Out with the New, In with the Old? Bank Supervision and the Composition of Firm Investment*

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Abstract

Using exogenous variation generated by the creation of the Single Supervisory Mechanism (SSM) in the euro area, we find that relative to firms borrowing from banks remaining under national supervision, firms borrowing from SSM-supervised banks reduce intangible assets and increase tangible assets and cash holdings. These effects do not pre-date the supervisory reform, do not obtain in non-SSM jurisdictions, and coincide with a reduction in long-term borrowing. The reallocation of investment away from intangible assets is stronger in innovation-intensive sectors, suggesting that more stringent bank supervision can slow down the shift from the capital-based to the knowledge-based economy.

JEL classification: D25, G21, G28.

Keywords: Banking, Supervision, Lending, Investment, Intangibles.

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1 Introduction

Does banking system stability help or hinder economic growth? On the one hand, there is evidence that systemic banking distress results in a permanent reduction in GDP (Laeven and Valencia, 2010). More effective supervision of banks can reduce the likelihood of idiosyncratic and systemic banking distress and thus reduce aggregate economic losses that come with such distress. On the other hand, Ranciere et al. (2008) show that countries with more developed financial systems but occasional financial crises have, on average, grown faster than countries with stable but shallow financial conditions, arguing that financial liberalization increases investment but also systemic risk.

We contribute to this debate by studying the effect of one well-defined stability-relevant policy (the introduction of centralized bank supervision in the euro area) on one well-defined growth mechanism (corporate investment). After the Global Financial Crisis and sovereign debt crisis of the late 2000s and early 2010s, respectively, regulators enacted a number of reforms aimed at improving the resilience of European banks. The centerpiece of this drive was the introduction of the Single Supervisory Mechanism (SSM) in Frankfurt. Following an asset quality review and stress tests (together referred to as Comprehensive Assessment), a number of significant euro area banks became supervised by the SSM, while others remained under the supervision of their national authorities. Several recent studies have shown that the shift to centralized supervision resulted in stability-enhancing actions by the affected banks (Fiordelisi, Ricci and Stentella Lopes, 2017; Eber and Minoiu, 2017; Altavilla, Boucinha, Peydro and Smets, 2020). We use the announcement of the SSM in 2012 and its introduction in 2014 as a quasi-natural experiment to study the impact of a safer financial system on the performance of the real economy. Our principal finding is that relative to firms borrowing from banks remaining under national supervision, firms borrowing from SSM-supervised banks reduce intangible assets and increase tangible assets and cash holdings. This effect is stronger in R&D-intensive and innovation-intensive sectors. Our findings provide support for the notion that by increasing the stability of individual banks, centralized bank supervision can slow down the shift from the capital-based to the knowledge-based economy.

To assess the impact of this change in supervisory architecture, we match firm-level balance sheet data to firms' main lender across 119,713 unique firms and 1,946 banks belonging to 139 banking groups in 12 euro area countries over the period 2010 to 2017. We use Orbis, a micro database maintained by Bureau Van Dijk which contains both public and private companies that span the entire firm-size distribution. The database has detailed firm-level balance sheet information on assets, employment, debt, and output across a large number of European countries. One of the main advantages of this dataset is that it allows us to distinguish between different types of assets (e.g., tangible, intangible, or current/cash). The database also includes information on each firm's main creditor(s), which we use to match firms and banks. For each firm's main bank, we determine whether they were affected by the implementation of the SSM or not (i.e., whether they moved to being centrally supervised after 2014, or remained supervised by national authorities). A big advantage of our data set is its representative coverage of SMEs, which tend to be informationally opaque and dependent on banks for their external financing, and therefore more likely to be affected by changing conditions at their creditor (e.g., Berger and Udell, 1998; Kashyap, Lamont, and Stein, 1994). Moreover, SMEs account for almost 99 percent of all firms and for two thirds of the aggregate economic activity in Europe. We use a difference-in-differences approach to identify the effect of the shift in bank supervision on the composition of investment for firms borrowing from affected, relative to firms borrowing from unaffected, banks.[1] Furthermore, we perform all analyses on a sample of firms where we make sure that "treated" and "control" firms are similar in terms of observable characteristics, including those of the banks they borrow from.

More stringent supervision implies more frequent inspections and communication between supervisors and supervised entity. Stronger supervisory scrutiny can have an effect on risk management practices and governance within the bank, reinforcing incentives towards a more conservative risk appetite and reduced risk-taking. As argued by Kok, Mueller, Ongena, and Pancaro (2023), requests for more frequent information may also lead banks to invest more into information systems that enable them to manage their business more prudently. Empirical evidence has shown that more stringent supervision, including stress tests and loan-level scrutiny can lead banks to reduce lending and risk-

[1] A similar exercise would not be possible to the same extent for the US. It is true that the Y14 Corporate Loan Schedule has recently become available, and it includes credit exposures exceeding 1 million USD for banks with more than 100 billion USD in assets. While these loans account for around 75 percent of all commercial and industrial lending volume, such an analysis would miss the equivalent to less significant institutions and smaller firm borrowers.

taking (Bassett, Lee and Spiller, 2015; Ivanov and Wang, 2023; Kok, Mueller, Ongena, and Pancaro, 2023; Passalacqua, Angelini, Lotti, and Soggia, 2020). While banks might be able to move risk across subsidiaries in different countries according to stringency of national supervisor, this is no longer possible under centralized supervision. Finally, lower risk-taking would also imply a stronger focus on collateralized lending, as a screening tool (Stiglitz and Weiss, 1981) or as a disciplining tool (Boot and Thakor, 1994; Holmstrom and Tirole, 1997).

Theory, however, provides contrasting hypotheses on the effect of centralized vs. decentralized supervision on bank lending and thus firm financing. On the one hand, Laffont and Tirole (1993) argue that local supervision results in better monitoring of firms. Colliard (2020) argues that local supervisors might be better able to extract information from banks than a centralized supervisor. Carletti, Dell'Ariccia, and Marquez (2021) point to lower incentives for local supervisors to collect information if supervisory decisions are centralized. If local supervisors provide more rigorous supervision than centralized supervisors, we would expect firms whose lenders change to centralized supervision to increase their investment, including into less collateralizable assets, such as intangible capital.

On the other hand, because bank supervision exhibits scale economies, centralized supervision might be more effective (Eisenbach, Lucca, and Townsend, 2022). Centralized supervision might be better able to reduce the risk of banks arbitraging differences in regulatory stringency across countries (Dell'Ariccia and Marquez, 2006), and can increase supervisory independence (Rochet, 2008). If centralized supervisors are more effective in holding in check banks' risk-taking, banks under their supervision might tighten lending standards and increase collateral requirements, with negative implications for investment, especially in intangible assets, which are less collateralizable.

Our regression analysis shows, first, that relative to firms borrowing from banks that remained under the supervision of national authorities, firms borrowing from SSM-supervised banks experienced a significant increase in total assets, accompanied by significant reallocation across different asset types. During the Comprehensive Assessment period (2013–2014) when banks' balance sheets were closely inspected in preparation for joining the SSM, affected firms increased their investment in current assets (i.e., cash) and reduced investment in intangible assets (such as R&D), relative to unaffected firms. Those same firms increased their investment in tangible assets (such as machines and equipment) after the implementation of the SSM (2015–2017).

The immediate increase in current assets and decline in intangible assets, as well as the gradual increase in tangible assets, are quite robust across specifications that account for non-similarities between "control" and "treated" firms, for time-varying firm-specific shocks, as well as for the unbalanced property of the panel and for model misspecification. They are also robust to controlling for unobservable firm heterogeneity, for country-sector-specific trends, and for bank fixed effects.

Crucially, we document a similar patterns when we use supervisory data on bank lending and EU KLEMS data on R&D: R&D investment declines significantly in country-sectors relatively more exposed to lending by SSM-supervised banks, both during the Comprehensive Assesment and during the SSM period. Given the long lag between R&D investment and patented innovation (Kordal, Cahoy, Minkabo, and Sherer, 2016), our results suggest that the reduction in intangible investment we document can precipitate a long-term productivity decline. Supporting this conjecture, we already observe a decline (albeit an insignificant one) in total factor productivity towards the end of the sample period.

Moreover, we find that the decline in intangible investment is particularly pronounced in innovation-intensive sectors, and especially during the early period of the SSM. Such industries are instrumental in contributing to productivity-driven long term growth in modern knowledge-based economies. In line with economic efficiency, they should see a steady stream of investment in intangible assets, such as R&D. Finding the opposite suggests that more intense bank supervision can force innovative firms to reallocate investment away from relatively risky projects, and thus slow down the shift from the "old" to the "new" economy. This can have negative repercussions for economic growth, given the increasing reliance of advanced economies on intangible assets (Corrado and Hulten, 2010; Haskel and Westlake, 2017) and the limited contribution that banks can make to economic growth in economies that rely heavily on intangible assets (Beck, Dottling, Lambert, and van Dijk, 2023). On the other hand, a slower shift towards intangible assets might also slow the trend towards less effective monetary policy that has been document by Dottling and Ratnovski (2023), due to the increasing importance of firms relying on intangible rather than tangible assets.

Our results are robust to two falsification tests. First, we find that there were no different trends across treatment and control firms before the announcement and the implementation of the SSM. Second, we show that in the case of tangible and intangible assets, the differences in investment patterns across firms borrowing from two distinct sets of banks are absent in jurisdictions which were not subject to a centralization of bank supervision. Specifically, we use a firm sample for Denmark, Croatia, Hungary, Poland, and the United Kingdom – all five non-euro EU member states during the sample period – and identify banks that would have been subject to SSM supervision had these countries joined the banking union. Comparing firms borrowing from banks that would have been under SSM supervision and firms borrowing from banks that would have stayed under national supervision, we find that after the implementation of the SSM, tangible assets increase and intangible assets decline only for euro-area firms. These results confirm that our findings are not driven by other global or regional trends affecting banks of different sizes and systemic importance and their borrowers differently.

Finally, we show that corporate lending by banks that came under SSM supervision declined during the transition period, compared to corporate lending by banks not subject to SSM supervision. In contrast, during the SSM period, lending increased, especially for well-capitalized banks, which may help explain the concurrent increase in firms' tangible investment. At the same time, we record a decline in long-term debt for firms borrowing from SIs, which may help explain the reduction in (long-term) intangible assets. Our findings thus suggest that lending retrenchment might have been one channel through which firms were forced to adjust their investment. They also suggest that the negative effect of the supervisory reform in Europe on intangible investment may be a long-term trend, rather than a short-term feature of the initial stress tests.

In summary, our findings are consistent with hypotheses that posit a dampening effect of centralized supervision on banks' lending, and thus a shift of firms' investment towards assets that are more easily collateralizable.[2] They are also consistent with theories that focus less on the distance between banks and supervisors and more on the positive effect of centralized supervision on the independence and rigor of bank supervisors.

[2]See Falato, Kadyrzhanova, Sim, and Steri, 2022, for evidence that tangible assets are easier to use as collateral.

Our analysis contributes to several strands of the literature. First, our paper relates to the literature on optimal supervisory architecture. Beck, Todorov, and Wagner (2013) show that the timing of supervisory interventions is correlated with the share of a bank's foreign shareholders, deposits, and assets and thus a bias in national supervisory decisions on cross-border banks. Behn, Haselman, Kick, and Vig (2017) show that bail-out decisions taken by German politicians sitting on the board of failing banks lead to inefficient bail-outs, implying that the proximity of public authorities to the bank is undesirable in this case. Calzolari, Colliard, and Loranth (2019) show that centralized supervision can induce multinational banks to change their legal structure, so as to extract more subsidies from deposit insurance. Boyer and Ponce (2012) caution that a central supervisor will be weaker against lobbying efforts than separate supervisors. Gornicka and Zoican (2016), Foarta (2018), and Segura and Vicente (2018) focus on the impact of bail-outs and recapitalizations in the Banking Union. Finally, Repullo (2018) theoretically assesses the optimal allocation of responsibilities, i.e., information collection and liquidation decisions, between a local and a central supervisor. While this literature focuses on the stability implications of the supervisory architecture, our paper focuses on the real effects of one specific change in this architecture whereby direct supra-national supervision of banks is introduced in a large and diverse economic area.

Second, our paper adds to a small but expanding literature on the effect of supervisory architecture and actions on bank behavior. This literature has mostly exploited the US case where similar banks in close proximity, or even the same banks, can be supervised by different authorities, allowing for a discontinuity-type analysis. Using the exogenous variation stemming from the fact that state banks in the US are supervised by state or federal supervisors on a rotating basis, Agarwal, Lucca, Seru, and Trebbi (2014) show that federal supervisors are twice as likely as state supervisors to downgrade the bank they supervise, suggesting that local supervisors are more lenient than central supervisors.[3] Gopalan, Kalda, and Manela (2021) show that closing local branches of the federal authority responsible for supervising nationally-chartered banks in the US leads neighbouring banks to take significantly more risks, suggesting that geographic proximity increases supervisory efficiency. This finding is confirmed by Delis and Staikouras (2011) who show a negative relationship between the number of on-site

[3]For corroborating evidence, see also Kang, Lowery, and Wardlaw (2015), Rezende (2016), and Danisewicz, McGowan, Onali, and Schaeck (2018).

inspections and bank risk in an international sample. Again for the US, Hirtle, Kovner, and Plosser (2020) find that the top-ranked banks that receive more supervisory attention hold less risky loan portfolios, are less volatile, and are less sensitive to industry downturns. Granja and Leuz (2017) document that the extinction of the thrift regulator (Office of Thrift Supervision, OTS) following Dodd-Frank led to stricter supervision of former OTS banks, and resulted in higher business lending. Kandrac and Schlusche (2021) show that the reduction in bank supervision and examination driven by experienced supervisors quitting their job increases bank risk taking, leading to risky lending, faster asset growth, and a greater reliance on low-quality capital. Finally, Ivanov and Wang (2024) show that following a supervisory rating downgrade of a specific syndicated loan, lead banks lower their internal risk assessments, decrease loan commitments, and exit lending relationships.

In related work, Bonfim, Cerqueiro, Degryse, and Ongena (2023) exploit information on a unique series of authoritative on-site inspections of bank credit portfolios in Portugal to investigate how such inspections affect banks future lending decisions. They find that following an on-site inspection, a bank becomes significantly less likely to refinance a firm with negative equity, implying that more hands-on supervisors are less likely to tolerate zombie lending by commercial banks.

Our paper contributes to this literature in three distinct ways. First, we provide a comprehensive analysis of the link between supervision and bank lending and risk taking in Europe, adding to a literature dominated by US studies. Second, we focus on a systematic change in supervisory architecture, moving banks that make up around 80% of total banking sector assets in the euro area into a new supervisory framework, with a more prominent role for centralized rather than local (national) supervisors. Thus, relative to the analysis of on-site supervision of Portuguese banks, we exploit a continent-wide supervisory reform that makes it possible to describe empirical regularities that transcend an individual country and thus put to rest concerns about external validity. Third, and crucially, we are the first to analyse the transmission of supervisory reform to firms' investment decisions.

Finally, our paper also adds to a small empirical literature focusing specifically on the effect of the introduction of the SSM on banks' behavior in the euro area. Fiordelisi, Ricci, and Stentella Lopes (2017) show that banks that expected to come under the supervision of the SSM reduced their lending activities and increased their capital ratios in comparison with banks below the asset threshold for supervision by the SSM. This is in line with the findings of Eber and Minoiu (2016) who show that SSM-supervised banks reduced their asset size and reliance on wholesale debt over the period 2012-15, compared with banks that did not fall under the supervision of the SSM. It is also consistent with Altavilla, Boucinha, Peydro, and Smets (2020) who show that supranational supervision reduces credit supply to firms with very high ex-ante and ex-post credit risk, while stimulating credit supply to firms without loan delinquencies. Closest to our analysis is the work by Gropp, Mosk, Ongena, and Wix (2019) who find that the 2011 capital exercise by the European Banking Authority (an exercise similar to the Comprehensive Assessment that we study) induced some banks to increase their capital ratios by reducing their risk-weighted assets which led firms to reduce overall investment. While this literature has largely focused on the effect of bank supervision on the asset side of bank balance sheets, we go one important step further by focusing on the real effects of bank supervision—in particular, on the *composition* of firms' investment, crucially distinguishing between more capital-based (tangible) and more knowledge-based (intangible) investment. Our paper is thus the first to study how supervisory reform affects the mechanisms of economic growth in bank-dependent economies.

2 Institutional setting

On 29 June 2012, the heads of government of all euro area countries issued a statement announcing that the Commission would present proposals for the creation of a Single Supervisory Mechanism (SSM), underpinned by the necessity to break the vicious circle between banks and sovereigns. The SSM was meant to be the first element of the so-called Banking Union, which would be complemented by a single resolution mechanism and a common deposit scheme. The regulation on the SSM mandates the European Central Bank to exercise prudential supervision of all banks located in the euro area, whether directly by the ECB's own supervisory arm for the significant banks, or indirectly by the national prudential supervisors but under the general guidance of the ECB for the less significant banks.

An important step in preparing the SSM to become fully operational was the Comprehensive Assessment that took place between November 2013 and October 2014. Before that, in October 2013, the criteria guiding the classification of euro area banks into *Significant Institutions* (SIs, supervised directly by the SSM) and *Less Significant Institutions* (LSIs, supervised by national authorities) was published.[4] With this, the 2014 Comprehensive Assessment, which included an asset quality review and stress test, was a financial health check of 130 banks in the euro area, covering approximately 82% of total bank assets. The results were published on 26 October 2014, and on 4 November the SSM was born.

How are banks slotted into the two groups (SIs and LSIs)? The criteria for a bank being classified as an SI are the following: - size (the total value of its assets exceeds 30 billion); - economic importance (for the specific country or the EU economy as a whole); - cross-border activities (the total value of its assets exceeds 5 billion and the ratio of its cross-border assets/liabilities in more than one other participating Member State to its total assets/liabilities is above 20%); - direct public financial assistance (it has requested or received funding from the European Stability Mechanism or the European Financial Stability Facility).[5]

As of end-2023, the ECB directly supervises 113 significant banking groups in the participating countries. The actual supervisory activities are conducted by joint supervisory teams (JSTs) involving both ECB staff and national supervisory staff. Less significant institutions continue to be supervised by their national supervisors, in close cooperation with the ECB.

3 Data and matching

This section discusses the firm- and bank-level data we use to test the relationship between changes in the euro area supervisory framework and firms' investment behavior, as well as the matching procedure which we use in order to choose comparable sub-samples of "treated" and "control" firms.

[4]See https://www.ecb.europa.eu/pub/pdf/other/notecomprehensiveassessment201310en.pdf.

[5]See https://www.bankingsupervision.europa.eu/banking/list/criteria/html/index.en.html

3.1 Firm-level data and matching

3.1.1 Orbis data

Our firm-level data come from the Orbis data set provided by Bureau van Dijk (BvD). Orbis contains financial and ownership data for millions of firms world-wide.[6] For our analysis, we focus on EU companies with financial data in the period 2010−2017, and we work with unconsolidated accounts. We follow the downloading methodology and cleaning procedure described in Kalemli-Özcan, Sorensen, Villegas-Sanchez, Volosovych, and Yesiltas (2024) in order to ensure the database is nationally representative and contains minimal missing information. We first note that the number of firms varies significantly by country. For example, there are on average 372 firms per year in Cyprus, and 664,469 firms per year in France. Therefore, we make sure that we only analyse countries with good firm coverage by dropping those for which Orbis coverage relative to Eurostat is below 10%, namely the Czech Republic (8% coverage), Malta (4% coverage), and Cyprus (1% coverage).

In terms of firm-specific information, we make use of the following variables: total assets, tangible fixed assets, intangible fixed assets, other fixed assets, current assets, employment, long-term debt, short-term debt, cash flow, sales, and age. Our consistency checks make sure that balance-sheet identities hold within a small margin and entries are meaningful from an accounting point of view. We drop firm-year observations in which total assets, fixed assets, intangible fixed assets, sales, long-term debt, loans, creditors, other current liabilities, or total shareholder funds and liabilities have negative values. Furthermore, we drop firm-year observations for which some basic accounting identities are violated by more than 10 percent. These identities ensure that (i) total assets match total liabilities, (ii) total assets match the sum of fixed assets and current assets, and (iii) current liabilities match the sum of loans, trade credit and other current liabilities. We restrict our sample to firms which have at least one observation during the pre-Banking Union period (2010–2012), the Comprehensive Assessment period (2013–2014) and the SSM period (2015–2017), producing a balanced panel. We winsorize all variables at the 1% level, and we drop observations where period-on-period log differences are higher than 1 or lower than -1.

[6] For details on Orbis, see Kalemli-Özcan, Sorensen, Villegas-Sanchez, Volosovych, and Yesiltas (2024).

In addition, the Orbis database provides, for each company, the name of the main bank(s) the company conducts business with. For practical purposes, we focus on the firm's main bank. This information allows us to identify whether a company is related to a bank which became directly supervised by the SSM when it was established, or whether it is related to a bank which is only indirectly supervised by the SSM.[7]

The bank relationship variable provided is a self-reported text variable and thus can contain typos. We compare the list of creditors in Orbis to the list of Significant Institutions provided by the SSM. In the process, we manually check each entry to correct any reported typo (accents, upper vs. lower caps, etc.) to make sure the match with the list of directly and non-directly supervised banks is done properly. This variable is not available for all countries in the dataset.

3.1.2 Final sample construction

The firms in our sample may not be comparable on two margins. The first is the size of their creditor. SIs – or banks supervised by the SSM – are typically the country's systemically important institutions. As a result, they are significantly larger than the LSIs in our sample. This raises the possibility that we are comparing dissimilar firms because their creditors are different not only in the dimension of who supervises them, but also in terms of access to liquidity, internal capital markets, etc. If so, then observable differences across the two types of firms may have less to do with supervision and more with intrinsic differences across creditors. To make sure that we are comparing firms borrowing from relatively similar banks, we exclude firms borrowing from the 2 largest SIs and firms borrowing from LSIs other than the 5 largest, in each country.

Second, firms borrowing from SIs and LSIs may themselves be different. In Table 1, we report summary statistics for a range of firm-specific balance sheet characteristics during the the pre-treatment period (2010 − 2012). In Panel A, we document significant differences across firms, depending on which group of banks they have a credit relationship with. In particular, firms borrowing from banks that switched from being supervised by national supervisors to being supervised directly by the SSM

[7] We note that the firm-bank relationship in Orbis is based on a snapshot taken in 2013 and thus sticky over the sample period.

are smaller and older and have higher net worth and cash flow-to-assets ratios, as well as lower debt-to-asset ratios. Simply controlling for these on the right-hand side of the regressions might be insufficient if the distributions of these variables across treated and control samples do not overlap sufficiently (see Rosenbaum and Rubin, 1983).

To address this point, we proceed to apply a propensity-score matching criterion for choosing the treatment and control observations. In particular, for each firm, we calculate a propensity score based on the firm-level variables considered in Panel A of Table 1. We then use nearest neihbor propensity score matching to match observations across groups, using a probit model to estimate the probability of a firm being attached to a SI, as opposed to being attached to a LSI.

Panel B of Table 1 documents the differences between the variables of interest across the two groups of firms in this reduced (matched) sample. After matching on observable firm-level characteristics and on bank size, "treated" and "control" firms are no longer statistically different in any dimension.

These matching and selection procedures thus ensure that we are comparing "treated" and "control" firms that are similar on observable characteristics, as well as attached to banks of a similar size. After applying the two procedures, we are left with a sub-sample of 119,713 firms in 12 euro area countries (Austria, Estonia, France, Germany, Greece, Latvia, Lithuania, Luxembourg, Netherlands, Portugal, Slovenia, and Spain)[8] borrowing altogether from 1,946 banks belonging to 139 banking groups. Of these, 1,131 belong to 79 SI groups, and 815 belong to 60 LSI groups. This is a reduction of almost 40% relative to the starting sample of 199,065 firms and 3,377 banks. The resulting sample is slightly more balanced in terms of bank associations: 77.1% of firms have a relationship with a Significant Institution, as opposed to 80.5% in the unmatched sample.

In Table 2, we report summary statistics for all firm outcomes considered in the paper, for this matched sample and for the full sample period (2010 – 2017). The data imply that on average, during the full sample period, tangible and intangible assets decreased by 5.6 and 7.1 percent, respectively, while total assets and current assets increased by 1.2 and 1.1 percent, respectively.[9] Firm-level employment declined on average by 1.1 percent, while TFP declined by about 1.2 percent. The table also

[8]The main reason for the significant reduction in the number of countries is the lack of a reported firm-bank link.

[9]We note that due to data limitations, depreciation is not taken into account when computing investment.

makes it clear that during the full sample period, the firms in our sample deleveraged substantially: overall debt declined by 4.8 percent, which is largely driven by a substantial decline in long-term debt (by 7.3 percent).

3.2 Bank-level data: IBSI

We make use of two datasets which contain detailed bank-level balance sheet information. The first one is the ECB's Individual Balance Sheet Statistics (IBSI) dataset. This high-frequency data source contains end-of-month data on assets and liabilities, starting in August 2007, for 247 individual financial institutions in 18 European countries, comprising about 70 percent of the domestic banking sector. Banks are observed at an unconsolidated level, and therefore the dataset captures both domestic banks and affiliates of foreign banks active in a country. The data contains information on the stock of total lending, as well as on the stock of lending to various classes of customers, such as governments, non-financial corporations (NFCs) and households. Furthermore, the data allow us to distinguish between lending to domestic customers and customers from other euro area countries.

We focus on the same 12 euro area countries and the same set of banks that we arrived at in the Orbis database after the bank selection and matching procedure. As 5 of these are absent in IBSI, we end up with 126 banking groups from 7 euro area countries (Austria, France, Germany, Greece, Luxembourg, Netherlands, and Spain), down from 186 banking groups from the same 7 countries in the unmatched sample.

3.3 Bank-level data: SSM

The second bank-level dataset that we use is gathered and harmonized by the SSM itself. More specifically, we use data coming from the financial reporting (FINREP) framework. The FINREP framework, provided by the European Banking Authority, ensures that homogeneous financial (accounting) information across all European credit institutions is reported to the regulator. In particular, we use template F 06.00 ("Breakdown of loans and advances to non-financial corporations by NACE codes") which contains information on total loans granted by each credit institution to each Level 1 NACE code sector (18 sectors overall).

From FINREP, we extract data on total loans by an individual bank to firms in a sector in a country in an individual month. Next, we aggregate the information across firms and months, as well as across two classes of banks: SIs and LSIs. The final dataset contains data on the share of total lending by SIs, out of total lending by both SIs and LSIs, to an individual sector in an individual country in a year. We generate these data for the 12 countries in our final Orbis dataset, for 2010–2012, 2012–2014, and 2014–2017. Thus, our data allows us to proxy for overall exposure to SI lending by a country-sector.

3.4 R&D data: EU KLEMS

We complement the supervisory data just described with data coming from the 2019 release of the EU KLEMS database run by the Vienna Institute for International and Economic Studies. The EU KLEMS Release 2019 provides a database on measures of economic growth, productivity, employment, capital formation, and technological change at the industry level for all European Union member states. Productivity measures have been developed using growth accounting techniques. In addition, the EU KLEMS Release 2019 provides supplementary indicators on intangible assets, including expenses on Research&Development (R&D).[10]

From EU KLEMS we extract data on total R&D investment in an individual sector in an individual country in a given year. For consistency, we aggregate the data for the same 18 Level-1 sectors as in FINREP. We then calculate the change, year-on-year, in this variable. Once again, we generate these data for the 12 countries in our final Orbis dataset, for 2010–2012, 2012–2014, and 2014–2017. Thus, our data allows us to proxy for overall changes in total R&D investment in a country-sector.

4 Empirical strategy

Our goal is to study differences in investment behavior across firms, distinguishing between firms with credit relationships with banks directly and indirectly affected by the introduction of the Single

[10]See Stehrer et al., 2019, for further details on the methodology for the database construction.

Supervisory Mechanism (SSM). To that end, we estimate the following panel regression model with multi-dimensional fixed effects:

$$\Delta log\, K_{fbcst} = \beta_1 SI_{fbcs} \times Post\, 2012_t + \beta_2 SI_{fbcs} \times Post\, 2014_t + \mu_f + \phi_{cst} + \varepsilon_{fbcst}, \qquad (1)$$

where $\Delta log\, K_{fbcst}$ is the year-on-year log difference in investment by firm f, borrowing from bank b, located in country c, operating in sector s in year t. We distinguish between four different types of capital. Specifically, *Tangible assets* denote assets such as buildings, machinery and equipment, while *Intangible assets* denote assets such as R&D and on-the-job training. The difference between the two types of assets is that tangible assets are preferred by banks in loan contracts, as unlike intangible assets, they are redeployable. *Current assets* stand for cash and other short term assets that are expected to be converted to cash within a year. Finally, *Total assets* denotes for the sum of the firm's various types of assets.[11]

Turning to the explanatory variables, SI is a dummy variable equal to one if the firm is borrowing from a Significant Institution, i.e., from a bank which during the period 2013–2014 underwent the Comprehensive Assessment and was placed under the direct supervision of the Single Supervisory Mechanism in late 2014.

We interact the variable SI with time dummies to construct a difference-in-differences set-up. To account for the independent effects of the Comprehensive Assessment, which took place in 2013 and in 2014, and the implementation of the SSM, which took over direct supervision of SIs in November 2014, we include two time dummies. $Post\, 2012_t$ is a dummy variable equal to one in 2013 and 2014. $Post\, 2014_t$ is a dummy variable equal to one in 2015–2017. The pre-Banking Union period is thus 2010–2012. We choose 2012 as the last year of the pre- period because the list of significant versus less significant institutions was announced in March 2013, which is when the Comprehensive Assessment started for those.

In our main model, we directly address the possibility that within a firm, investment decisions may be correlated over time. Our original data is at the annual frequency. However, by estimating a model

[11] We omit from the analysis *Other fixed assets* which stand for fixed assets on the firms' balance sheets which are neither tangible nor intangible.

where changes in investment are observed within a firm for as much as eight years in a row, we would be introducing the possibility of biased point estimates due to the presence of autocorrelated standard errors over time within a firm. To address concerns about autocorrelation, and following Bertrand, Duflo, and Mullainathan (2004), we estimate Equation (1) after first collapsing the underlying annual data into one observation per firm-period. More precisely, we aggregate information on the different types of investment under consideration into one pre-SSM observation (i.e., over the period 2010–2012), one Comprehensive Assessment observation (i.e., over the period 2013–2014), and one post-SSM observation (i.e., over the period 2015–2017). We only use firms for which we have at least one underlying observation in each of the three periods.

We include firm-fixed effects μ_f to control for unobservable firm-specific time-invariant factors explaining variation in investment behavior. The term ϕ_{cst} is an interaction of country, sector and period dummies, which absorbs any time-varying shocks to demand or to technology specific to a particular sector in a particular country during a particular year (e.g., construction services in Spain or production of heavy machinery in Germany in 2014). This allows us to control more tightly for the confounding effect of regional factors, such as local demand or technology, on individual sectors. Identification is thereby achieved by comparing the average investment levels of two observationally equivalent firms in the same country borrowing from significant versus less significant financial institutions. Finally, ε_{fbcst} is the idiosyncratic error term.

In most of the analysis we do not include firm controls on the right-hand side, because most move slowly and so are collinear with the firm fixed effects. However, in later robustness tests we control for variables such as the logarithm of total assets, the ratio of cash flow to total assets, net worth (defined as the difference between total assets and total liabilities, divided by total assets), the ratio of debt to total assets, and age. The inclusion of these variables allows us to capture the independent impact of various firm-specific developments, such as shocks to overall debt, profits, cash flow, or assets. We also interact the firm controls with the dummies $Post2012$ and $Post2014$, to control for the time-varying effect of firm-specific controls on firms' investment patterns.

We do not include the variable SI separately in the model specification above because its direct effect on investment is absorbed by the firm fixed effects. Analogously, we do not include the variables

*Post*2012 and *Post*2014 on their own because their direct effect on investment is absorbed by the country-sector-year fixed effects.

Finally, in all regressions, we cluster the standard errors at the country-SI level. This accounts for the fact that the SSM shock applies to bank groups within a country. In robustness tests, we show that the main results in the paper are robust to clustering the standard errors at different levels, such as bank, country, or country-SI-period.

The coefficients of interest are β_1 and β_2. A negative coefficient β_1 (β_2) would imply that all else equal, investment of a specific asset type declines for firms whose bank is now subject to SSM supervision, relative to firms whose lender is not subject to change in supervision, during the Comprehensive Assessment period (the SSM period). The point estimates of β_1 and β_2 thus measures the numerical change in investment from switching the firm from the control group to the treatment group.

One potential source of bias is that even if treatment is randomly assigned, spillover effects between treated and control banks/firms are possible. For example, firms may be likely to increase their reliance on non-treated banks, while simultaneously reducing reliance on treated banks after the roll-out of the SSM as both SSM and non-SSM banks operate in the same corporate lending markets. Berg, Reisinger, and Streitz (2021) show that such spillover effects could bias the treatment effects estimates, especially in models heavily saturated with fixed effects. However, we believe that if present, this potential bias is small and goes against us. For one, firm-bank relationships tend to be stable; for example, Dwenger, Fossen, and Simmler (2015) show that in Germany, less than 3% of firms switch across banks in an individual year (although this seems not to be the case in France; see Boualam and Mazet-Sonilhac (2023)). Second, if firms are moving from treated to non-treated banks, we would see less impact of the reform. In the extreme, we would see no effect because any firm that sees an increase in credit constraints or is asked for more tangible collateral would choose to move to a non-treated bank.

5 Empirical results

5.1 Baseline result

In Table 3, we present the headline results of the paper; specifically, the results from four different versions of Model (1) where the dependent variable is, in turn growth in *Total assets*, *Tangible assets*, *Intangible assets*, and *Current assets*. All regressions include firm fixed effects and country-sector-period fixed effects.

Column (1) of Table 3 shows that total assets increased during both periods, for firms borrowing from SIs relative to firms borrowing from LSIs, with the increase during the Comprehensive Assessment period being statistically significant. In column (2), we find that tangible assets also increased during both periods, significantly so during the SSM period. The evidence also suggests that during the Comprehensive Assessment period, firms borrowing from SIs experienced a significant increase in current assets (column (4)). The latter are defined as cash and short-term assets that can be easily converted into cash.[12] The data suggest that the growth in tangible (current) assets accelerated by 0.45 (0.19) percentage points during the SSM period (Comprehensive Assessment period). Both effects are sizeable given a mean value of -5.6% (1.1%) across our sample.

The increase in tangible assets and in current assets is mirrored by a significant decline in intangible investment for firms borrowing from SSM-supervised bank, relative to similar firms with a credit relationship with banks supervised by national authorities, during the Comprehensive Assessment period (column (3)). This investment is related to assets such as R&D that are difficult to collateralize as the bank cannot easily redeploy them. Given an average year-on-year decline in intangible investment in the full sample of 7.1 percentage points, the point estimates of -0.0020 suggest that for firms borrowing from SSM-supervised banks, intangible investment declined by 2.8% more than for similar firms whose banks continued being supervised by a national authority.

[12]This result is consistent with a general increase in cash holdings by firms, as documented by, among others, Bates, Kahle and Stulz (2009), including for Europe (Beck, Peltonen, Perotti, Serano, and Suarez, 2023). The literature has offered different reasons for this trend, including an increasing reliance on intangible assets that are difficult to fund with bank or other debt.

The totality of evidence presented in Table 3 suggests that after the announcement of the SSM, and relative to firms borrowing from Less Significant Institutions, firms borrowing from SSM-supervised banks reallocated investment away from intangible assets, first towards current assets and later towards tangible assets. The evidence in Table 3 is consistent with the idea that the centralization of supervision following the announcement and implementation of the SSM was associated with an overall increase in firm investment, which however masks an important adjustment in the types of assets firms invest in. In particular, firms moved away from long-term intangible investment, such as investment in R&D, and towards investment in cash and property, plant and equipment. At the same time, intangible investment is associated with TFP-enhancing activities, which are fundamental for economies at the forefront of technological progress (e.g., Fernald and Jones, 2014; Corrado and Hulten, 2010). The evidence therefore suggests that centralized supervision may have pushed banks to reduce their support for the "new", knowledge-based economy and increase their support for the "traditional", capital-based economy.

Our findings are consistent with Gropp, Mosk, Ongena, and Wix (2019), but also suggest that when analysing the real effects of regulatory policies affecting banks' balance sheets, it is important to look at the composition of firms' investment, because different components of firms' assets can be affected differently.

We also need to mention that the explanatory power of the tests is quite high. In the range of four different specifications, the variation in attachment to particular sets of banks, together with firm fixed effects and country-sector-year fixed effects, explains between 37% and 44% of the variation in investment rates over time.

What is the aggregate effect? Take the decline in intangible investment that we document in Table 3, column (3). Around four-fifths of the firms in our sample are borrowing from SIs, and an SI firm has on average intangible assets that are a quarter higher than the intangible stock of a firm borrowing from an LSI. Consequently, 5/6 (or 0.83) of the intangible capital in the economy is held by firms borrowing from SIs. Therefore, the decline in intangible investment for firms borrowing from SIs of 2.8% due to the introduction of the SSM implies an aggregate decline in intangible investment of 0.83 x 2.8% = 2.3% over the period 2014-2016.

5.2 Parallel trends

There are two sources of bias that may be compromising our analysis and that we need to address. The first bias is that the trends we capture precede the announcement and implementation of the SSM. In other words, firms borrowing from banks that switched from national to supra-national supervision were reallocating investment away from intangible and towards tangible assets already before the Banking Union. If so, then we are simply picking a continuation of longer-term trends.

The results in Table 4 mitigate the concerns that our findings are driven by trends independent of the change in supervisory architecture. We now test for the parallel-trends assumption, i.e., for whether the treatment and the control group were subject to the same trend in investment before the treatment took place, or not. In practice, we estimate the following model:

$$\Delta log\, K_{fbcst} = \beta_1 SI_{fbcs} \times Post\, 2010_t + \mu_f + \phi_{cst} + \varepsilon_{fbcst}, \tag{2}$$

In this model, we only look at the pre-treatment period, and we split it into years 2009 and 2010 (pre-period) and years 2011 and 2012 (post-period). We then aggregate the data into one observation per period, and we compare investment rates across the two periods. If the same trends documented in Table 3 are already visible before 2012, then the parallel-trends assumption would be violated and our results would be compromised.

The point estimates from Equation (2), reported in Table 4, clearly suggest that there were no different trends across treatment and control firms before the announcement and the implementation of the SSM. While intangible assets were already declining over time before the announcement of the SSM in 2012 for firms that borrowed from future significant institutions, this relative decline was not significant at any acceptable statistical level (column (3)). Similarly, both tangible and current assets were on the decline during this period for these firms relative to firms that borrowed from future less significant institutions, but this relative decline was again not statistically significant. Put differently, regardless of the overall trend in different types of investment, this trend was not different for firms borrowing from SIs relative to firms borrowing from LSIs.

Figure 1 plots the series of coefficients and corresponding 90% confidence intervals from estimating regressions analogous to Equation (1), in which we replace $Post2012$ and $Post2014$ with a sequence of year dummies spanning the estimation period. The point estimate is thus a difference-in-differences coefficient measuring the differential time effect for firms borrowing from Significant Institutions were investing at the same rate as firms borrowing from Less Significant Institutions. The reference year is 2011, the year immediately before the introduction of the Banking Union. The timing evidence corroborates a causal interpretation of our results. The plot shows no evidence of pre-trends for any of the four types of assets, meaning that firms borrowing from SIs were investing at the same rate as firms borrowing from LSIs. After 2012, however, total assets increase, as do tangible and current assets, and intangible assets decline, for firms borrowing from SIs, compared to firms borrowing from LSIs.

5.3 Placebo test

The second source of bias may be that after 2013, tangible and current investment increased, and intangible investment declined, for all firms borrowing from SSM-eligible (i.e., larger) banks, regardless of whether the SSM actually took over the supervision of these banks. This evolution may have been driven by other regulatory reforms, too: for example, around the same period, the larger, more systemic banks in the euro area also became subject to additional O-SII capital buffers (e.g., Cappelletti et al., 2019).

To address this concern, we add to the analysis a sample of firms from Croatia, Denmark, Hungary, Poland, and the United Kingdom. None of these countries was a euro-area member state during the sample period, meaning that its domestic banks did not move to being centrally supervised by the SSM after 2014. We then apply the SSM criterion to the banks which the firms in Orbis have a credit relationship with. 65 percent of the firms in this new sample are borrowing from one of the pseudo-SSM banks.

With these data in hand, we now run the following specification:

$$
\begin{aligned}
\Delta log\, K_{fbcst} = \quad & \beta_1 SI_{fbcs} \times Post\, 2012_t \times EA + \beta_2 SI_{fbcs} \times Post\, 2014_t \times EA \\
& \beta_3 SI_{fbcs} \times Post\, 2012_t + \beta_4 SI_{fbcs} \times Post\, 2014_t + \mu_f + \phi_{cst} + \varepsilon_{fbcst},
\end{aligned} \tag{3}
$$

where EA is a dummy equal to one if the firm is in the euro area, and to 0 if it is in a non-euro-area European country.

The estimates from Equation (3) are reported in Table 5. We find that with the exception of current assets, the evolution of investment that we documented in Table 3 – namely, a reallocation of investment from intangible to tangible assets – is a euro-area phenomenon and not a global one. This suggests that our results are not driven by other, EU-wide reforms such as the introduction of the O-SII buffers. Moreover, total assets decline, for EA firms borrowing from SIs, relative to similar non-EA firms. At the same time, we note that there are only 28,737 firms from five countries in the placebo samples, as opposed to 119,713 firms from 12 countries in the main sample, resulting in an unbalanced test.

5.4 Sector-level R&D expenses

In the analysis presented so far, we have used information on the intangibles accounting entry of firms' balance sheets. A possible concern relates to the fact that this entry contains elements that are not part of an active decision on the firm to invest in productive assets (e.g., goodwill). From our available data sources, it is not possible to obtain information on the different components of intangible assets at the firm level. In particular, there is no information on firm-level R&D investment in Orbis. To address this issue, we turn to the 2019 release of the EU KLEMS database run by the Vienna Institute for International and Economic Studies. The EU KLEMS Release 2019 provides measures of economic growth, productivity, employment, capital formation, and technological change at the industry level for all member states of the European Union.

More importantly for our purpose, the database provides supplementary indicators on intangible assets, and in particular contains a measure of the annual expenditure on R&D at the sector level, for each country in our analysis. We merge this data with information coming from the SSM on banks' lending to different industrial sectors. From there, we calculate a proxy for the share of total lending coming from Significant Institutions, for each sector in each country.[13]

With these data in hand, we run the following regression:

$$\Delta log\, R\&D_{cs} = \beta_1 ShareSI_{cs} + \beta_2 \Delta GrossOutput_{cs} + \mu_c + \phi_s + \varepsilon_{cs}, \quad (4)$$

Here, $\Delta R\&D_{cs}$ is the change in R&D expenses by sector s in country c over a given period. $ShareSI_{cs}$ is the share of total lending in each sector s and country c coming from Significant Institutions in 2014 (the first year in which the SSM records this information). $\Delta GrossOutput_{cs}$ is the change in gross output generated by sector s in country c within a two year period. We also control for country and sector fixed effects. The two change variables are trimmed at the 1st and 99th percentile to mitigate the impact of outliers. We run this regression for three different two-year periods: 2010-2012 (pre-SSM), 2012-2014 (Comprehesive Assessment) and 2014-2016 (post-SSM). The first period regression acts as a type of control, in which we should not expect the share of SI lending to have an effect on the R&D expenses. For the two subsequent periods, the Comprehensive Assessment and post-SSM periods, our hypothesis is that a larger share of SI lending would result in a decrease in R&D expenses. This prior is in line with the main results on investment in intangibles presented in the sections above.

The results in Table 6 show that while the share of SI lending does not play a significant role in determining the evolution of R&D expenses in the period before the SSM was established (column (1)), those sectors with a relatively large share of lending coming from SIs saw a decline in total R&D expenses between 2012 and 2014 (column (2)). The effect is statistically significant and persists over time after the SSM was established (column (3)). The size of the effect is also non-negligible. Numerically, the change in R&D expenses in a sector with a share of SI lending at the 75th percentile of the distribution is 0.34 percentage points lower than that of a sector with a share of SI lending

[13] Both EU KLEMS and SSM data report sector information using NACE codes. EU KLEMS data combines together sectors "M: Professional, scientific and technical activities" and "N: Administrative and support service activities", so we combine those 2 sectors in the SSM data. We are thus left with 17 sectors.

at the 25th percentile of the distribution, between the years 2012-2014. This compares to a median change in R&D expenses across sectors and countries of 2.75% during this period.

These results provide additional support to the main findings presented in Section 5.1. Our results thus suggest that during the Comprehensive Assessment period and the subsequent establishment of the SSM, firms borrowing from SSM-supervised banks reduced their investment in intangible assets relative to those supervised by non-SSM banks, and this is mirrored by a decline in R&D investment.

5.5 Robustness tests

We subject our estimates to a number of robustness tests, reported in the Appendix, aimed at making sure that the results reported in Table 3 are not an artefact of using a particular empirical set-up.

For a start, in Appendix Table 1 we confirm that the main results of the paper continue obtaining in the full sample, in the absence of propensity score matching. In this case, total assets increase in both periods, as do tangible and current assets. Intangible assets decline during the Comprehensive Assessment period, but not significantly so.

Next, the model estimated in Table 3 may be mis-specified because we do not control for other firm-level characteristics that can be correlated with investment decisions. In particular, changes in investment may be a function of the firm's size, debt, or profitability. The country-sector-period fixed effects that we employ allow us to control for trends that are common across firms within a country-sector, therefore, we are accounting for unobservable country-sector trends (such as TFP growth in the textile industry in Greece). Nevertheless, many of the important trends that drive investment can be at the firm rather than country-sector level.

To that end, in Appendix Table 2 we re-estimate a version of Equation (1) which includes a set of firm-specific controls: the natural logarithm of total assets, net worth, the ratio of total debt to assets, the ratio of cash flow to assets, and age. To address the possibility that these are jointly determined with investment, we measure these firm controls with a 1-year lag. Furthermore, we also include the interactions of these variables with the variables $Post2012$ and $Post2014$, though we do not report the coefficients. In this way, we allow for the possibility that the impact of, for example, debt overhang on intangible investment is different before and after the announcement of the SSM. The evidence confirms the main result of the paper. Namely, after the introduction of centralized supervision, and relative to firms borrowing from banks that continued being supervised by national authorities, firms borrowing from SSM-supervised banks experience an increase in total assets (column (1)) that is explained by a staggered increase first in current assets (column (4)) and then in tangible assets (column (2)). In contrast, intangible assets decline during the first period (column (3)).

Next, we note that our clustering scheme may be insufficiently conservative. It is possible that the standard errors are correlated across firms within countries or within country-bank classes, rather than within country-bank class-period, because of long-term factors. Alternatively, it is possible that the right clustering of the standard errors is at the bank level, because this is the unit of the shock induced by the supervisory reform.

In Appendix Tables 3-5, we report the estimates from Equation 1 where the standard errors are clustered by country, country-SI-period, and bank, respectively. In all three cases, the main result of the analysis – an increase in total assets driven by an increase in tangible and current, but not in intangible, assets – continues to obtain, even though the significance levels are sometimes below 10%.

Another way in which the model estimated in Table 3 can be misspecified is that in Equation (1) we do not control for other, non-SSM related shocks that may be affecting the level and composition of banks' credit supply. To address this possibility, in Appendix Table 6 we re-estimate Equation (1) after including bank fixed effects, in addition to firm fixed effects and interactions of country, sector, and period dummies. The point estimates of the coefficients of interest in Equation (1) continue to confirm the main results of the paper, namely, a reallocation of investment away from intangible and towards tangible and current assets.

Next, we note that our preferred Equation (1) is based on aggregated firm-specific data within three periods. This has resulted in three observations per firm out of possible eight. On the plus side, this allows us to flexibly deal with potential autocorrelation in the standard errors over time within a firm, which is consistent with the recommended approach in Bertrand, Duflo, and Mullainathan (2004). On the downside, our preferred approach has resulted in the loss of some information. We now run a version of Equation (1) where we still require that each firm has at least one observation in each of the three periods under consideration, but instead of collapsing the data, we use all possible observations over the course of 2010–2017.

We report the estimates from these alternative tests in Appendix Table 7 and find that even in this less restrictive specification, the estimates continue to lend strong support to the notion that supervisory reform is followed by a reallocation of investment. The evidence continues to suggest that relative to firms borrowing from less significant institutions, firms borrowing from SSM-supervised banks increased first current and then tangible assets, and decreased their investment in intangible assets during both periods, significantly so during the SSM period.

In Appendix Table 8, we re-run all tests on a sub-sample of firms that have at least one observations during each of the three periods for all dependent variables. The resulting sample is symmetric, addressing the concern that in our tests, we are dealing with a sample where the number of observations fluctuates from one test to another. The main results of the paper still obtain, even though the increase in current assets during the CA period, for firms borrowing from SIs, is no longer significant.

In Appendix Table 9, instead of the variable SI we employ, in the case of firms borrowing from SIs, a variable equal to the difference between 15 and the country-specific Supervisory Power Index of the country before the SSM reform (see Loipersberger, 2015). In this way, we measure the intensity of improvement in supervision resulting from the move to centralized supervision. The results are similar to those in Table 3, although the reduction in intangibles during the Comprehensive Assessment period is marginally insignificant (p-value of 0.15).

In Appendix Table 10, we drop firms borrowing from banks that received public assistance during the Global Financial Crisis.[14]. We lose about 21,000 observations, or 5.8% of the sample. The main results still obtain.

Finally, we check whether the amount of capital held by SSM banks at the time of the Comprehensive Assessment plays any role in our results. We run a regression similar to Equation (1) but including as main right hand-side variables the interactions of the common equity Tier 1 capital (right before the CA) with the CA period and with the SSM period dummies. Appendix Table 11 shows that these interactions are not significant for any of the investment categories in our analysis, except

[14]We collect data on individual banks from Igan et al., 2019

in the case of tangible assets where the effect is negative.

5.6 Firm, sector and country heterogeneity

5.6.1 Firm heterogeneity

Is the effect we document in the paper identical across firms attached to SIs, or is it driven by those of them that are credit constrained? The most natural way to address this question is to account for size and age. Both small firms (Berger and Udell, 1998) and young firms (Haltiwanger, Jarmin, and Miranda, 2013) have been shown to be more sensitive to changes in credit access, suggesting that size and age are fundamental factors that for higher sensitivity to fluctuations in market conditions.

To test for this possibility, we modify Equation (1) as follows:

$$\begin{aligned}\Delta log\, K_{fbcst} &= \beta_1 SI_{fbcs} \times Post\,2012_t + \beta_2 SI_{fbcs} \times Post\,2012_t \times Constrained_f \\ &+\beta_3 SI_{fbcs} \times Post\,2014_t + \beta_4 SI_{fbcs} \times Post\,2014_t \times Constrained_f \\ &+\mu_f + \phi_{cst} + \varepsilon_{fbcst},\end{aligned} \quad (5)$$

where $Constrained_f$ is, in turn, a dummy variable equal to one if the firm has fewer than 50 employees ($Small$) and a dummy variable equal to one if the firm is younger than ten-years old ($Young$). The coefficient β_2 (β_4) now measures the change in investment during the Comprehensive Assessment period (SSM period), for small versus large and for young versus old firms borrowing from affected versus non-affected banks.

The estimates of Equation (5) are reported in Table 7. While theoretically appealing, the mechanism related to credit constraints does not find systematic support in the data. The one exception is that young firms borrowing from SIs appear to be significantly more like to increase their investment in tangible assets during the Comprehensive Assessment period (Panel B). At the same time, small firms across the board increase tangible investment after 2014, suggesting that while the type of bank does not matter, general credit conditions improved after the introduction of the SSM.

5.6.2 Industry heterogeneity

Is the effect we document in the paper identical across the different sectors of the economy? Or is it stronger for some sectors? One natural margin to examine in answering this question is the sector's technological composition of investment. For example, some sectors at the forefront of the modern economy (biotech, high-tech, robotics) rely more on intangible investment, such as R&D and human capital, and less on tangible investment, such as machines. Other, more traditional sectors (textile, timber) rely relatively more on tangible investment and to a lesser degree on innovation and human capital. The effect we document in this paper–a firm-level reallocation away from intangible and towards tangible investment–would have an even more profound effect if it took place in sectors that are technologically more suited to intangible asset growth.

To test for this possibility, we modify Equation (1) in the following way. First, we create a sector-level variable which denotes the sector's technological innovation intensity. Then we interact this sectoral benchmark with the interaction of the SI dummy and the $Post$ dummy, as follows:

$$\begin{aligned} \Delta log\, K_{fbcst} &= \beta_1 SI_{fbcs} \times Post\,2012_t + \beta_2 SI_{fbcs} \times Post\,2012_t \times Innovation_s \\ &+\beta_3 SI_{fbcs} \times Post\,2014_t + \beta_4 SI_{fbcs} \times Post\,2014_t \times Innovation_s \\ &+\mu_f + \phi_{cst} + \varepsilon_{fbcst}, \end{aligned} \tag{6}$$

where $Innovation_s$ is a sector-level benchmark that is common to all firms in the same sector. We omit the interactions $Innovation_s \times Post_t$ and $SI_{fbcs} \times Innovation_s$ because they are subsumed in the country x industry x period fixed effects. The coefficient β_2 (β_4) now measures the change in investment during the Comprehensive Assessment period (SSM period), for firms borrowing from affected versus non-affected banks, in innovation-intensive versus innovation-non-intensive sectors.

We borrow two proxies for $Innovation_s$ from Hsu, Tian, and Xu (2014). The first one, R&D, is calculated as the sum of all R&D expenses divided by total sales reported by public firms in an industry between 1976 and 2006, globally. The second one, *Patents*, is calculated as the sum of all patents with the USPTO by non-government organizations or individuals in an industry between 1976 and 2006, globally. Both proxies capture, in one way or another, a similar aspect of the sector's technology that is related to innovation, or intangibles-based growth. Finally, the underlying data are only available for the manufacturing sector, and as a result, the number of observations declines relative to the previous tests.

The estimates of Equation (6), reported in Table 8, show a strong reduction in intangible assets during the CA period, in particular in sectors that are innovation-intensive. In this reduced sample of manufacturing sectors, we no longer find any effect of the supervisory reform on tangible assets or on current assets. The strong and significant reduction in intangible assets, on the other hand, holds regardless of whether we define innovation intensity using data on R&D levels (Panel A) or on patents (Panel B). In both cases, the decline is significant at the 1% statistical level.

Our evidence thus suggests that the reallocation away from more towards less TFP-enhancing investment we documented in Table 3 is affecting the sectoral asset composition, too. As a result, more innovative sectors are moving away from assets that are to a larger degree associated with innovation. Given that in the long-run, around 60% of GDP growth is due to R&D investment (Fernald and Jones, 2014), our evidence suggests that stability-enhancing supervision may have adverse consequences for some of the channels of long-term growth.[15]

5.6.3 Country heterogeneity

One final source of plausible heterogeneity is related to observable characteristics of the country's credit markets. We hypothesize that the effects we observe can be amplified by variations in the extent of credit market competition. To test for this possibility, we modify Equation (1) as follows:

$$
\begin{aligned}
\Delta log\, K_{fbcst} &= \beta_1 SI_{fbcs} \times Post\, 2012_t + \beta_2 SI_{fbcs} \times Post\, 2012_t \times HHI5_c \\
&+\beta_3 SI_{fbcs} \times Post\, 2014_t + \beta_4 SI_{fbcs} \times Post\, 2014_t \times HHI5_c \\
&+\mu_f + \phi_{cst} + \varepsilon_{fbcst},
\end{aligned} \tag{7}
$$

where $HHI5_c$ denotes the market share of the five largest banks in the country. We take this

[15] In Appendix Table 12, we present tentative evidence that firms in R&D- and patent-intensive sectors are more likely to exit if they borrow from SIs – under the strong assumption that firms with no investment observations in Orbis no longer exist.

information from Henriksson and Otosson (2021). There is substantial variation in this variable in our sample, from 0.30 in Germany to 0.91 in Estonia. The coefficient β_2 (β_4) now measures the change in investment during the Comprehensive Assessment period (SSM period), for firms in less versus more competitive credit markets, borrowing from affected versus non-affected banks.

The estimates of Equation (7) are reported in Table 9. We find that for some types of investment, local banking markets matter, at least in the short run. In particular, the propensity of firms borrowing from SIs to reallocate investment away from intangible is stronger in less competitive credit markets (column (3)). More surprisingly, the same appears to be true of tangible assets (column (2)).

5.7 Employment and labor productivity

In this subsection, we address two important questions. The first concerns the degree of complementarity between investment and employment. The extent to which capital and labor are complements or substitutes in production is typically driven by the firm's technology. At the same time there may be important differences among various types of investments. For example, in the presence of strong skill bias, labor should move in the same direction as intangible investment. In contrast, if labor is mostly low-skill, it will likely move in the same direction as investment in fixed assets, such as land, building, and machines. Moreover, the impact of supervisory reform on employment is an important question on its own, and its answer provides additional insights to the welfare implications of the policy we study.

To address this issue, we now estimate a version of Equation (1) where the dependent variable is in turn the between-period growth in employment and in TFP. 'Employment' is calculated as number of employees, while 'TFP' is calculate as the Solow residual from a regression of sales on employment and total assets, controlling for for firm and country-sector-time fixed effects.[16] As before, the main variable of interest is the interaction between an indicator variable equal to one if the firm has a credit relationship with a bank affected by the introduction of the SSM, and two indicator variables equal to one during 2012–2013 and after 2014, respectively, for all firms. The regressions also include firm and country-sector-period fixed effects.

[16] Note that Orbis does not allow us to distinguish between skilled and unskilled labor.

The results from these tests are reported in Table 10. The point estimates on the employment equation suggests that the increase in tangible assets during the SSM period is accompanied by an increase in employment (column (1)). This suggests that labor and capital are complements in production.

In the case of TFP growth, the data fail to reject the null hypothesis of no effect of the announcement and implementation of the SSM (column (2)). While TFP growth does decline during both the Comprehensive Assessment and the SSM period, this decline is not statistically significant.

The evidence documented in Table 10 thus suggests that at least in the short-to-medium run, the additional safety (in terms of lower bank risk) promoted by the introduction of the SSM has not come at the expense of lower long-term growth, as proxied by a reduction in firm-level productivity. At the same time, the literature has also suggested that the period between R&D investment and filing a patent is between five and ten years (Kordal, Cahoy, Minkabo, and Sherer, 2016). This leaves the door open for a long-term decline in firm productivity driven by the decline in intanigble and R&D investment documented in Tables 3 and 6.

5.8 Supervisory reform and the evolution of lending

So far, we have focused mostly on different investment types, as well as employment and productivity as outcome variables. To better understand the mechanisms, through which changes in supervisory architecture affects investment and productivity, we now turn to lending, first using firm-level and then bank-level data.

5.8.1 Analysis based on firm-level data

Our evidence so far raises the natural question of the channel whereby changes in the quality of supervision affect firm investment. One possibility is a reduction in bank lending. A stricter supervisor can ask banks to lower the risk of their asset portfolios. Banks may respond to this demand by shrinking their lending portfolio and increasing their (sovereign) bond portfolio (see Fiordelisi, Ricci, and Stentella Lopes, 2017, for supporting evidence), which would account for the reduction in intangible investment at the firm level that we document. A second possibility is a change in the manner of lending. Banks may be extending the exact same amount of loans to non-financial corporations, but under stricter collateral rules. In this case, firms would be forced to change their investment pattern towards one where relatively more tangible assets are generated. This would account for both the increase in tangible investment and the decline in intangible investment that we document.

While the Orbis dataset does not include information on loan conditionality, we can test for changes in firm borrowing following the change in supervisory architecture. In addition to other types of financial information, firms report their overall indebtedness. We summarize this information in Table 2. We can now use it as an outcome variable and thus check for the impact of supervision on total debt, for treated relative to control firms.

To that end, we estimate the following equation:

$$\Delta log\ \frac{Debt_{fbcst}}{Assets_{fcst-1}} = \beta_1 SI_{fbcs} \times Post\,2012_t + \beta_2 SI_{fbcs} \times Post\,2014_t + \mu_f + \phi_{cst} + \varepsilon_{fbcst}, \qquad (8)$$

where the dependent variable is now the firm's total debt, the firm's short-term debt (maturity less than 1 year) or the firm's long-term debt (maturity more than 1 year), scaled by the firm's total assets. As before, the main variable of interest is the interaction between an indicator variables equal to one if the firm has a credit relationship with a bank affected by the introduction of the SSM, and two time indicator variables, *Post 2012*, which is equal to one in 2013–2014, and *Post 2014*, which is equal to one in 2015–2017, for all firms. The regressions also include firm and country-year fixed effects, and clustering is at the country-period level.

The results from these tests are reported in Table 11. They provide some statistical evidence that borrowing declined for firms linked to banks subject to the change in supervisory architecture. The data point to a decline in short-term debt during the Comprehensive Assessment period (column (2)). More importantly, the evidence points to a pronounced and significant decline in long-term debt during the SSM period (column (3)), which is mirrored by a decline in total debt (column (1)). Given a sample mean of -0.0728, the point estimates of -0.0089 implies a decline of around 12% in long-term debt after the implementation of the SSM.

We conclude that there is some evidence in the data to support the idea that following the intensification of supervision, banks reduced first short-term, and then long-term lending, to non-financial corporations. Given that intangible investment, such as investment in R&D, is by definition long-term, the effect we document in Table 11 can partially explain the reduction in intangible investment that we document in Tables 3 and 6. At the same time, an effect that we cannot document – safer lending based more than before on tangible collateral – could be at play, too, helping to explain the increase in tangible assets at the firm level after the start of the SSM.

5.8.2 Analysis based on bank-level data

We now assess the impact of changes in the supervisory architecture on lending using bank-level data. To that end, we employ the IBSI dataset. As discussed in Section 3.2, this high-frequency data source contains end-of-month data on assets and liabilities, starting in August 2007, for 247 individual financial institutions in 18 European countries. The initial dataset thus corresponds to about 70 percent of the euro area's banking sector. The data contains information on the stock of total lending, as well as on the stock of lending to various classes of customers, in particular NFCs which are the main focus of our analysis. The data allow for a further distinction between lending to domestic customers and customers from other euro area countries.

We focus on the same euro area countries and the same set of banks that we arrived at in the Orbis database after the bank selection and matching procedure. This leaves us with 126 banking groups from 7 euro area countries (Austria, France, Germany, Greece, Luxembourg, Netherlands, and Spain). As in the tests so far, we study both the impact of the Comprehensive Assessment and of the SSM itself.

Our main variable of interest is the change in NFC Lending, defined as the period-on-period difference in the natural logarithm of total lending to domestic NFCs. As before, and to account for potential serial correlation, given that the underlying data are monthly, we follow Bertrand, Duflo, and Mullainathan (2004) and we aggregate the information into three periods. The first period is the pre-Comprehensive Assessment period, which covers the period between January 2010 and December 2012. The second period is the Comprehensive Assessment period, which covers the period between

January 2013 and December 2014. The third period is the SSM period, which covers the period between January 2015 and December 2017. In this way, we analyze a 7-year period consisting of three sub-periods of unequal length.

With these data at hand, we estimate the following model:

$$\Delta \log NFCLending_{bct} = \beta SI_{bct} \times Post2012_t + \gamma SI_{bct} \times Post2014_t + \mu_b + \phi_{ct} + \varepsilon_{bct}, \qquad (9)$$

Here SI is a dummy variable equal to one if the bank is a Significant Institution, and to zero otherwise. Once again, there are three observations per bank, one for each period. Identification is strengthened by the inclusion of bank fixed effects, which allows us to hold control for unobservable time-invariant bank-specific factors. Furthermore, we include country-period dummy interactions, which allows us to net out the impact of country-specific shocks that are common to both Significant and Less Significant Institutions within the same country.

The results in column (1) of Table 12 point to a 7% reduction in total lending by SIs to domestic NFCs during the Comprehensive Assessment period compared to LSIs. This effect is significant at the 1% statistical level. The data thus strongly suggest that the reform in European supervisory architecture was associated with a reduction in lending both in the long run (Table 11) and in the short run (Table 12).

In column (2) of Table 12, we include interactions with bank capital on the right-hand side of Equation (8). We calculate bank capital as the average ratio of the banks' equity to total assets before the announcement of the SSM in 2012. The point estimates suggest that the decline in corporate lending during the Comprehensive Assessment (SSM) period was significantly larger (smaller) for SIs which had relatively low capital levels before the announcement of the SSM.[17] The coefficient on the triple interaction implies that during the Comprehensive Assessment period, an SI reduced corporate lending by a quarter of a standard deviation more if it was at the 25th, relative to the 75th, percentile of pre-SSM capital levels. This finding supports the notion put forth in Carletti,

[17]The first result in particular is reminiscent of prior evidence in the literature of a decline in lending during that period driven by the low capitalization of banks exposed to sovereign debt shocks (e.g., Popov and van Horen, 2015; Bofondi, Carpinelli, and Sette, 2018; and Bottero, Lenzu, and Mezzanotti, 2020).

Dell'Arriccia, and Marquez (2021) that the effect of supervision on bank risk taking crucially depends on the bank's degree of capitalization. The findings on lower lending by Significant Institutions after the announcement of the SSM is consistent with previous research by Fiordelisi, Ricci, and Stentella Lopes (2017), Eber and Minoiu (2016), and Altavilla, Boucinha, Peydro, and Smets (2020).

The estimates reported in Tables 11 and 12 thus allow us to tentatively conclude that at least in part, the reduction in intangible investment for firms with credit relationships to SSM banks appears to be driven by a reduction in overall lending by such banks to their corporate clients.[18]

6 Conclusion

Theory provides opposing hypotheses regarding the effect of supervisory architecture on bank lending and thus corporate finance. On the one hand, centralized supervision might be more effective, if bank supervision exhibits scale economies. Centralized supervision might also be better able to reduce the risk of banks arbitraging differences in regulatory stringency across countries. On the other hand, centralized supervisors' ability to extract information from banks may be lower. Centralized supervision can also reduce the monitoring of firms, if it reduces the incentives for local supervisors to collect information. These conflicting theories have corresponding conflicting predictions about the impact of different supervisory organizations on bank lending and risk taking, as well as on the decisions that firms borrowing from affected banks take.

In this paper, we take this theoretical ambiguity to the data, using the introduction of the SSM as an exogenous shock to how some (but not all) euro-area firms' lenders are supervised. We find that relative to firms with credit relationships to banks that remained under the supervision of national authorities, firms borrowing from SSM-supervised banks reduced investment in intangible assets. The

[18] In Appendix Table 13, we report one final robust version of Equation (1), where we use the contemporaneous change in firm-level debt instead of the SSM identifier. The evidence strongly suggests that firms which increased their level of long-term debt increased their total assets, an effect driven by an increase in current assets (column (4)) and especially in intangible assets (column (3)). This supports the notion that two of the three main results of our analysis – the reduction in intangible investment and increase in current assets – are partially explained by an SSM-driven reduction in long-term bank lending.

same firms also increased cash holdings in the short-run, and investment in tangible assets in the long run. These effect are robust to controlling for observable and unobservable firm heterogeneity, to controlling for country trends, to controlling for firm-specific balance sheet shocks, to comparing very similar distributions of treated and control firms, and to controlling for bank connections. Importantly, these trends do not pre-date the announcement and introduction of the SSM, and they are not observed in counterfactual tests in countries that did not join the SSM.

The main effect in the paper is stronger in innovation-intensive industries. We also find that the decline in intangible investment at the firm level is mirrored by a decline in R&D investment at the sector level. This points to a potential negative long-run effect from the reduction in productivity-enhancing investment. Finally, we also find that part of the effect in the paper is explained by a reduction in overall lending, and especially by long-term lending, by banks affected by the supervisory reform.

Overall, our results suggest that centralized bank supervision is associated with a decline in lending to firms, which is accompanied by a shift away from intangible investment and towards more cash holdings and higher investment in easily collateralizeable physical assets. This is an instructive result, in light of the fact that in the long run, capital investment has a negligible contribution to economic growth, while R&D investment accounts for the bulk of long-term growth (Fernald and Jones, 2014). The combination of the two effects we document thus raises the possibility that centralized bank supervision can slow down the shift from the "old", capital-based, to the "new", knowledge-based, economy. Our results thus point to an important trade-off associated with more stringent bank supervision: there are positive effects for financial stability, as also shown by previous studies, but there is also reduced bank financing for the knowledge economy.

Several caveats are in order when interpreting our empirical results. First, we use the introduction of centralized supervision as quasi-natural shock to firms whose main lender shifted to SSM-supervision. Obviously, the allocation of firms to treated and control banks is not random, which might introduce a bias into our analysis. However, we use an array of different methods to control for any bias that such non-random assignment might pose. Second, while we confirm our findings are consistent across firm- and bank-level regressions, we can only shed limited light onto the channels through which centralized supervisors affects banks' risk-taking and firm's funding and investment choices.

Our findings point to the important debate on the role of banks in the transition to the knowledge economy. Beck, Dottling, Lambert, and van Dijk (2023) show that liquidity creation by banks has a positive relationship with economic growth, but less so in economies that rely more on intangible rather than tangible assets. Combining these findings points to the need for a stronger role of non-bank financing providers in European economies to foster their transition to a knowledge economy relying on intangible rather than tangible assets. As shown by Darmouni and Papoutsi (2022), this trend is already under way, with an increase in bond financing of firms in Europe, with increased bond financing of European non-financial corporations, potentially mitigating the effect of changing credit conditions.

References

Agarwal, S., Lucca, D., Seru, A., and F. Trebbi, 2014. Inconsistent regulators: Evidence from banking. Quarterly Journal of Economics 129, 889-938.

Altavilla, C., Boucinha, M., Peydro, J.-L., and F. Smets, 2020. Banking supervision, monetary policy, and risk-taking: Big data evidence from 15 credit registers. ECB Working Paper 2349.

Bassett, W., Lee, S.J. and T. Popeck Spiller, 2015. Estimating changes in supervisory standards and their economic effects. Journal of Banking and Finance 60, 21-43.

Bates, T., Kahle, K. and R. Stulz, 2009. Why do U.S. firms hold so much more cash than they used to? Journal of Finance 64, 1985–2021.

Beck, T., Dottling, R., Lambert, T., and M. van Dijk, 2023. Liquidity creation, investment, and growth. Journal of Economic Growth 28, 297–336.

Beck, T., Peltonen, T., Perotti, E., Serano, A. and J. Suarez, 2023. Report of the Advisery Scientific Committee of the ESRB No. 14.

Beck, T., Todorov, R., and W. Wagner, 2013. Supervising cross-border banks: Theory, evidence and policy. Economic Policy 28, 5-44.

Berg, T., Reisinger, M., and D. Streitz, 2021. Spillover effects in empirical corporate finance. Journal of Financial Economics 142, 1109–1127.

Berger, A. and G. Udell, 1998. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. Journal of Banking and Finance 22, 613–673.

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

Bian, B., Haselmann, R., Kick, T., and V. Vig, 2017. The political economy of decentralization: Evidence from bank bailouts. Working paper.

Bofondi, M., Carpinelli, L., and E. Sette, 2018. Credit supply during a sovereign debt crisis. Journal of the European Economic Association 16, 696–729.

Bonfim, D., Cerqueiro, G., Degryse, H., and S. Ongena, 2023. On-site inspecting zombie lending. Management Science 69, 2547–2567.

Boot, A. and A. Thakor, 1994. Moral hazard and secured lending in an infinitely repeated credit market game. International Economic Review 35, 899-920.

Bottero, M., Lenzu, S., and F. Mezzanotti, 2020. Sovereign debt exposure and the bank lending channel: Impact on credit supply and the real economy. Journal of International Economics 126 (C).

Boualam, Y. and C. Mazet-Sonilhac, 2023. Credit Market Fluidity. Mimeo.

Boyer, P., and J. Ponce, 2012. Regulatory capture and banking supervision reform. Journal of Financial Stability 8, 206-217.

Calzolari, G., Colliard, J.-E., and G. Loranth, 2019. Multinational banks and supranational supervision. Review of Financial Studies 32, 2997-3035.

Cappelletti, G., Ponte Marques, Varraso, P., Budrys, Z., and J. Peeters, 2019. Impact of higher capital buffers on banks lending and risk-taking: Evidence from the euro area experiments. ECB Working Paper 2292.

Carletti, E., Dell'Ariccia, G., and R. Marquez, 2021. Supervisory incentives in a Banking Union. Management Science 67, 455–470.

Colliard, J.-E., 2020. Optimal supervisory architecture and financial integration in a Banking Union. Review of Finance 24, 129–161.

Corrado, C., and C. Hulten, 2010. How do you measure a technological revolution? American Economic Review 100, 99-104.

Danisewicz, P., McGowan, D., Onali, E., and K. Schaeck, 2018. The real effects of banking supervision: Evidence from enforcement actions. Journal of Financial Intermediation 35, 86–101.

Darmouni, O. and M. Papoutsi, 2022. The rise of bond financing in Europe: five facts about new and small issuers. ECB Working Paper 2663.

Delis, M., and P. Staikouras, 2011. Supervisory effectiveness and bank risk. Review of Finance 15, 511-543.

DellAriccia, G., and R. Marquez, 2006. Competition among regulators and credit market integration. Journal of Financial Economics 79, 401-30.

Dottling, R., and L. Ratnovski, 2023. Monetary policy and intangible investment. Journal of Monetary Economics 134, 53–72.

Dwenger, N., Fossen, F., and M. Simmler, 2015. From financial to real economic crisis: Evidence from individual firm-bank relationships in Germany. ZBW Disussion Paper 2015/28.

Eber, M., and C. Minoiu, 2016. How do banks adjust to stricter supervision? Working paper.

Eisenbach, T., Lucca, D., and R. Townsend, 2022. Resource allocation in bank supervision: Trade-offs and outcomes. Journal of Finance 77, 1685–1736.

Falato, A., Kadyrzhanova, D., Sim, J., and R. Steri, 2022. Rising intangible capital, shrinking debt capacity, and the US corporate savings glut. Journal of Finance 77, 2799–2852.

Fernald, J., and C. Jones, 2014. The future of U.S. economic growth. American Economic Review 104, 44–49.

Fiordelisi, F., Ricci, O., and F. Stentella Lopes, 2017. The unintended consequences of the launch of the Single Supervisory Mechanism in Europe. Journal of Financial and Quantitative Analysis 52, 2809–2836.

Foarta, D., 2018. The limits to partial banking unions: A political economy approach. American Economic Review 108, 1187-1213.

Gopalan, Y., Kalda, A., and A. Manela, 2021. Hub-and-spoke regulation and bank leverage. Review of Finance 25, 1499–1545.

Gornicka, L., and M. Zoican, 2016. Too-international-to-fail? Supranational bank resolution and market discipline. Journal of Banking and Finance 65, 41-58.

Granja, J., and C. Leuz, 2017. The death of a regulator: Strict supervision, bank lending, and business activity. European Corporate Governance Institute (ECGI) - Law Working Paper No. 447/2019 LawFin Working Paper No. 4.

Gropp, R., Mosk, T., Ongena, S., and C. Wix, 2019. Banks response to higher capital requirements:

Evidence from a quasi-natural experiment. Review of Financial Studies 32, 266–299.

Haltiwanger, J., Jarmin, R., and J. Miranda, 2013. Who creates jobs? Small versus large versus young. Review of Economics and Statistics 95, 347–361.

Haskell, J., and S. Westlake, 2017. Capitalism Without Capital: The Rise of the Intangible Economy. Princeton University Press: Princeton, NJ.

Henriksson, D., and A. Otosson, 2021. Does competition in the EU banking market lead to lower interest margins? Stockholm University mimeo.

Hirtle, B., Kovner, A., and M. Plosser, 2020. The impact of supervision on bank performance. Journal of Finance 75, 2765–2808.

Holmstrom, B. and J. Tirole, 1997. Financial intermediation, loanable funds, and the real sector. Quarterly Journal of Economics 112, 663-91.

Hsu, P.-H., Tian, X., and Y. Xu, 2014. Financial development and innovation: Cross-country evidence. Journal of Financial Economics 112, 116–135.

Igan, D., Moussawi, H., Tieman, A., Zdzienicka, A., Dell'Ariccia, G., and P. Mauro, 2019. The Long shadow of the Global Financial Crisis: Public interventions in the financial sector. IMF Working Paper WP/19/164.

Ivanov, I., and J. Wang, 2024. Bank supervision, corporate credit supply, and bank monitoring. Management Science, forthcoming.

Kalemli-Özcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V., and S. Yesiltas, 2024. How to construct nationally representative firm level data from the Orbis Global Database: New facts on SMEs and aggregate implications for industry concentration. American Economic Journal: Macroeconomics, forthcoming.

Kandrac, J., and B. Schlusche, 2021. The effect of bank supervision and examination on risk taking: Evidence from a natural experiment. Review of Financial Studies 34, 3181–3212.

Kang, A., Lowery, R., and W. Wardlaw, 2015. The costs of closing failed banks: A structural estimation of regulatory incentives. Review of Financial Studies 28, 1060-1102.

Kashyap, A., Lamont, O., and J. Stein, 2004. Credit conditions and the cyclical behavior of inventories. Quarterly Journal of Economics 109, 565–592.

Kok, C., Mueller, C., Ongena, S. and C. Pancaro, 2023. The disciplining effect of supervisory scrutiny in the EU-wide stress test. Journal of Financial Intermediation 53.

Kordal, R., Cahoy, D., Minkabo, S., and E. Sherer, 2016. Discovery process R&D lead time needed for innovation. Technology Transfer and Entrepreneurship 3, 32–39.

Laeven L. and F. Valencia, 2010. Resolution of banking crises: The good, the bad, and the ugly. IMF Working Paper 10/146.

Laffont, J.-J., and J. Tirole, 1993. A Theory of Incentives in Procurement and Regulation. MIT Press: Cambridge, MA.

Loipersberger, F., 2018. The effect of supranational banking supervision on the financial sector: Event study evidence from Europe. Journal of Banking and Finance 91, 34–48.

Passalacqua, A., Angelini, P., Lotti, F., and Soggia, G. 2020. The real effects of bank supervision: Evidence from on-site bank inspections. Working Paper.

Popov, A., and N. van Horen, 2015. Exporting sovereign stress: Evidence from syndicated bank lending during the Euro Area sovereign debt crisis. Review of Finance 19, 1825–1866.

Ranciere, R., Tornell, A., and F. Westermann, 2008. Systemic crises and growth. Quarterly Journal of Economics 123, 359–406.

Rezende, M., 2016. The effects of bank charter switching on supervisory ratings. Working paper.

Repullo, R., 2018. Hierarchical bank supervision. Journal of the Spanish Economic Association 9, 1–26.

Rochet, J.-C., 2008. Why Are There So Many Banking Crises? The Politics and Policy of Bank Regulation. Princeton University Press: Princeton, NJ.

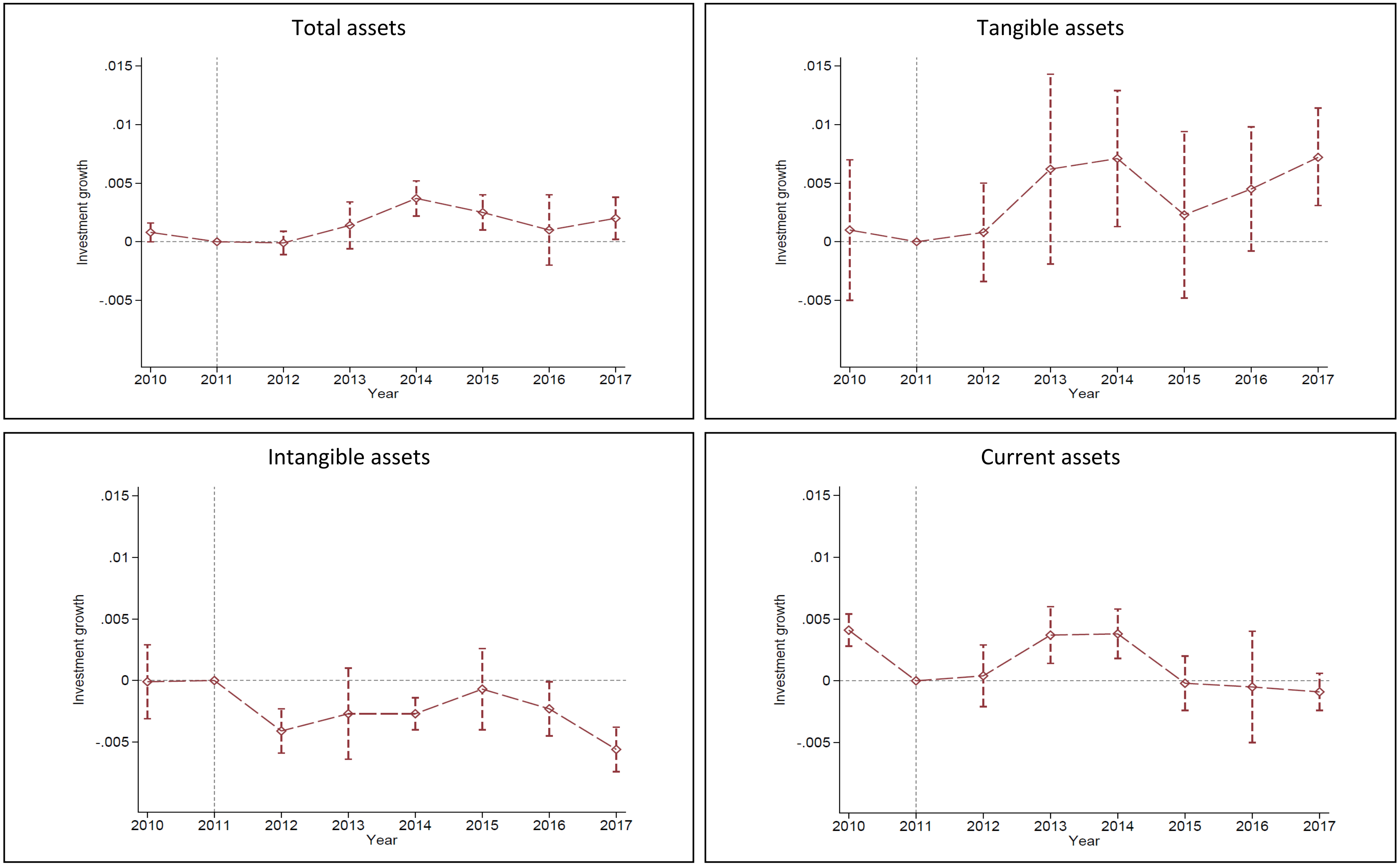
Rosenbaum, P., and D. Rubin, 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70, 41-55.

Segura, A., and S. Vicente, 2018. Bank resolution and the public backstop in an asymmetric banking union. Working paper.

Stehrer, R., A. Bykova, K, Jger, O. Reiter and M. Schwarzhappel, 2019. Industry Level Growth and Productivity Data with Special Focus on Intangible Assets. The Vienna Institute for International Economic studies report, October 29.

Stiglitz, J. and A. Weiss, 1981. Credit rationing in markets with imperfect information. American Economic Review 71, 393-410.

Figure 1. SSM and firm assets over time: SI versus LSI firms



Note: The figure uses annual data for the period 2010 to 2017. The graph plots year-by-year coefficients and 90% confidence intervals that we obtain by replacing in Equation (1) the variables *Post2012* and *Post2014* in the interaction with *SI* with a sequence of year dummies.

Table 1. Summary statistics, pre-treatment period: Full sample and matched sample

Panel A. Firm-specific factors: Full sample

	(1)	(2)
	Difference (SI=1, SI=0)	*P*-value
Log (Assets)	-0.0017***	0.000
Cash / Assets	0.0153***	0.000
Age	0.0004***	0.000
Debt / Assets	-0.0001***	0.000
Net worth	0.0001***	0.000
# firms	200,194	

Panel B. Firm-specific factors: Matched sample

	(1)	(2)
	Difference (SI=1, SI=0)	*P*-value
Log (Assets)	0.0005	0.262
Cash / Assets	0.0035	0.567
Age	0.0000	0.749
Debt / Assets	0.0002	0.605
Net worth	-0.0002	0.567
# firms	119,713	

Note: The Table summarizes the variables used in the empirical tests. Only firms that report a credit association with at least one bank are included. The sample includes firms from both euro-area and non-euro-area countries. In Panel A, statistics are reported for the full sample. In Panel B, statistics are reported for the Propensity Score Matched sample. In column (1), the coefficient from a regression of SI on the respective variable, accounting for country-sector and time fixed effects, is reported. In column (2), the *P*-value from an *F*-test is reported. 'Log (Assets)' denotes the natural logarithm of the firm's total assets. 'Cash / Assets' denotes the ratio of the firm's cash flow to the firm's total assets. 'Age' is the firm's age in years. Data come from Orbis. 'Debt / Assets' denotes the ratio of the firm's total debt to the firm's total assets. 'Net worth' denotes the ratio of total assets minus total liabilities to total assets.

Table 2. Firm-specific outcomes: Full sample period, matched sample, euro-area

	(1)	(2)	(3)	(4)	(5)
	Mean	Median	St. dev.	Min.	Max.
Δ Total assets	0.0116	0.0025	0.1171	-0.9024	0.9804
Δ Tangible assets	-0.0560	-0.0450	0.1924	-0.9993	0.9952
Δ Intangible assets	-0.0712	0.0000	0.2119	-0.9998	0.9999
Δ Current assets	0.0108	0.0103	0.1543	-0.9972	0.9960
Δ Employment	-0.0111	-0.0014	0.1236	-0.9942	0.9831
Δ TFP	-0.0116	-0.0016	0.1809	-0.9997	0.9998
Δ Total debt / Assets	-0.0479	-0.0380	0.3033	-0.9999	0.9997
Δ Short-term debt / Assets	-0.0206	-0.0101	0.3587	-0.9999	0.9999
Δ Long-term debt / Assets	-0.0728	-0.0599	0.3454	-0.9999	0.9999
# firms	119,713				
# banks	1,946				

Note: The Table summarizes the variables used in the empirical tests. Only firms that report a credit association with at least one bank are included. The sample includes only firms from euro-area countries. Statistics are reported for the Propensity Score Matched sample from Table 1, Panel B, for the sub-sample of firms in the euro area. 'Δ Total assets' denotes the year-on-year percentage change in the firm's total assets. 'Δ Tangible assets' denotes the year-on-year percentage change in the firm's tangible assets. 'Δ Intangible assets' denotes the year-on-year percentage change in the firm's intangible assets. 'Δ Current assets' denotes the year-on-year percentage change in the firm's current assets. 'Δ Employment' denotes the year-on-year percentage change in the firm's employees. 'Δ TFP' denotes the year-on-year percentage change in the firm's TFP. 'Δ Total debt / Assets' denotes the year-on-year percentage change in the firm's ratio of total debt to total assets. 'Δ Short-term debt / Assets' denotes the year-on-year percentage change in the firm's ratio of debt with maturity of less than one year to total assets. 'Δ Long-term debt / Assets' denotes the year-on-year percentage change in the firm's ratio of debt with maturity over one year to total assets.

Table 3. Bank supervision and firm investment: Main result

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0017**	0.0041	-0.0020*	0.0019*
	(0.0006)	(0.0027)	(0.0012)	(0.0010)
Post 2014 × SI	0.0008	0.0045***	0.0002	-0.0012
	(0.0007)	(0.0011)	(0.0013)	(0.0010)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 4. Bank supervision and firm investment: Pre-trend

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2010 × SI	-0.0003	-0.0002	-0.0002	-0.0053
	(0.0003)	(0.0038)	(0.0015)	(0.0006)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	239,076	217,134	179,744	233,034
R-squared	0.52	0.59	0.64	0.48

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2010' is a dummy variable equal to one in 2011 and 2012. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in two observations per firm, one average for the 2009—2010 period, and one average for the 2011—2012 period. In all regressions, only firms with at least one observation before and at least one observation after 2011 are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2009—2012. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 5. Bank supervision and firm investment: Placebo

	(1)	(2)	(3)	(4)
	Δ Total Assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI × Euro	-0.0116***	-0.0022	-0.0031**	-0.0135***
	(0.0010)	(0.0028)	(0.0015)	(0.0011)
Post 2014 × SI × Euro	-0.0083***	0.0064***	0.0011	-0.0114
	(0.0010)	(0.0018)	(0.0017)	(0.0011)
Post 2012 × SI	0.0134***	0.0063***	0.0012	0.0154***
	(0.0007)	(0.0006)	(0.0010)	(0.0004)
Post 2014 × SI	0.0091***	-0.0018	-0.0008	0.0102
	(0.0007)	(0.0014)	(0.0011)	(0.0006)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	444,498	439,669	431,123	443,071
R-squared	0.42	0.44	0.45	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank would be a significant institution if the country was under the jurisdiction of the SSM. 'Euro' is a dummy variable equal to one if the firm is domiciled in a Euro-area country. The sample of non-Euro-area countries includes Croatia, Denmark, Hungary, Poland, and the UK. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010–2017. All regressions are based on a propensity-score-matched sample using the same procedure as in Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 6. Bank supervision and R&D investment: SSM and KLEMS data

	(1)	(2)	(3)
		Δ R&D	
	Pre-2012	Post-2012	Post-2014
Share SI lending	0.0233	-0.0483***	-0.0324*
	(0.0312)	(0.0158)	(0.0191)
Country FEs	Yes	Yes	Yes
Sector FEs	Yes	Yes	Yes
Clustering		Country	
Observations	245	241	238
R-squared	0.80	0.65	0.68

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the percentage change in the sector (for each country) total expenses in Research & Development between 2010 and 2012 (column (1)); between 2012 and 2014 (column (2)); and between 2014 and 2016 (column (3)). 'Share SI' is the share of total lending coming from Significant Institutions for each sector/country in 2014. Data for R&D expenses are from the KLEMS database. Data for the share of SI lending come from the Single Supervisory Mechanism. All regressions include fixed effects as specified and control for the change in Gross Output at the sector/country level for each respective period. Standard errors clustered at the country level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 7. Bank supervision and firm investment: Firm heterogeneity

Panel A. Small firms

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0060	0.0088	-0.0103	0.0067
	(0.0042)	(0.0075)	(0.0062)	(0.0047)
Post 2012 × SI × Small	-0.0054	-0.0057	0.0100	-0.0059
	(0.0051)	(0.0072)	(0.0084)	(0.0062)
Post 2014 × SI	0.0023	0.0074***	-0.0058	-0.0011
	(0.0038)	(0.0022)	(0.0046)	(0.0026)
Post 2014 × SI × Small	-0.0018	-0.0033	0.0071	-0.0001
	(0.0044)	(0.0030)	(0.0047)	(0.0030)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Panel B. Young firms

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0007	0.0027	-0.0020*	0.0022**
	(0.0012)	(0.0029)	(0.0012)	(0.0011)
Post 2012 × SI × Young	0.0079	0.0104**	0.0019	0.0018
	(0.0058)	(0.0049)	(0.0034)	(0.0040)
Post 2014 × SI	0.0006	0.0041**	0.0005	-0.0003
	(0.0012)	(0.0015)	(0.0016)	(0.0011)
Post 2014 × SI × Young	-0.0008	-0.0008	-0.0011	-0.0028
	(0.0062)	(0.0053)	(0.0057)	(0.0067)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. 'Small' is a dummy variable equal to one if the firm has fewer than 50 employees. 'Young' is a dummy variable equal to one if the firm is less than 10-years old. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 8. Bank supervision and firm investment: Industry heterogeneity

Panel A. R&D intensity

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0028	-0.0018	0.0004	-0.0020
	(0.0019)	(0.0025)	(0.0024)	(0.0027)
Post 2012 × SI × R&D	-0.0022	0.0014	-0.0077***	0.0000
	(0.0029)	(0.0033)	(0.0008)	(0.0024)
Post 2014 × SI	0.0001	0.0120***	-0.0012	-0.0009
	(0.0011)	(0.0024)	(0.0034)	(0.0020)
Post 2014 × SI × R&D	-0.0011	-0.0005	-0.0009	-0.0011
	(0.0011)	(0.0032)	(0.0016)	(0.0013)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	62,442	62,195	60,180	62,394
R-squared	0.42	0.44	0.44	0.36

Panel B. Patent intensity

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0021	-0.0018	0.0014	-0.0026
	(0.0019)	(0.0025)	(0.0024)	(0.0026)
Post 2012 × SI × Patents	-0.0028	0.0031	-0.0187***	0.0016
	(0.0060)	(0.0073)	(0.0019)	(0.0045)
Post 2014 × SI	-0.0011	0.0109***	-0.0015	-0.0023
	(0.0010)	(0.0022)	(0.0033)	(0.0019)
Post 2014 × SI × Patents	0.0008	0.0020	-0.0010	0.0015
	(0.0020)	(0.0064)	(0.0024)	(0.0026)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	62,442	62,195	60,180	62,394
R-squared	0.42	0.44	0.44	0.36

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. 'R&D' is the sum of all R&D expenses divided by total sales reported by public firms in an industry between 1976 and 2006. 'Patents' is the sum of all patents with the USPTO by non-government organizations or individuals in an industry between 1976 and 2006. Data on these two industry benchmarks come from Hsu, Tian, and Xu (2014). Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 9. Bank supervision and firm investment: Country heterogeneity

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0023	0.0365**	0.0118**	0.0055
	(0.0037)	(0.0161)	(0.0059)	(0.0080)
Post 2012 × SI × Bank HHI5	-0.0010	-0.0576**	-0.0246**	-0.0065
	(0.0061)	(0.0267)	(0.0104)	(0.0138)
Post 2014 × SI	-0.0078	0.0058	-0.0175	0.0012
	(0.0059)	(0.0071)	(0.0109)	(0.0068)
Post 2014 × SI × Bank HHI5	0.0153	0.0023	0.0316	-0.0043
	(0.0108)	(0.0126)	(0.0177)	(0.0116)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. Bank HHI' is the market share of the five largest credit institutions in the country. Data on these two country benchmarks come from Kosekova et al. (2023). Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 10. Bank supervision, employment, and productivity

	(1)	(2)
	Δ Employment	Δ TFP
Post 2012 × SI	0.0006	-0.0003
	(0.0010)	(0.0008)
Post 2014 × SI	0.0029***	-0.0008
	(0.0004)	(0.0018)
Firm FEs	Yes	Yes
Country × Sector × Period FEs	Yes	Yes
Clustering	Country × SI	
Observations	273,148	247,821
R-squared	0.38	0.29

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's employment (column (1)), and the year-on-year percentage change in the firm's TFP (column (2)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(2), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 11. Bank supervision and firm debt: Orbis data

	(1)	(2)	(3)
	Δ Total debt / Assets	Δ Short-term debt / Assets	Δ Long-term debt / Assets
Post 2012 × SI	-0.0003	-0.0061***	0.0014
	(0.0022)	(0.0014)	(0.0028)
Post 2014 × SI	-0.0087***	-0.0025	-0.0089**
	(0.0015)	(0.0020)	(0.0033)
Firm FEs	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes
Clustering		Country × SI	
Observations	271,461	196,676	235,469
R-squared	0.34	0.33	0.34

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's ratio of total debt to total assets (column (1)), the year-on-year percentage change in the firm's ratio of debt with maturity of less than one year to total assets (column (2)), and the year-on-year percentage change in the firm's ratio of debt with maturity over one year to total assets (column (3)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observation during each period are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Table 12. Bank supervision and lending to firms: IBSI data

	(1)	(2)
	Δ Loans / Assets	
Post 2012 × SI	-0.0727***	-0.1152***
	(0.0267)	(0.0384)
Post 2014 × SI	0.0051	0.0541
	(0.0287)	(0.0385)
Post 2012 × Capital		-0.3269
		(0.2158)
Post 2014 × Capital		1.2417**
		(0.4985)
Post 2012 × SI × Capital		0.5476*
		0.3142)
Post 2014 × SI × Capital		-0.8236*
		(0.4352)
Bank FEs	Yes	Yes
Country × Period FEs	Yes	Yes
Clustering	Country × Period	
Observations	354	354
R-squared	0.50	0.50

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the period-on-period log difference in total lending to all domestic non-financial corporations. 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the bank is a significant institution. 'Capital' is the bank's average ratio of equity to total assets before the announcement of the SSM. All regressions include fixed effects as specified. The sample period is 2010—2017. Data come from IBSI. All regressions include fixed effects as specified. Standard errors clustered at the country-period level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 1. Bank supervision and firm investment: Unmatched sample

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0044***	0.0034*	-0.0006	0.0049***
	(0.0008)	(0.0019)	(0.0008)	(0.0013)
Post 2014 × SI	0.0041***	0.0031***	0.0001	0.0027***
	(0.0004)	(0.0009)	(0.0013)	(0.0006)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	596,790	593,049	578,206	595,692
R-squared	0.41	0.44	0.44	0.36

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the pre-matched sample from Table 1, Panel A. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 2. Bank supervision and firm investment: Controlling for lagged firm characteristics

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0022*	0.0041	-0.0021*	0.0024**
	(0.0013)	(0.0030)	(0.0011)	(0.0009)
Post 2014 × SI	0.0020*	0.0049***	0.0005	-0.0010
	(0.0011)	(0.0009)	(0.0017)	(0.0007)
Firm controls	Yes	Yes	Yes	Yes
Post 2012 × Firm controls	Yes	Yes	Yes	Yes
Post 2014 × Firm controls	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	336,090	334,164	324,734	335,568
R-squared	0.48	0.44	0.45	0.41

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a du mmy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. 'Firm controls' include 'Log (Assets)', 'Net worth', 'Debt / Assets', 'Cash / Assets', and 'Age', all 1-period lagged. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 3. Bank supervision and firm investment: Clustering at country level

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0017**	0.0041	-0.0020	0.0019*
	(0.0008)	(0.0035)	(0.0016)	(0.0014)
Post 2014 × SI	0.0008	0.0045***	0.0002	-0.0012
	(0.0009)	(0.0015)	(0.0016)	(0.0013)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country			
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 4. Bank supervision and firm investment: Clustering at country-SI-period level

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0017**	0.0041	-0.0020	0.0019*
	(0.0007)	(0.0026)	(0.0038)	(0.0010)
Post 2014 × SI	0.0008	0.0045**	0.0002	-0.0012
	(0.0007)	(0.0018)	(0.0017)	(0.0009)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI × Period		
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI-period level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 5. Bank supervision and firm investment: Clustering at bank level

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0017	0.0041*	-0.0020	0.0019
	(0.0015)	(0.0024)	(0.0017)	(0.0016)
Post 2014 × SI	0.0008	0.0045**	0.0002	-0.0012
	(0.0013)	(0.0021)	(0.0014)	(0.0015)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Bank			
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the bank level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 6. Bank supervision and firm investment: Controlling for bank-level omitted variables

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0017**	0.0041	-0.0020*	0.0019*
	(0.0006)	(0.0027)	(0.0012)	(0.0010)
Post 2014 × SI	0.0008	0.0045***	0.0002	-0.0012
	(0.0007)	(0.0011)	(0.0013)	(0.0010)
Firm FEs	Yes	Yes	Yes	Yes
Bank FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	358,791	356,713	347,175	358,240
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 7. Bank supervision and firm investment: Non-collapsed data

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0023**	0.0061	-0.0013	0.0023**
	(0.0011)	(0.0037)	(0.0015)	(0.0010)
Post 2014 × SI	0.0016*	0.0040**	-0.0015**	-0.0019*
	(0.0010)	(0.0015)	(0.0007)	(0.0010)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Year FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	1,105,286	1,040,663	942,594	1,088,984
R-squared	0.22	0.26	0.31	0.18

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are annual. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 8. Bank supervision and firm investment: Symmetric dataset

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0012**	0.0044	-0.0021*	0.0015
	(0.0005)	(0.0030)	(0.0012)	(0.0012)
Post 2014 × SI	0.0002	0.0037**	-0.0008	-0.0015
	(0.0006)	(0.0015)	(0.0012)	(0.0012)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Year FEs	Yes	Yes	Yes	Yes
Clustering	Country × SI			
Observations	323,121	323,121	323,121	323,121
R-squared	0.42	0.43	0.43	0.36

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are annual. In all regressions, only firms with at least one observations during each period, for all individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 9. Bank supervision and firm investment: Intensity of supervisory reform

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × Affected	0.0003**	0.0009**	-0.0002	0.0005***
	(0.0001)	(0.0004)	(0.0001)	(0.0001)
Post 2014 × Affected	0.0001	0.0008***	-0.0000	-0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	357,057	354,998	345,489	356,514
R-squared	0.42	0.44	0.44	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'Affected' measures the difference between 15 (maximum value) and the country-specific value of the Supervisory Power Index (from Loipersberger, 2018) before the SSM reform. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period are included, for each individual variable in columns (1)–(4). Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 10. Bank supervision and firm investment: Excluding firms borrowing banks that received public assistance during the GFC

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × SI	0.0022***	0.0043	-0.0024*	0.0018*
	(0.0007)	(0.0029)	(0.0013)	(0.0009)
Post 2014 × SI	0.0011	0.0057***	-0.0004	-0.0012
	(0.0008)	(0.0014)	(0.0014)	(0.0010)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Year FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	327,693	325,806	316,893	327,205
R-squared	0.42	0.43	0.45	0.37

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. Data are annual. In all regressions, only firms with at least one observations during each period, for all individual variable in columns (1)—(4), are included. The sample excludes firms borrowing from banks that received public assistance during the Global Financial Crisis. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 11. Bank supervision and firm investment: SSM banks capital ratios

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Post 2012 × CET1	-0.0508	-0.1404*	0.0826	0.0215
	(0.0499)	(0.0750)	(0.0806)	(0.0399)
Post 2014 × CET1	-0.0616	-0.1241**	-0.0179	-0.0117
	(0.0344)	(0.0454)	(0.0393)	(0.0397)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	244,963	243,500	236,516	244,615
R-squared	0.41	0.42	0.44	0.36

Notes: The Table reports the point estimates from OLS regressions. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Post 2012' is a dummy variable equal to one in 2013 and 2014. 'Post 2014' is a dummy variable equal to one in 2015, 2016, and 2017. 'CET1' is the 2013 year-end Common Equity Tier 1 ratio. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the SSM banks included in the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 12. Bank supervision and firm investment: Firm exit

	(1)	(2)
	Firm exit	
SI	0.0005	0.0004
	(0.0006)	(0.0007)
SI × R&D	0.0010*	
	(0.0005)	
SI × Patent		0.0023*
		(0.0014)
Firm FEs	Yes	Yes
Country × Sector × Period FEs	Yes	Yes
Clustering	Country × SI	
Observations	65,376	65,376
R-squared	0.01	0.01

Notes: The Table reports the point estimates from OLS regressions. The dependent variable 'Firm exit' is a dummy variable equal to one if the firm is observed during periods 1 and 2, but not during period 3. 'SI' is a dummy variable equal to one if the firm's main bank is a significant institution. 'R&D' is the sum of all R&D expenses divided by total sales reported by public firms in an industry between 1976 and 2006. 'Patents' is the sum of all patents with the USPTO by non-government organizations or individuals in an industry between 1976 and 2006. Data on these two industry benchmarks come from Hsu, Tian, and Xu (2014). The sample period is 2015—2017, aggregated into one observation per firm. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.

Appendix Table 13. Firm debt and firm investment

	(1)	(2)	(3)	(4)
	Δ Total assets	Δ Tangible assets	Δ Intangible assets	Δ Current assets
Δ Short-term debt / Assets	-0.0131***	-0.0184***	-0.0026	-0.0157***
	(0.0048)	(0.0057)	(0.0028)	(0.0044)
Δ Long-term debt / Assets	0.0004***	0.0008	0.0002***	0.0002*
	(0.0000)	(0.0010)	(0.0000)	(0.0001)
Firm FEs	Yes	Yes	Yes	Yes
Country × Sector × Period FEs	Yes	Yes	Yes	Yes
Clustering		Country × SI		
Observations	337,511	335,545	326,157	336,979
R-squared	0.43	0.44	0.45	0.37

Notes: The Table reports the point estimates from OLS. The dependent variable is the year-on-year percentage change in the firm's total assets (column (1)); the year-on-year percentage change in the firm's tangible assets (column (2)); the year-on-year percentage change in the firm's intangible assets (column (3)); and the year-on-year percentage change in the firm's current assets (column (4)). 'Δ Short-term debt / Assets' is the year-on-year percentage change in the firm's ratio of debt with maturity of less than one year to total assets. 'Δ Long-term debt / Assets' is the year-on-year percentage change in the firm's ratio of debt with maturity over one year to total assets. Data are aggregated in three observations per firm, one average for the 2010—2012 period, one average for the 2013—2014 period, and one average for the 2015—2017 period. In all regressions, only firms with at least one observations during each period, for each individual variable in columns (1)—(4), are included. Data come from Orbis. All regressions include fixed effects as specified. The sample period is 2010—2017. All regressions are based on the propensity-score-matched sample from Table 1, Panel B. Standard errors clustered at the country-SI level are reported in parentheses where ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent statistical level, respectively.