in the context of collateral eligibility if more frequent but smaller loan sizes would render the loans ineligible. We operationalize this by estimating equation (3) over a balanced panel and add zeros to all bank-firm-quarter triples where there was no loan issuance. The positive coefficient in the second column of Table B.1 suggests a positive effect of the collateral framework shock on total credit supply. For the extensive margin, specified as linear probability model, we transform all observations into an indicator variable equal to one if bank i supplied a loan to firm j in quarter t. Column (4) of Table B.1 shows that the probability of extending a loan is one percentage point larger for affected banks after the treatment. Combined with a positive intensive margin, a positive effect in the extensive margin specification also points towards an increase in total credit supply, since banks interact with firms more often and supply more credit when they interact. It should be noted that this notion of the extensive margin does not distinguish between repeated bank-firm interactions and new relationships. Defining a dummy that equals one if firms and banks interact for the first time and else is zero does not yield any significant results when interacting the Post-dummy with the bank-specific *Affected*-measure, neither for transactions where those banks acted as participants nor where they were lead arrangers and also irrespective of the borrower location.

Table B.1: **Loan Supply: Extensive and Total Margin.** This table presents the effect of the single list's introduction on credit supply. The sample is extended into a balanced panel of firm-bank pairs at the quarterly frequency, including zeros where there was no interaction in the firm-bank pair. The dependent variable in the first two columns, *Loan*, is the loan issuance from lead bank i to firm j at quarter t. The dependent variable in the last two Column, *Pr(Loan)*, equals one if lead bank i extended a loan to firm j at quarter t. $Affected_i(0/1)$ is based on a median split of banks along the *Affected*-measure, see equation (2). $Post07_t$ indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

VARIABLES	(1) ln(Loan)	(2) ln(Loan)	(3) Pr(Loan)	(4) Pr(Loan)
$\text{Affected}_i(0/1) \times \text{Post07}_t$	-0.051	0.067**	-0.008	0.010**
	(0.065)	(0.032)	(0.011)	(0.005)
Post07_t	-0.047		-0.008	
	(0.043)		(0.008)	
Observations	10,992	10,992	10,992	10,992
R-squared	0.001	0.949	0.001	0.947
Bank FE	Yes	Yes	Yes	Yes
BankCountry × Time FE	No	Yes	No	Yes
Firm × Time FE	No	Yes	No	Yes
Cluster	Bank	Bank	Bank	Bank

B.2 Loan Spreads

While we focus on the quantity dimension of credit supply - loan volume - in the main text, we also use the price dimension as a measure of credit supply, i.e. loan spreads. Therefore, we use the same specification to test the effect of the single list regime on loan spreads:

$$S_{ijt} = \beta_1 \text{Affected}_i(0/1) \times \text{Post07}_t + \gamma \text{X}_{i,t-4} + \mu_{ij} + \nu_{jt} + c_{jt} + \epsilon_{ijt} \,. \tag{7}$$

Since we expect affected banks to increase their credit supply, the coefficient β_1 should be negative when using spreads as dependent variable.

Second, Table B.2 shows that the response of loan spreads is consistent with our baseline results. Under the most stringed specifications in columns (3) to (5), the coefficient on $Affected_i(0/1) \times Post07_t$ is significantly negative at the 1%-level once loan demand is controlled for. The effect size of 16 basis points is comparable to Pelizzon et al. (2024) or Mésonnier, O'Donnell, and Toutain (2021) and is quite large given the full sample average

spread of 200 basis points. Bank and loan level controls are mostly insignificant, only the loan purpose has a significantly positive effect on loan spreads.

Table B.2: **Loan Spreads.** This table presents the effect of the single list's introduction on loan spreads. *Affected$_i$(0/1)* is based on a median split of banks along the *Affected*-measure, see equation (2). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Spread	Spread	Spread	Spread	Spread
Affected$_i$(0/1) × Post07$_t$	9.546	-14.221*	-16.233***	-10.970***	-15.321***
	(20.399)	(7.049)	(3.912)	(3.139)	(4.216)
ln(Total Assets)			-20.055	-7.392	-6.065
			(13.492)	(10.612)	(8.486)
Equity ratio			-2.444	0.774	0.756
			(4.612)	(2.561)	(3.069)
Return on Equity			-0.064	0.048	0.048
			(0.125)	(0.094)	(0.141)
Cash ratio			5.166*	4.347	6.174
			(2.912)	(2.634)	(3.801)
Securities ratio			0.925	0.661	0.861
			(1.059)	(0.700)	(1.081)
Deposit ratio			-0.126	-0.160	-0.243
			(0.284)	(0.192)	(0.229)
Loan refinancing			-26.588	-26.577	-27.685
			(25.604)	(25.235)	(25.114)
Loan secured			-21.629	-21.627	-23.439
			(15.451)	(15.271)	(16.342)
Loan purpose			17.235**	17.302**	15.903**
			(7.893)	(7.787)	(7.724)
Post07$_t$	-22.838**				
	(9.062)				
DomAff$_i$(0/1) × Post07$_t$				-14.086***	
				(4.844)	
Observations	3,206	3,206	3,206	3,206	3,180
R-squared	0.766	0.782	0.782	0.782	0.781
Bank-level Controls	No	No	Yes	Yes	Yes
Loan-level Controls	No	No	Yes	Yes	Yes
Bank × Firm FE	Yes	Yes	Yes	Yes	Yes
FirmCountry × Time FE	No	Yes	Yes	Yes	Yes
FirmCountry × Industry × Time FE	No	No	No	No	Yes
BankCountry × Time FE	No	Yes	Yes	No	Yes
Firm × Time FE	No	Yes	Yes	Yes	No
Cluster	Bank	Bank	Bank	Bank	Bank

B.3 Announcement Effects

The single list and the future eligibility of cross-border bank loans was announced around one and a half years before its implementation. Therefore, we test for announcement effects on credit supply. Since syndicated loans are non-marketable assets, we do not expect to find a large announcement effect: until these assets can actually be posted into collateral accounts, they continue to occupy balance sheet space and can not be used as collateral.

Table B.3 presents results of using the announcement instead of the implementation date. The dummy $Post05_t$ takes on the value of zero until Q2 2005 and a value of one afterwards. We find no significant effect across all specifications, which suggests that the announcement date did not play a relevant role in banks' lending decisions. Since syndicated bank loans are non-marketable, it is not surprising that there are no announcement effects of the collateral framework shock.

Table B.3: **Announcement Effect.** This table presents the effect of the single list's announcement date on credit supply. *Loan* is the loan issuance from bank i to firm j at quarter t. *Affected$_i$(0/1)* is based on a median split of banks along the *Affected*-measure, see equation (2). $Post05_t$ indicates the announcement of the single-list regime after June 2005. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on firm headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	ln(Loan)	ln(Loan)	ln(Loan)	ln(Loan)
Affected$_i$(0/1) × Post05$_t$	0.009	0.039	0.031	0.023
	(0.151)	(0.024)	(0.024)	(0.023)
Observations	3,372	3,372	3,372	3,351
R-squared	0.865	0.876	0.877	0.877
Bank-level Controls	No	No	Yes	Yes
Loan-level Controls	No	No	Yes	Yes
Bank × Firm FE	Yes	Yes	Yes	Yes
Country × Time FE	No	Yes	Yes	Yes
Country × Industry × Time FE	No	No	No	Yes
Firm × Time FE	No	Yes	Yes	No
Cluster	Bank	Bank	Bank	Bank

B.4 Subsidiary Level

We also test for credit supply effects of the single list at the subsidiary level. The results are slightly weaker than using the *Affected*-measure at the group level, consistent with the existent of internal capital markets in multinational banks (De Haas and Van Lelyveld 2010). We re-estimate (3) at the *subsidiary-level*:

$$ln(L_{kjt}) = \beta_1 \text{Affected}_k(0/1) \times \text{Post07}_t + \beta \text{X}_{i,t-4} + \mu_{kj} + \nu_{jt} + c_{jt} + \epsilon_{kjt} \ . \tag{8}$$

The median-split is now performed at the subsidiary level, such that a bank group i can have both affected and unaffected subsidiaries. Bank-firm fixed effects μ_{kj} are now defined at the subsidiary level, as is the clustering of standard errors. Since eligibility is restricted to loans involving at most two jurisdictions, we expect to observe significant effects at the subsidiary level as well.

Table B.4 shows the results of estimating the single list's effect on loan supply at the subsidiary level. Similar to the baseline specification, the coefficient of interest β_1 is significantly positive after including country $\times$ time and firm $\times$ time fixed effects and is robust to including loan-level controls and modifications in the fixed effect structure. Subsidiaries increase loan supply by 5.1% to 7.4%, depending on the specification: the effect size is slightly smaller than in the baseline but of comparable magnitude.

Table B.4: **Credit Supply: Subsidiary Level.** This table presents the effect of the single list's introduction on credit supply of subsidiaries. The analysis is based on data on the bank-loan-quarter level from Q1 2006 to Q4 2007. *Loan* is the loan issuance from subsidiary s to firm j at quarter t. *Affected$_k$(0/1)* is based on a median split of subsidiaries along the subsidiary-level *Affected*-measure, see equation (1). *Post07$_t$* indicates the single-list regime after January 2007. The loan-level control variables are lagged by 4 quarters. Country-fixed effects are based on borrower headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

Panel A: Subsidiary Measure

VARIABLES	(1) ln(Loan)	(2) ln(Loan)	(3) ln(Loan)	(4) ln(Loan)	(5) ln(Loan)
Affected$_k$(0/1) × Post07$_t$	0.199	0.142	0.068**	0.067*	0.068**
	(0.125)	(0.156)	(0.034)	(0.035)	(0.033)
Post07$_t$	0.131				
	(0.080)				
DomAff$_k$(0/1) × Post07$_t$				0.057	
				(0.042)	
Observations	2,931	2,931	2,931	2,931	2,905
R-squared	0.850	0.860	0.864	0.864	0.865
Loan-level Controls	No	No	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes	Yes
Subsidiary×Firm FE	Yes	Yes	Yes	Yes	Yes
Country×Time FE	No	Yes	Yes	Yes	Yes
Country×Ind×Time FE	No	No	No	No	Yes
Firm×Time FE	No	Yes	Yes	Yes	No
Cluster	Subsidiary	Subsidiary	Subsidiary	Subsidiary	Subsidiary

Panel B: Group Measure

VARIABLES	(1) ln(Loan)	(2) ln(Loan)	(3) ln(Loan)	(4) ln(Loan)	(5) ln(Loan)
Affected$_i$(0/1) × Post07$_t$	0.233*	0.105	0.093**	0.093**	0.093**
	(0.137)	(0.156)	(0.043)	(0.045)	(0.043)
Post07$_t$	0.131				
	(0.080)				
DomAff$_i$(0/1) × Post07$_t$				0.047	
				(0.055)	
Observations	3,326	3,326	3,326	3,326	3,300
R-squared	0.850	0.859	0.864	0.864	0.864
Loan-level Controls	No	No	Yes	Yes	Yes
Subsidiary FE	Yes	Yes	Yes	Yes	Yes
Subsidiary×Firm FE	Yes	Yes	Yes	Yes	Yes
Country×Time FE	No	Yes	Yes	Yes	Yes
Country×Ind×Time FE	No	No	No	No	Yes
Firm × Time FE	No	Yes	Yes	Yes	No
Cluster	Subsidiary	Subsidiary	Subsidiary	Subsidiary	Subsidiary

B.5 Lead Arrangers and Participants

Table B.5: **Lead Arranger and Participant Sample.** This table presents the effect of the single list's introduction on credit supply, interacted with a borrower location dummy. *Loan* is the loan issuance from bank i to firm j at quarter t. *Affected$_i$(0/1)* is based on a median split of banks along the *Affected*-measure, see equation (2). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on firm headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	ln(Loan)	ln(Loan)	ln(Loan)	ln(Loan)
Affected$_i(0/1) \times$ Post07$_t$	0.051	0.048***	0.032*	0.044***
	(0.050)	(0.013)	(0.016)	(0.016)
Observations	10,117	10,117	9,997	10,117
R-squared	0.857	0.862	0.863	0.863
Bank-level Controls	No	No	Yes	Yes
Loan-level Controls	No	No	Yes	Yes
Bank $\times$ Firm FE	Yes	Yes	Yes	Yes
Country $\times$ Time FE	No	Yes	Yes	Yes
Firm $\times$ Time FE	No	Yes	Yes	Yes
Cluster	Bank	Bank	Bank	Bank

Table B.6: **Borrower Location - Triple Diff.** This table presents the effect of the single list's introduction on credit supply, interacted with a borrower location dummy. *Loan* is the loan issuance from bank i to firm j at quarter t. *Affected$_i$(0/1)* is based on a median split of banks along the *Affected*-measure, see equation (2). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on firm headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

	(1)	(2)
	Lead	Participants
VARIABLES	ln(Loan)	ln(Loan)
Affected$_i$(0/1) × Post07$_t$ × Dom	0.306***	-0.065***
	(0.065)	(0.021)
Affected$_i$(0/1) × Post07$_t$	-0.052	0.032**
	(0.042)	(0.016)
Dom × Post07$_t$	-0.155***	0.026
	(0.045)	(0.018)
Observations	1,751	3,366
R-squared	0.883	0.892
Bank-level Controls	Yes	Yes
Loan-level Controls	Yes	Yes
Bank×Firm FE	Yes	Yes
Country×Time FE	Yes	Yes
Country×Ind×Time FE	Yes	Yes
Cluster	Bank	Bank

B.6 Alternative Affected-Measure

In this section, we present results using a robustness measure that is defined with respect to total bank assets rather than total loan supply. To do so, we use *total assets* at the group level

$$\text{AffectedTA}_i \equiv \frac{\sum_{t\in\mathcal{T}}\sum_{j\in\mathcal{J}^{ea}} L_{kjt}}{TA_{\text{Q2 2005}}} \cdot \text{Affected}_k \; . \tag{9}$$

This measure obtains from multiplying the baseline measure (2) by the group-level ratio of euro area loans to total assets. Banks to which the euro area loan market is of smaller importance are thus down-weighted under the modified measure (9). This alleviates concerns that results are driven by a control group of banks that are overall less active on the syndicated loan market but would lend almost exclusively to domestic borrowers if they become active.

Table B.7: **Affected Defined Over Total Assets: Loan Supply.** This table presents the effect of the single list's introduction on credit supply. The analysis is based on data on the bank-loan-quarter level from Q1 2006 to Q4 2007. *Loan* is the loan issuance from bank i to firm j at quarter t. *AffectedTA$_i$(0/1)* is based on a median split of banks along the modified *Affected*-measure, see equation (9). *Post07$_t$* indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on borrower headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

VARIABLES	(1) ln(Loan Vol)	(2) ln(Loan Vol)	(3) ln(Loan Vol)	(4) ln(Loan Vol)	(5) ln(Loan Vol)
Affected$_i$(0/1) × Post07$_t$	0.296**	0.117**	0.133***	0.100**	0.133**
	(0.133)	(0.046)	(0.048)	(0.043)	(0.052)
Post07$_t$	0.101				
	(0.084)				
DomAff$_i$(0/1) × Post07$_t$				-0.063	
				(0.044)	
Observations	3,187	3,187	3,187	3,187	3,161
R-squared	0.848	0.865	0.866	0.866	0.867
Bank-level Controls	No	No	Yes	Yes	Yes
Loan-level Controls	No	No	Yes	Yes	Yes
Bank × Firm FE	Yes	Yes	Yes	Yes	Yes
FirmCountry × Time FE	No	Yes	Yes	Yes	Yes
FirmCountry × Industry × Time FE	No	No	No	No	Yes
BankCountry × Time FE	No	Yes	Yes	No	Yes
Firm × Time FE	No	Yes	Yes	Yes	No
Cluster	Bank	Bank	Bank	Bank	Bank

B.7 Excluding German Banks

Since German banks have been comparatively active on the international loan market, particularly in the US, a large share of affected banks might be located in Germany, which could confound our identification strategy. To ensure that our results are not driven by German banks, we re-classify all non-German banks into *affected* and *unaffected* banks and re-estimate equation (3). Table B.8 shows that our baseline loan supply results as well as the geographical distribution of loan supply is robust to excluding German banks.

Table B.8: **Excluding German Banks: Loan Supply.** This table presents the effect of the single list's introduction on credit supply. The analysis is based on data on the bank-loan-quarter level from Q1 2006 to Q4 2007. *Loan* is the loan issuance from bank i to firm j at quarter t. *AffectedTA$_i$(0/1)* is based on a median split of banks along the modified *Affected*-measure, see equation (9). *Post07*$_t$ indicates the single-list regime after January 2007. The control variables on bank and loan level are lagged by 4 quarters. Country-fixed effects are based on borrower headquarters. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

VARIABLES	(1) ln(Loan Vol)	(2) ln(Loan Vol)	(3) ln(Loan Vol)	(4) ln(Loan Vol)	(5) ln(Loan Vol)
Affected$_i$(0/1) × Post07$_t$	0.196*	0.133***	0.222***	0.151***	0.233***
	(0.107)	(0.041)	(0.057)	(0.040)	(0.058)
Post07$_t$	0.167***				
	(0.052)				
DomAff$_i$(0/1) × Post07$_t$				-0.080*	
				(0.045)	
Observations	2,413	2,413	2,413	2,413	2,389
R-squared	0.849	0.869	0.870	0.870	0.871
Bank-level Controls	No	No	Yes	Yes	Yes
Loan-level Controls	No	No	Yes	Yes	Yes
Bank × Firm FE	Yes	Yes	Yes	Yes	Yes
FirmCountry × Time FE	No	Yes	Yes	Yes	Yes
FirmCountry × Industry × Time FE	No	No	No	No	Yes
BankCountry × Time FE	No	Yes	Yes	No	Yes
Firm × Time FE	No	Yes	Yes	Yes	No
Cluster	Bank	Bank	Bank	Bank	Bank